Single-cell spatial transcriptomics of fixed, paraffin-embedded biopsies reveals colitis-associated cell networks

Short Title: Spatial transcriptomics analysis of colitis

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ABSTRACT

Background & Aims: Imaging-based, single-cell spatial transcriptomics (iSCST) using formalin-fixed, paraffin-embedded (FFPE) tissue could transform translational research by retaining all tissue cell subsets and spatial locations while enabling the analysis of archived specimens. We aimed to develop a robust framework for applying iSCST to archived clinical FFPE mucosal biopsies from patients with inflammatory bowel disease (IBD).

Methods: We performed a comprehensive benchmarking comparison of three iSCST platforms capable of analyzing FFPE specimens. We analyzed FFPE mucosal biopsies (n=57) up to 5 years old from non-IBD controls (HC; n=9) and patients with ulcerative colitis (UC;n=11). After platform-specific cell segmentation, we applied a uniform data processing pipeline to all datasets, including transcript detection, cell annotation, differential gene expression, and neighborhood enrichment. Transcriptomic signatures identified with iSCST were validated using external, publicly available bulk transcriptomic datasets.

Results: A custom 290-plex Xenium gene panel exhibited the highest sensitivity and specificity for transcript detection, enabling precise identification and quantification of diverse cell subsets and differentially expressed genes across cell types and disease states. We mapped transcriptionally distinct fibroblast subsets to discrete spatial locations and identified inflammation-associated fibroblasts (IAFs) and monocytes as a colitis-associated cellular neighborhood. We also identified signatures associated with Vedolizumab (VDZ) responsiveness. VDZ non-responders were characterized by an IAF-monocyte transcriptional signature, while responders exhibited enrichment of epithelial gene sets.

Conclusions: Our optimized iSCST framework for archived FFPE biopsies provides unique advantages for assessing the role of colitis-associated cellular networks in routinely collected clinical samples. FFPE-based biomarkers could integrate with existing clinical workflows and potentially aid in risk-stratifying patients.

Keywords: Spatial transcriptomics, ulcerative colitis, vedolizumab

INTRODUCTION

Single-cell multi-omics studies in inflammatory bowel disease (IBD) have rapidly accelerated our understanding of intestinal inflammation, highlighting critical roles for multiple cell subsets across stromal, epithelial, and immune compartments[1–8]. While powerful, traditional single-cell multi-omics analyses of prospectively collected and digested colon biopsies suffer from several important limitations. These include cellular dropout or under-representation of epithelial and granulocyte subsets, loss of spatial information, and prolonged patient recruitment[9,10]. As an example, neutrophils contribute to acute colitis and treatment non-response, but they are particularly difficult to capture with many single-cell multi-omics approaches, and their proximity and interactions with inflammatory fibroblasts are lost in disaggregated tissue[8,10,11]. Analyzing cellular networks such as these before and after treatment in responders and non-responders across multiple therapies from prospectively collected samples requires prolonged recruitment. Spatial transcriptomics of formalin-fixed, paraffin-embedded (FFPE) tissue with subcellular resolution directly addresses these shortcomings by comprehensively capturing cell subsets and transcriptional states in mucosal biopsies, retaining spatial relationships, and accelerating recruitment for retrospective, longitudinal, case-control analyses of archived clinical specimens collected as part of standard of care.

Spatial transcriptomics technologies hold great promise for identifying tissue biomarkers and augmenting our understanding of disease and treatment response. These technologies are still emerging, and a growing body of literature leverages these approaches to study mouse models[12] or patient samples[10,13], but few studies have benchmarked different platforms for the optimal analysis of archived FFPE clinical specimens, and those that have were primarily focused on tumor tissues[14–17]. Hence, it is unclear whether prior iSCST comparisons extrapolate to archived clinical specimens from inflammatory disorders such as IBD. We performed a comparison of three commercially available imaging-based single-cell spatial transcriptomics (iSCST) platforms capable of analyzing FFPE specimens with subcellular resolution from tissue sections. These platforms were used to analyze FFPE colon mucosal biopsies archived for up to 5 years from non-IBD controls and patients with UC. Our primary comparison examined specific and non-specific transcript detection, cell-subset identification, and differential gene expression between healthy and inflamed tissue. We also examined cell segmentation and the impact of sample age on assay performance. Using our custom IBD panel, we identified transcriptionally and spatially distinct fibroblast subsets in health and disease, and we defined an inflammation-associated fibroblast (IAF)-monocyte cellular network that increased in abundance and spatial proximity in patients with active UC. We present an optimized iSCST pipeline for analyzing archived mucosal biopsies from patients with inflammatory intestinal disorders, offering unique advantages for evaluating colitis-associated cellular networks in routinely collected clinical samples.

RESULTS

Xenium Outperforms Competing iSCST Platforms in Sensitivity and Detection of Colon-Associated Cell Types.

To develop an iSCST pipeline for studying archived FFPE specimens, here focused on mucosal biopsies from IBD patients, we evaluated three commercially available imaging-based spatial transcriptomics platforms: Xenium (10X Genomics), CosMx (NanoString), and MERSCOPE (Vizgen). The CosMx dataset was previously generated using a 1,000 gene predesigned CosMx Human Universal Cell Characterization RNA Panel on an FFPE tissue microarray (TMA) containing colon biopsies from UC patients and patients without IBD, referred to as healthy controls (HC), and was re-analyzed for this study (**Figure 1A, Supplementary Table 1**)[9]. The Xenium and MERSCOPE spatial platforms were used to test the same TMA that was used to generate the CosMx data. The custom Xenium panel contained 290 genes, and the custom MERSCOPE panel contained 280 genes (**Supplementary Table 2)**. Both panels were designed to detect colon-associated mucosal and submucosal cell subsets and differentially expressed genes (DEGs) identified by single-cell RNA sequencing (scRNA-seq) of colon biopsies from UC and HC patients[9]. Due to difficulties with tissue clearing, MERSCOPE could not detect most of the genes in the panel (**Supplementary Figure 1A-B**). Even though some genes were detected as shown in the TMA scanned area (**Supplementary Figure 1C**), they were low quality and only 0.17% of cells passed quality control (QC) (**Supplementary Figure 1D**). Thus, MERSCOPE was excluded from the remainder of the analysis. The Xenium and CosMx panels shared 159 overlapping genes and were compared for transcript and gene detection, cell annotation, and differential gene expression (**Supplementary Table 2)**.

We began by using the default cell segmentation settings for each platform to identify single cells. For the Xenium platform, we employed the integrated default nuclear expansion method, extending nuclear boundaries by 5 μm or until another cell boundary is encountered. In contrast, the CosMx platform combines nuclear and cell membrane staining for cell identification. Although this led to slight differences in the distribution of nuclear versus cytoplasmic transcripts between platforms (**Supplementary Figure 2A**), the median cell area was similar (**Supplementary Figure 2B**). To further investigate outlier cells with larger areas observed in the Xenium platform, we examined cell boundaries using the Xenium Explorer visualization tool from 10X Genomics. Some cells displayed expanded boundaries, but the distortion affected primarily cells adjacent to luminal space (**Supplementary Figure 2C**). Overall, the nuclear expansion cell segmentation inflated the cell area of a relatively small percentage of cells.

We then evaluated sensitivity metrics across the full gene panel for both the Xenium and CosMx platforms. The larger CosMx panel yielded a higher number of transcripts and unique features per cell (**Figure 1B-C**). However, when the analysis was restricted to the 159 overlapping genes between the two panels, Xenium detected significantly more transcripts and unique features per cell compared to CosMx (**Figure 1B-C**). Importantly, Xenium also exhibited ten times lower detection of negative probes per cell (0.03 vs 0.37, $p<0.001$) (**Figure 1D**). Xenium demonstrated significantly higher transcript counts for the overlapping genes (**Figure 1E**). The higher signal per gene with reduced non-specific detection of negative probes yielded a markedly higher signal over

background for Xenium compared to CosMx (**Supplementary Table 3**). Upon examining dataset-specific genes unique to either the Xenium or CosMx panels, we found that most genes exhibited similar expression levels, typically ranging from 1 to 5 transcripts per cell. However, immunoglobulin genes expressed by B and plasma cells (*IGHG2, IGKC, IGHG1, IGHA1*) displayed higher expression levels (**Supplementary Figure 2D**). These highly expressed immunoglobulin genes could not be included in the Xenium panel due to their abundance and issues with optical crowding, pointing to one limitation of the signal amplification with Xenium. Notably, the age of the sample block had minimal impact on performance metrics for both methods, showing no meaningful differences in the median number of transcripts or genes detected per cell per core or FOV across 2-, 3-, 4-, and 5-year-old sample blocks (**Supplementary Figure 2E-F**). The HC samples were prospectively collected and processed in the laboratory, while the UC samples were retrospectively retrieved years after processing and storage through the usual standard of care. Despite this, the retrospectively retrieved UC samples exhibited equivalent or better transcript and feature detection compared to prospectively collected HC samples (**Figure 1F-G)**.

A key advantage of iSCST is its ability to spatially locate transcriptomic cell states that were previously identified by unsupervised clustering of single-cell RNA sequencing (scRNA-seq) from dissociated tissue. We assessed how each platform's specificity and sensitivity affected unsupervised cell type identification in FFPE colon biopsies. Using the same data processing pipeline, we generated uniform manifold approximation and projection (UMAP), clustering, and annotation, and generated heatmaps of landmark genes and correlation matrices for Xenium (**Fig 2A-D**) and CosMx (**Fig 2E-H**). At both the coarse (**Figure 2A, 2E**) and fine level (**Figure 2B, 2F**), comparing this CosMx re-analysis and prior analysis[9], Xenium enabled the identification of a broader range of colon-associated cell types, including various fine subsets of epithelial cells, fibroblasts, endothelial cells, and fragile innate immune cells like neutrophils and mast cells. Some subsets were difficult to confidently assign, such as intraepithelial lymphocytes (IELs), which is likely due in part to cell segmentation challenges. Overall, unsupervised clustering of single-cell gene expression profiles from Xenium produced more distinct gene expression signatures per cluster, yielding clearer cell cluster separation, as shown in heatmaps (**Figure 2C, 2G**) and correlation plots (**Figure 2D, 2H**). In contrast, the same data processing pipeline of the CosMx data from the same TMA resulted in >20% of cells being labeled as "Unassigned" due to indistinct transcriptomic profiles (**Figure 2I**). There was also a small percentage of cells labeled "ncount_hi" characterized by the high expression of B and plasma cell-related genes. Although finer cell annotation is possible with both the Xenium and CosMx datasets, here we applied comparable pipelines to provide a more direct comparison of subset identification. We then assessed the mutually exclusive co-expression rate (MECR) values for each platform, which provides a metric for lineage-specific genes that are unique to prominent cell types (**Supplementary Figure 3**). As a gold standard, we compared MECR values to previously published scRNA-seq data from HC and UC patient biopsies[9]. MECR values were generally similar for the two iSCST platforms, and neither was as specific as scRNA-seq, but the higher transcript counts for unique landmark genes enabled finer cell annotation with Xenium (**Supplementary Figure 3, Figure 2B**). Overall, the improved performance of Xenium for cell

identification in these colon FFPE samples is due to multiple factors, including higher cell number, a custom panel optimized for colon biopsies, and higher sensitivity and specificity for landmark gene expression. Then, to address reproducibility with the Xenium platform, we performed a replicate run of separate sections from the same TMA. We observed high reproducibility for gene expression levels (**Supplementary Figure 4A**) and the samples demonstrated a balanced representation of cell types across replicates (**Supplementary Figure 4B**). Doubling the number of cells in our dataset enhanced the accuracy of our detailed fine annotations (**Supplementary Figure 4C, Supplementary Figure 5A-B**). Taken together, our comprehensive comparison of three iSCST platforms for FFPE specimens indicates that the Xenium platform exhibits superior transcript and gene sensitivity, enables the detection of a greater range of colon-associated cell types and transcriptional states, exhibits high reproducibility across replicates, and is robust to tissue age.

A custom 290-plex iSCST Xenium panel differentiates cases and controls in UC FFPE colon biopsies, revealing spatial transcriptomic profiles of B Cells, epithelial cells, and mononuclear phagocytes.

Next, we aimed to extend our comparison of the CosMx and Xenium iSCST platforms beyond QC and cell identification metrics to evaluate their ability to identify transcriptomic signatures associated with UC pathology. Publicly available bulk transcriptomic data served as the comparator for this analysis, rather than scRNA-seq, because bulk RNA isolation methods do not involve digestion and, therefore, do not suffer from cellular or transcriptional dropout like scRNA-seq studies. We generated pseudobulk iSCST transcriptomic profiles by aggregating the transcript counts for all cells for each individual patient. We then performed a DEG analysis comparing UC biopsies before treatment with VDZ (UC PRE) to HC using the full gene panels for both platforms. Using a cutoff of >0.4 Log2FC and q-value <0.1, the transcriptomic profile obtained from the Xenium platform identified a broad range of upregulated genes in both UC and HC groups, with 32 genes significantly upregulated in UC PRE and 60 in HC (**Figure 3A**). The UC-associated DEGs included genes well-known for their association with inflammatory infiltrates, specifically neutrophils and monocytes (S100A8/S100A9) as well as lymphocytes (CD19, LTB, SELL, MS4A1), with cell identities confirmed in our Xenium iSCST dataset (**Supplementary Figure 5C**). Conversely, HC-associated genes included mostly genes associated with intact intestinal epithelial cells (IECs), such as *c15orf48, EPCAM*, *AQP8*, *FABP1, FABP2, PHGR1* (**Supplementary Figure 5C**). In contrast, data from the CosMx platform on the same TMA identified 57 genes upregulated in UC PRE and only one gene significantly upregulated in HC (**Figure 3B**). Unsupervised hierarchical clustering of a subset of the DEGs showed unique expression patterns that readily distinguished UC PRE patients and HC in the Xenium dataset (**Figure 3C**) but not CosMx (**Figure 3D**). CosMx identified a slightly higher number of DEGs in the UC PRE samples compared to Xenium, but only identified a single gene associated with HC (**Figure 3E**). It is important to acknowledge that testing more genes (1000 vs 290) leads to a statistical penalty for CosMx due to FDR correction. We then focused our comparison on the overlapping genes across platforms. This revealed a poor correlation between the differentially expressed genes identified by the two platforms (R = 0.12), with only *COL1A1*, *MZB1*, and *TIMP1* being significant in both datasets (**Figure 3F**). Overall, genes identified by Xenium exhibited a higher fold change compared to those from CosMx (**Figure 3F**). To further validate our Xenium gene

signatures identified for HC and UC PRE, we performed gene set enrichment analysis (GSEA) on an external bulk transcriptomic dataset[18], confirming significant Normalized Enrichment Scores (NES) in HC and UC PRE, and nearly flawless validation of the UC PRE-associated signature (**Figure 3G**). CosMx showed a slightly lower NES compared to Xenium for the UC PRE signature (-2.49 vs -2.66; **Figure 3G** and **Supplementary Figure 6A)**. To further adjudicate the conflicting DEGs between the Xenium and CosMx datasets (**Figure 3F**), we then determined whether the individual DEGs from the two iSCST methods exhibited concordance or discordance with up-regulation in the UC PRE external bulk transcriptomic dataset. Although both methods revealed significant concordance, CosMx demonstrated more discordance with bulk transcriptomic data, as 13 DEGs in the CosMx UC PRE signature were instead associated with HC in bulk transcriptomic data (**Supplementary Figure 6B**). These discordant CosMx genes included *KRT20* and *LGALS3*, which were enriched in HC in the external dataset and are expressed by intact IECs (**Supplementary Table 5**).

Finally, we leveraged the spatial information associated with each transcript to create spatial transcript scatter plots for the mucosal biopsies for subsets of DEGs identified by Xenium for HC and UC PRE patients. Transcript-level spatial scatter plots for IEC-specific genes (*AQP8, EPCAM*, and *PIGR*) were more abundant in HC tissue, while B cell-specific genes (*BANK1, IGHD, MS4A1*, and *SELL*) and MNP and neutrophil-specific genes (*S100A8, S100A9*, and *TIMP1*) were linked to disease (**Figure 3H**). Overall, the custom Xenium 290-plex gene panel identified more DEGs between HC and UC patients, with higher log fold changes and greater concordance with external validation bulk transcriptomic data. This strong differentiation between cases and controls in UC FFPE colon biopsies is marked by a shift in transcriptomic profiles, from epithelial cells predominating in HC to B cells, neutrophils and MNPs in UC.

Optimized iSCST pipeline identifies spatially and transcriptionally distinct fibroblast populations in FFPE colon biopsies.

Previous work by our group[9] and others[1,19] has highlighted the importance of distinct fibroblast subsets, characterized by unique transcriptional states, in colon tissue under steady-state conditions, as well as in UC pathology and treatment response. While the spatial location of those transcriptomic subsets has been recently described in IBD mouse models[12], equivalent detailed spatial characterization in clinical biopsies has been challenging and is still lacking. By leveraging the high sensitivity of the Xenium iSCST platform, unsupervised clustering from our custom 290-plex gene panel identified five transcriptionally distinct fibroblast subsets (S1, S2, S3, S4 and IAF; **Figure 2B and Supplementary Figure 5A**) that were previously characterized in scRNA-seq of human colonic stromal cells[1,9,19]. In agreement with prior scRNA-seq studies, Xenium iSCST identified transcriptionally distinct S1 (*CCL8*, *ADAMDEC1, APOE, FABP5)*, S2 (*F3, SOX6, PDGFRA, WNT5A, POSTN, CXCL14*), S3 (*GSN, OGN, CCDC80, C7*), S4 (*C3, TNFSF13B, IRF8, PTGDS)*, and IAF (*IL1R1, TIMP1, CD44, IL13RA2, MMP1, MMP3, OSMR, NFKBIA, TNFAIP3*) subsets (**Figure 4A**). These subsets display a broad range of functions and identities, and some have previously been linked to specific locations in the colon[20]. S1 fibroblasts have been linked to *PDGFRA*^{lo} colonic crypt fibroblasts (cCF) at the bottom of the colon crypts, S2

fibroblasts have been described to line the colonic crypt, and share features with *PDGFRA*^{hi} crypt top fibroblasts (CTFs) that are also high in *SOX6* and *WNT5A*[1,9,19,20]. While IAF are disease-associated, S1-4 subsets were present at steady state. We spatially mapped the transcriptomic states present in colon tissue at steady state (**Figure 4B**). Spatial scatter plots showed that the S1-cCF fibroblasts were somewhat dispersed but were biased more toward the crypt base, while S2-CTF fibroblasts lined the colonic crypt as previously described (**Figure 4B**). S3 fibroblasts localize to the submucosal (**Figure 4B**), while S4 fibroblasts express fibroblastic reticular cell (FRC)-associated genes, including *TNFSF13B* or B-cell activating factor (BAFF) and colocalize with B cells in gut-associated lymphoid tissue (GALT) aggregates (**Figure 4B**). Together, this study provides a comprehensive spatial map of transcriptomic subsets of colonic fibroblasts at steady state in archived clinical FFPE mucosal biopsies using iSCST.

Inflammation-associated fibroblast–monocyte network and B cell abundance in GALT are associated with UC

Our spatially resolved Xenium iSCST dataset accurately identified 34 distinct transcriptomic cell states, including fragile populations such as neutrophils which are typically lysed during cryopreservation and thawing or are excluded by encapsulation in single-cell sequencing workflows[9]. This provided us with a unique opportunity to study cell composition, gene expression changes, and spatial location in undissociated colon tissue between HC and UC cases without cellular dropout. First, by comparing cell abundances between HC and UC PRE, we revealed 19 cell subsets that differed significantly after FDR correction (**Figure 5A and Supplementary Figure 7**). We observed significant variations associated with disease, specifically in monocyte, neutrophil, IAF, and S4 fibroblast abundance (**Figure 5A**). Furthermore, there was a significant increase across all endothelial subsets, pericytes, B and plasma cells, and both CD4 and CD8 T lymphocytes in UC PRE, with a reduction in IEC subsets (**Supplementary Figure 7**). iSCST with Xenium identified transcriptionally and spatially distinct colonic mucosal cell subsets in homeostasis and disease, providing a more comprehensive framework for interrogating stromal and immune subsets.

We then leveraged the spatial aspect of the dataset to explore the proximity and interactions between our annotated cell types, comparing HC and UC PRE. Spatial neighborhood graphs were constructed for the HC and UC PRE data subsets using the fine annotation cell type categories aggregating all patients. Using these spatial neighbor graphs, we calculated neighborhood enrichment z-scores for each cell type pair (**Supplementary Figure 8**). Comparing cellular neighborhoods between HC and UC PRE, we identified several notable changes for the monocytes, including neighborhood enrichment with IAFs, neutrophils, and B cells (**Supplementary Figure 8B**). Next, we focused on the neighborhood enrichment z-scores between IAFs and all other cell types in HC (**Figure 5B**) and UC PRE (**Figure 5C**). Monocytes exhibited the highest interaction scores in both HC and UC PRE, with a collectively higher value in UC PRE. The IAF-monocyte enrichment was followed by IAF-neutrophil enrichment, which has been described in recent single-cell analyses of UC biopsy specimens[8,10]. Neutrophils and monocytes exhibit similarities in gene expression, so there could be overlap in

the annotation of neutrophils and monocytes. Here, the monocyte population exhibited higher *HLA-DRA, HLA-DRB1,* and *VCAN,* while the neutrophils expressed higher *CSF3R, FCGR3B, S100A8, S100A9, and TREM1 (***Supplementary Figure 8C**. To investigate this interaction further, we calculated the neighborhood enrichment z-scores between IAF and monocytes for each individual core and averaged the scores per patient. This revealed low enrichment scores in HC, with multiple instances where z-scores could not be calculated due to low or no abundance (**Figure 5D**). UC PRE biopsies showed a trend (p value 0.07) toward increased z-scores for IAFs and monocytes, consistent with the increased abundance and proximity of IAFs and monocytes in colitis. Spatial scatter plots of these subsets within representative HC and UC PRE samples confirmed these findings (**Figure 5E**). Taken together, we define an IAF-monocyte cellular network that increases in abundance and spatial proximity in patients with active UC.

Finally, we examined the biopsies from UC patient's pre-treatment with vedolizumab, stratified by subsequent treatment response, to assess the association of spatial cellular network with treatment outcomes. We performed a pseudobulk DEG analysis, stratifying the UC PRE group into responders (UC PRE R) and non-responders (UC PRE NR) to VDZ (**Supplementary Figure 9, Supplementary Table 6**). Consistent with previous findings[9], our Xenium dataset identified response-associated genes linked to IEC crypts, including *AGR2*, *PIGR*, and *SPINK4*. Additionally, we observed an increase in IAF and MNP-associated genes, such as *MMP1*, *MMP3* for IAF and *FCER2, CD1C* for the MNP, in non-response (**Supplementary Figure 9A-C**). Moreover, the Xenium dataset enabled the detection of differences in genes associated with B cells (*CD19, MS4A1, BANK1* and *SELL*) in UC PRE NR versus UC PRE R (**Supplementary Figure 9A-B**). These B cell genes were located spatially in GALT aggregates (**Supplementary Figure 9C**). This raised the possibility that VDZ non-responders have higher levels of GALT pre-treatment compared to responders, supporting recent work showing that VDZ reduces GALT in responders after treatment[21]. We then performed GSEA of external bulk transcriptomic data using our Xenium-defined gene sets from VDZ responders and non-responders. GSEA validated our Xenium VDZ response signature, comprised largely of epithelial genes (**Supplementary Figure 9D**). Interestingly, the overall Xenium VDZ non-response signature was not validated by GSEA in this external dataset. We then divided the Xenium VDZ non-response signatures into two separate signatures, one comprised of genes from IAF, monocytes, and neutrophils, and the other comprised of genes enriched in GALT aggregates, including B cell, DC, and S4 fibroblast landmark genes. The IAF-monocyte-neutrophil signature was enriched in VDZ non-responders by GSEA in the external dataset, but the GALT-B-DC-S4 fibroblast signature was not, suggesting that there may be some heterogeneity in VDZ non-responders. These data demonstrate the potential for Xenium to identify pre-treatment response and non-response signatures using archived clinical FFPE specimens.

DISCUSSION

To identify the optimal spatial transcriptomics platform for analyzing archived, clinical FFPE mucosal biopsies of non-IBD patients and patients with UC, we compared three commercially available platforms on the same FFPE TMA. The Vizgen MERSCOPE was not able to analyze these samples due to difficulties with tissue clearing.

Comparing 10X Genomics Xenium and Nanostring CosMx, the Xenium detected more transcripts and genes per cell for overlapping genes with significantly lower non-specific probe detection. The smaller custom Xenium panel, optimized for mucosal biopsies of patients with IBD, enabled the identification, annotation, and quantitation of more cell subsets and identified more differentially expressed genes across cell subsets and disease states. The default nuclear expansion cell segmentation with Xenium inflated the cell sizes of a small percentage of cells but identified comparable median cell area to other algorithms with minor impact on the overall results. Using this improved spatial pipeline, we mapped transcriptionally distinct fibroblast subsets to discrete spatial locations, and we identified increased abundance and trends toward increased spatial proximity of IAFs and monocytes in patients with UC. We also identified signatures associated with response or non-response to VDZ, highlighting IAF-monocyte networks and B cell-GALT abundance in non-responders as well as IEC gene sets in responders. Spatial transcriptomics preserves cell subset frequency and transcriptional states with high fidelity, and these methods can facilitate robust tissue profiling using archived FFPE.

Several recent studies have examined imaging-based spatial platforms on tumor tissue, and the results are largely consistent with this study[14–16]. One study found higher sensitivity and broader dynamic range with Xenium for FFPE prostate cancer samples[15]. Another study of FFPE tumor blocks originating from breast, colorectal, lung, ovary, bladder, and lymphoma similarly observed better gene clustering, fewer false positives, and better correlation with whole transcriptome approaches for Xenium as compared to CosMx[16]. A third study of 7 tumor types and 16 normal tissues found higher transcript counts, higher specificity, and lower false discovery rates for Xenium compared to CosMx, and showed that MERSCOPE was the most dependent on RNA integrity[16]. The default Xenium cell segmentation consistently inflated cell sizes across all these studies, but the overall impact on performance was minor, consistent with our findings. It is important to note that the preferred spatial transcriptomics approach may depend on the upstream processing and tissue type. For example, one recent benchmarking study using fresh-frozen mouse brain samples demonstrated superior performance with Vizgen's MERSCOPE over the Xenium platform[22]. Therefore, considering the tissue type and sample processing protocol will be critical for choosing a spatial transcriptomics platform.

It is also important to acknowledge that some of the improvements in cell annotation we observed with Xenium were due to the customized panel for IBD, which included key landmark genes for our cell subsets of interest. This focused panel allowed us to map transcriptionally distinct fibroblast subsets to discrete spatial locations, for example, confirming S2 as sub-epithelial crypt-associated fibroblasts, S3 as submucosal fibroblasts, and S4 as follicular stromal cells co-localizing with lymphoid aggregates in GALT. Although it would be appealing to employ an unbiased universal panel across tissues, our results suggest that an optimized panel for a specific tissue type and disease state will capture more cells and genes of interest with improved performance. In IBD, there are ample reference tissue scRNA-seq datasets to guide panel design[1–4,6,7,9], but other tissues and disease processes may benefit from initial studies using larger, unbiased panels or whole transcriptome approaches. While we observed excellent cell subset identification using a smaller, custom IBD panel, this focused panel may not capture the breadth of differentially expressed genes offered by larger panels or whole transcriptome

methods. Due to optical crowding with imaging-based spatial transcriptomics platforms, there will likely continue to be a trade-off between the signal for each gene and the size of the panel. Therefore, multiple complementary spatial transcriptomics approaches might be necessary to adequately capture the transcriptional diversity of cell subsets and disease states in FFPE tissue. Whether focused or whole transcriptome methods are used, the transcript counts for these spatial methods are generally orders of magnitude lower than scRNA-seq, which could limit downstream differential gene expression analyses. Therefore, bulk RNA-seq and scRNA-seq will continue to be critical for dissecting tissue inflammation and informing spatial transcriptomics datasets.

The identification of both B cell abundance in GALT and IAF-monocyte networks in UC biopsies, including some VDZ non-responders, complements recent studies regarding UC and the effects of VDZ. Comprehensive flow cytometry analysis of mucosal biopsies identified a significant reduction of $CD1c^+$ ($BDCA1^+$) type 2 conventional dendritic cells (cDC2s) in UC patients on VDZ[23]. We subsequently reported a shift of $\alpha4\beta7^+$ conventional dendritic cells (cDCs) from the tissue to the circulation in UC patients on VDZ[9]. Interestingly, another group reported that VDZ reduced naïve B and T cells and gut-homing plasmablasts, culminating in GALT attrition in VDZ responders[21]. Given the central role of cDCs in priming naïve T and B cells in lymphoid tissue, VDZ may reduce GALT by markedly inhibiting migratory cDCs from trafficking to the colon. Here, we identified higher B cell abundance and *CD1C* expression in some VDZ non-responders pre-treatment by Xenium. Given that both B cells and $CD1c^+$ cDCs localize to GALT, these data imply that higher pre-treatment GALT area may be associated with VDZ non-response, although the GALT signature in VDZ non-responders was not validated in an external transcriptomic dataset. Recruitment of neutrophils and monocytes to inflamed colon tissue by IAFs has also been associated with UC and non-response to VDZ[8,9]. In this study, we also observed an increased abundance and trend toward proximity of IAFs and monocytes in UC compared to HC, confirming prior associations of this cellular network with colitis. Neutrophils were also increased in abundance in patients with UC in this study, and given similarities in gene expression, there is likely some overlap in the annotation of neutrophils and monocytes using spatial transcriptomics. Finally, we identified pre-treatment spatial transcriptomics signatures in the epithelial compartment associated with a response to VDZ, suggesting a potential mechanism for mucosal healing. Namely, VDZ responders may have IECs that are poised to regenerate the epithelium once inflammation is suppressed.

There are important limitations of this study to consider, and several caveats regarding spatial transcriptomics in general. First and foremost, we compared healthy and inflamed colon biopsies and VDZ responders versus non-responders using a small number of patients. Future longitudinal spatial transcriptomics studies will need to include more patients on various therapies to identify signatures predictive of response or non-response. We also focused exclusively on archived human FFPE colon tissue, which is a unique tissue type. These endoscopic mucosal biopsies are placed directly in formalin within seconds of collection, they permeabilize easily due to their small size, and embedding is typically completed within a day or a few days. Thus, our findings may not extrapolate seamlessly to other specimens that vary in size and fixation times. As noted above, several studies have examined imaging-based spatial platforms on tumor and normal tissue, and the results largely align with

our study[14–16], but certain tissues or disease processes may be captured differently by various platforms. Moreover, additional gene sets would be required to adequately profile ileal samples. Another fundamental limitation of spatial transcriptomics is that annotating cells exclusively using transcriptional signatures has inherent drawbacks. For example, confidently differentiating naïve, effector, regulatory, and memory T cell subsets would be markedly improved with simultaneous spatial proteomic surface marker analysis. Similarly, the identification of polymorphonuclear cells (PMNs) and IELs would be greatly enhanced with expert concurrent annotation of H&E images by a pathologist, rather than relying solely on landmark gene expression. Spatial transcriptomics studies are also limited by sampling variability. For example, here we analyzed 4μm-thick sections of cores from 2-3mm biopsies meant to reflect the inflammatory status of an organ approximately one meter long. Adequate tissue sampling will be critical to consider in all future spatial transcriptomics studies.

In summary, we compared three commercially available platforms and optimized a custom spatial transcriptomics panel for analyzing archived FFPE colon mucosal biopsies from patients with or without colitis. Our custom IBD-specific Xenium panel detected more transcripts and genes per cell for overlapping genes, identified more unique cell subsets, quantitated more significant changes in cell frequency, and detected more differentially expressed genes across disease states. This approach yielded improved annotation and spatial analysis of fibroblast subsets and uncovered IAF-monocyte neighborhood enrichment in inflamed colon biopsies. This study adds to the growing body of literature identifying critical interactions among MNP, neutrophil, and fibroblast subsets in inflamed tissues across multiple diseases. We also identified increased B cell frequency in UC biopsies compared to HC, particularly in VDZ non-responders pre-treatment, demonstrating the ability of spatial transcriptomics to profile alterations in GALT across disease states. The capability of generating spatial transcriptomics data from routinely collected, archived clinical specimens with subcellular resolution could enable transformative translational research. Spatial transcriptomics could accelerate the identification and validation of candidate biomarkers and nominate novel therapeutic targets in affected tissue for a variety of inflammatory disorders.

METHODS

Study approval

The study was conducted according to the Declaration of Helsinki principles and was approved by the Institutional Review Board of the University of California, San Francisco (19-27302). Written informed consent was received from participants prior to inclusion in the study.

Study participants and biospecimen collection

For this study, both prospectively collected and retrospectively retrieved archived formalin-fixed paraffin-embedded (FFPE) samples were used. Healthy control (HC) patients refer to those without known or suspected inflammatory bowel disease (IBD) who were undergoing routine colonoscopy or sigmoidoscopy for various indications, such as colorectal cancer screening. HC biopsies were prospectively collected, placed in 10% formalin in 5 mL tubes for approximately 24h, then washed with PBS three times, and then transferred to 30%,

50%, and finally 70% ethanol, and they are stored in 70% ethanol for up to a month prior to paraffin embedding. All UC specimens were retrospectively retrieved. For retrospective retrieval, study subjects were identified by querying the electronic medical records of patients previously seen by UCSF Gastroenterology with existing archived specimens. This was followed by obtaining written informed consent and approval. Baseline demographic and clinical information about the study participants are provided in **Supplementary Table 1.** The CosMx dataset from this cohort was previously published and re-analyzed for this study[9]. Xenium and MERSCOPE analyses were acquired for this study as detailed below. We have consent to publish de-identified patient demographics including age at the time of sample collection, sex, diagnosis, and medical center. Demographic options were defined by the investigators, and participants chose their classifications. Biopsy samples were categorized based on the level of inflammation observed endoscopically: non-inflamed (score=0), mildly inflamed (score=1), moderately inflamed (score=2), or severely inflamed (score=3). Samples were assigned unique identifiers before biobanking.

Histology FFPE tissue microarray (TMA) construction

Tissue microarrays were constructed from FFPE blocks by Pantomics, with 1.1–1.5 mm cores. The IBD TMA contained multiple cores from 9 prospectively-collected HC and 11 retrospectively-retrieved UC patients. For UC patients, cores were obtained both before and after treatment with Vedolizumab. Core areas were selected based on individual H&E staining of each block, with representative areas chosen per core. Core samples from the same patients had at least duplicate cores from different locations, although some cores were not within the fiducials and final scanned area. The recipient TMA block was sectioned with a clearance angle of 10° and a thickness of 4 µm along the width of the block and was used for H&E staining. The TMA block was stored at 4 °C. Freshly cut TMA sections were prepared before each experiment, according to the recommended protocol for each spatial transcriptomic assay performed.

CosMx spatial transcriptomics tissue processing, staining, and imaging

FFPE TMA processing, staining, imaging, and cell segmentation were performed as previously described and published[24,9]. The time from sectioning to CosMx SMI analysis was 9 days. For this analysis, the raw data files were re-loaded into our preprocessing and technical performance comparison Jupyter notebooks to ensure consistent analysis across spatial transcriptomics platforms.

Xenium spatial transcriptomics tissue processing, staining, and imaging

Xenium sections were prepared following the Xenium “In Situ- Tissue Preparation Guide protocol” (10X Genomics, Demonstrated Protocol, CG000578-Rev C). Briefly, 4 µm sections of the FFPE TMA block were sectioned, and shortly kept afloat in an RNAse-free water bath at 42°C. They were then carefully transferred from the water bath to the marked sample area of the Xenium slide (PN-1000460). To remove excess of water, the slides were placed upright in a drying rack at room temperature for 30 minutes and then baked for 3 hours at 42°C. Thereafter, the slides were stored in a vacuum-sealed bag at room temperature until they were ready

for processing. The time from sectioning to Xenium analysis was 2 days for replicate 1 and 9 days for replicate 2. The Xenium slides were processed at UCSF according to the Xenium "In Situ for FFPE-Deparaffinization and Decrosslinking protocol" (10X Genomics, CG000580-Rev C). The slides were incubated at 60°C for 2 hours and then cooled down at room temperature for 7 minutes. After cooling, the slides were immersed first in xylene, then ethanol, and lastly, nuclease-free water to deparaffinize and rehydrate the tissue. Post rehydration, slides were assembled into the Xenium cassette (10X Genomics, PN-1000566) and the tissue sections were decrosslinked using the Xenium Slides and Sample Prep Reagents Kit (10X Genomics, PN-1000460). Decrosslinking involved a thermocycler incubation at 80°C for 30 minutes and then 22°C for 10 minutes with the decrosslinking buffer. The slides were washed multiple times with PBS-T and, subsequently, were hybridized following the Xenium "In Situ Gene Expression User Guide" (10X Genomics, CG000582 Rev D). Tissue slides were incubated at 50°C overnight with a customized gene panel, which included 290 genes (**Supplementary Table 2**). The next day, unbound probes were removed by washes with PBS-T and a thermocycler incubation at 37°C for 30 minutes with the post-hybridization wash buffer. After the removal of unbound probes, the junction between the RNA with its hybridized probes was ligated using the ligation mix in the thermocycler at 37°C for 2 hours. The probe-RNA product was then amplified at 30°C for 2 hours with the Amplification Master Mix to generate multiple gene-specific barcodes. Post amplification, the slides were washed and quenched with autofluorescence quencher to reduce signal noise. Lastly, before loading the Xenium cassette in the machine, nuclei were stained with DAPI. Xenium slides were imaged using the Xenium Analyzer following the guidelines provided in the Xenium Analyzer User Guide (10X Genomics, CG000584-RevB). The decoding modules A and B were transferred from 20°C to 4°C a night prior to the instrument run. On the day of the instrument run, first, the buffers (Wash Buffer A, Wash Buffer B, Xenium Instrument Wash Buffer, and Xenium Probe Removal Buffer) were prepared and loaded into the machine. Then, the decoding reagent plates, pipette tip rack, extraction tip, and the wetting consumable were loaded. Lastly, the Xenium cassettes containing the slides were loaded into the Xenium Controller machine. After successful loading, the machine took about an hour for a sample scan. From the output of the scan on the machine screen, we selected FOVs containing the tissue cores and started the run. Nucleus boundaries were identified using a nucleus segmentation algorithm applied to the nuclei-stained (DAPI) morphology image, and cell boundaries were determined by expanding the nucleus boundaries by 5 μm or until they intersected with another cell. The cell-specific and transcript-specific metadata, found in the cell summary and transcript output files, respectively, included several cell segmentation-related metrics: cell area (μm^2) and nucleus area (μm^2) for cells, and overlap with the nucleus (yes/no options) and nucleus distance (μm) for transcripts. After the Xenium run was completed, all data were stored in an organized output directory on the Xenium instrument. Data were downloaded and we used the cell summary file (cells.csv.gz) and the cell-feature matrix file (cell_feature_matrix.h5), which included the x and y coordinates for each individual cell. The transcript file (transcripts.csv) was used for the QC transcript-level comparisons.

MERSCOPE spatial transcriptomics tissue processing, and staining

MERSCOPE slides were prepared according to "MERSCOPE User Guide-Formalin-Fixed Paraffin-Embedded Tissue Sample Preparation" (91600112 Rev C). Briefly, 4 µm sections of the FFPE TMA block were sectioned, and place onto the center of the MERSCOPE FFPE slide (PN 20400100). Then, slides were transferred to a drying rack to remove excess water. Slides were dried at 55°C for 15 minutes and then at room temperature until no visible water droplets were present. Dry slides were stored in a 60-mm petri dish and sealed with parafilm at -20°C until further processing. The slides were processed within 6 weeks of sectioning. Before running the samples with the full gene panel, one of the MERSCOPE slides was used to run sample verification kit (91600004 Rev D), targeting a housekeeping gene EEF2 in Homo sapiens to verify RNA quality, assess background noise, and optimize protocol conditions. The assay using the full customized gene panel was then conducted. The MERSCOPE slide was equilibrated to room temperature for 30 minutes and underwent deparaffinization and decrosslinking steps. Subsequently, a pre-anchoring treatment (PN 20300116; PN 202300113) was performed at 37°C for 2 hours, followed by a cell boundary staining (PN20300100) with a primary staining solution at room temperature for 1 hour. Then, the MERSCOPE slide was washed three times with 1X PBS and incubated with a secondary staining solution at room temperature for 1 hour. After this step, samples were incubated with formamide wash buffer (PN 20300002) at 37°C for 30 minutes and subsequently incubated with RNA anchoring buffer (PN 20300117) at 37°C overnight. Following overnight incubation, another formamide wash was conducted at 47°C for 15 minutes and the slide was washed before to proceeding to the gel embedding step (PN 30200004). For resistant FFPE tissues, a digestion step (PN 20300005) was performed at 37°C for 5 hours before incubation in clearing solution (PN 20300114) for 13 days at 37°C to ensure tissue transparency, instead of the recommended 7 days in clearing solution, based on guidance from the manufacturer. Tissue transparency was never fully achieved. Consequently, MERSCOPE slides underwent autofluorescence quenching using MERSCOPE photobleacher (PN 10100003). Next, clearing solution was removed and slides were washed and incubated with formamide wash buffer at 37°C for 30 minutes before incubating with the customized 280-plex gene panel (**Supplementary Table 2**) in a humidified 37°C cell culture incubator for at least 36 hours. Finally, a post-encoding probe hybridization wash was completed through two incubations with formamide wash buffer at 47°C for 30 minutes each. Then, the slide was washed twice with sample wash buffer and incubated with DAPI and PolyT staining reagents at room temperature for 15 minutes. The slide was then assembled into MERSCOPE flow chamber and loaded on the MERSCOPE instrument for imaging following the User guide (91600001 Rev G) for proper configuration and data acquisition. Segmentation parameters were selected and image processing was run using the Cellpose segmentation algorithm to produce single-cell outputs[25]. The cell-feature matrix file (cell_by_gene.csv), cell metadata file (cell_metadata.csv), and cell and transcript location information file (micron_to_mosaic_pixel_transform.csv) were used for our data processing analysis.

Technical performance comparisons among spatial transcriptomics platforms

Our technical QC comparison between Xenium and CosMx platforms utilized transcript data, filtered to only include high-quality transcripts that passed platform-specific filters (Xenium platform phred-scaled quality value

(Q-Score) > 20; All CosMx QC flags = 'Pass') and our cell-level filtering schema, which included filtering out cells with <50 counts and <10 genes and filtering out genes with <1 count and detected in <10 cells.

The sources of the data values used for various QC comparisons are detailed below. To quantify cellular location classification for transcripts, we used the Xenium transcript metadata 'Overlaps Nucleus' metric (yes/no options) and the CosMx transcript metadata 'Cellular Compartment' metric (0, cytoplasm, membrane, and nuclear options). Post-filtering, we had 0 transcripts with 0 values. For the cellular location classification plot, we grouped cells as nuclear and non-nuclear for both platforms. Cell area was compared across platforms using μm^2 values. For Xenium, the cell area values were already provided in μm^2. However, for CosMx, the cell area values were initially in pixels and were converted to μm^2 by multiplying each pixel value by 0.0144, as 1 pixel equals 0.12 µm. Negative probes per cell were quantified using the 'Control Probe Counts' cell metadata column in Xenium and 'nCount NegProbes' cell metadata column in CosMx. Signal over background metrics were calculated by dividing the mean expression of each gene within cells by the mean negative probe counts per cell. Block age was measured from the time of tissue collection until the assay was conducted. As a specificity measure, we calculated mutually exclusive co-expression rate (MECR) values for each dataset[22]. We used lineage-specific genes that are highly expressed in our cell types of interest within the Xenium, CosMx, and our previous scRNA-seq dataset performed on colon biopsies collected from HC and UC patients (GSE250487). Ideally, these lineage-specific genes should only be expressed within their corresponding cell types. The MECR metric quantifies the detected co-expression rate of two lineage-specific genes in individual cells, normalized for the abundance of each gene. MECR values were calculated for each gene pair by dividing the fraction of cells that express both markers by the fraction of cells that express at least one of the markers.

Data preprocessing and annotation

We developed and optimized a standard preprocessing pipeline using the Python packages scanpy, squidpy, and anndata, tailored for use with CosMx, Xenium, and MERSCOPE data[26,27]. We created spatial data objects in Python for each data type using cell-level gene expression, metadata, and spatial location information. Low quality transcripts (as qualified by a Q-score < 20) were automatically removed from the Xenium cell-level data before processing steps. For the CosMx and Xenium data, we filtered out cells with <50 counts and <10 genes and genes with <1 count and detected in <10 cells. As the MERSCOPE dataset had very few cells passing QC, we tweaked our filtering schema to remove cells with <10 counts instead of <50 counts. The other filtering criteria remained the same. After filtering, we proceeded to normalize and log-transform the data and regress out unwanted sources of variation, specifically the number of transcripts per cell and the number of unique (gene) transcripts per cell. Next, we scaled the data and ran a Principal Component Analysis (PCA). We computed a neighborhood graph using n_neighbors=10 and n_pcs=30 (CosMx, Xenium) or n_pcs=14 (MERSCOPE). We embedded the neighborhood graph using UMAP, specifying min_dist=0.2 and spread=1.5 (CosMx, MERSCOPE) or spread=1.75 (Xenium), and clustered using Leiden community detection. We annotated cell clusters by known markers and spatial location, using the Chan-Zuckerberg CELLxGENE tool for refinement[28,29]. The CosMx and Xenium datasets were processed with the same pipeline and settings, as noted above. For the

Xenium dataset, some leiden clusters were further divided based on readily apparent, distinct landmark gene expression within subclusters. Cluster 07 was subdivided into neutrophils and monocytes, and the remaining cells expressed high levels of *BANK1, IGHD, MS4A1,* and *CD19* and were combined with the B cell clusters 11 and 16. Cluster 02 and 22 were combined into a coarse endothelial cluster, and then divided into arterial, venous, lymphatic, pericytes and Not Otherwise Specified (NOS) subsets. Cluster 15 was subdivided into S3 and S4 fibroblasts. A LYVE1^{+} macrophage subcluster was annotated macrophage cluster 10. Cluster 24 was subdivided into IAF and plasma cells, and those plasma cells were combined with plasma cell clusters 0, 24, and 30.

Integrating Xenium replicates

We created spatial data objects in Python for each Xenium replicate data using cell-level gene expression, metadata, and spatial location information. We added prefixes to the cell ID values to distinguish between replicates 1 and 2 and added a 'batch' metadata column. We proceeded to filter the datasets separately based on our standard filtering schema (filtered out cells with <50 counts and <10 genes and genes with <1 count and detected in <10 cells). Next, we concatenated the two replicate anndata objects along the observations axis (x-axis; rows) using the anndata.concat function. This process preserves all sub-elements of each object while stacking the observations in an ordered manner. By concatenating along the observations axis, we effectively combined data from different cells (observations) into a single dataset. We then added 15,000 to the x-coordinate value of each cell in replicate 2 to offset its value from those in replicate 1. This adjustment allowed us to visualize the spatial coordinates of the concatenated dataset with replicates 1 and 2 displayed side by side rather than overlapping. After concatenating, we proceeded with the preprocessing pipeline as usual: normalization and log-transformation of the data, regressing out unwanted sources of variation, and scaling the data. We ran a Principal Component Analysis (PCA), integrated the data with Harmony[30] to account for potential batch effects, and constructed a neighborhood graph using n_neighbors=10 and n_pcs=30. We embedded the neighborhood graph using UMAP, specifying min_dist=0.2 and spread=1.5, and clustered using Leiden community detection. We annotated cell clusters by known markers and spatial location, using the Chan-Zuckerberg CELLxGENE tool for refinement.

Neighborhood enrichment

We performed neighborhood enrichment analyses for fine annotation cell clusters within the Xenium HC and UC PRE data subsets using functions from the squidpy package. To do this, we constructed a spatial nearest-neighbor graph using Delaunay triangulation, which links cells based on their spatial proximity to each other within a connectivity matrix. We then calculated an enrichment z-score for each pair of fine annotation cell clusters based on cell proximity within the connectivity graph. These analyses were conducted for the Xenium HC and UC PRE data subsets in two ways: (1) by calculating neighborhood enrichment z-scores for each pair of fine annotation cell clusters across the entire dataset (all cores, all patients), (**Supplemental Figure 7A-B**), and (2) by calculating neighborhood enrichment z-scores specifically for our cell types of interest, Fibroblast_IAF

and MNP_monocyte cell clusters, within each individual core and then grouping these z-score values for each unique patient (**Figure 5D**).

Pseudobulk DE genes analysis and Gene Set Enrichment Analysis (GSEA)

Spatial transcriptomic data were used to perform pseudobulk differential expression (DE) analysis using DESeq2[31]. Three distinct Pseudobulk DE gene analyses were conducted: CosMx data comparing UC PRE to HC, Xenium data comparing UC PRE to HC and, Xenium data comparing UC PRE Non-Responders to UC PRE Responders. Samples were stratified by patients. The bulk transcriptomic dataset (GSE73661)[18], consisting of colonic biopsies from HC and UC patients before and after various biologic treatments, was obtained from the GEO database and utilized for GSEA[32]. For this analysis, the bulk transcriptomic samples were categorized into HC (n=12) and UC PRE (n=43), or UC PRE VDZ R (n=11) and UC PRE VDZ NR (n=9). Data were normalized and z-scored before being processing in the GSEA program (version 4.3.3). HC and UC PRE signatures were defined based on the Pseudobulk DE analysis from Xenium spatial transcriptomic data. For CosMx, only the UC PRE gene signature was identified. Gene signatures obtained from Xenium for UC PRE R, UC PRE NR, IAF-monocyte-neutrophil and GALT-B-DC-S4 fibroblast were explored in the external cohort of patients pre-VDZ stratified by UC PRE R and UC PRE NR. GSEA was then conducted for each gene signature (**Supplementary Table 7**). The number of permutations was set to 1000, with no dataset collapse, using the Affymetrix Human Gene 1.0 ST Array and t-test. For each analysis, a Normalized Enrichment Score (NES) was calculated, and only NES values with a p-value < 0.05 and an adjusted q-value (FDR) < 0.1 were considered significant.

Statistics

For the comparative analysis among different spatial transcriptomic platforms, the non-parametric method using Mann-Whitney test, two-tailed was utilized. However, for the number of transcripts and unique features per cell per core or FOV, the Kruskal-Wallis test was used to assess differences in population medians across 2-, 3-, 4-, and 5-year old samples. Cell frequencies for Xenium comparing two groups were also assessed using the Mann-Whitney test, followed by a two-stage linear step-up procedure of Benjamini, Krieger and Yekutieli, which adjusts for multiple comparisons by controlling the false discovery rate (FDR). The q-value, representing the FDR-adjusted p-value, was set for discovery at $q < 0.1$. For DeSeq2 analysis, significance thresholds were defined as log2fc >0.4 or <-0.4 and q < 0.1 and counts threshold of baseMean >500 for Xenium and >400 for CosMx (**Supplementary Table 4-6**). Additional statistical analyses were performed using GraphPad PRISM 10. The ComplexHeatmap R package was used to generate expression z-score heatmaps for DE genes.

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Author contribution statement

Conceptualization: GKF, MGK, AJC; patient recruitment and sample collection: GL, JH, UM, DYO, MGK; sample processing and data acquisition: EM, VJ, CE, GL, JT, JH, WE; cell subset annotation: EM, GL, DEL, JYH; spatial transcriptomics analysis: EM, ML; supervision: GKF, MGK, AJC; funding acquisition: GKF, MGK, AJC; all authors contributed to manuscript preparation.

Competing interests statement

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FIGURE LEGENDS

Fig. 1| Schematic of study design and technical performance comparison between Xenium and CosMx platforms. (**A**) Schematic of study design. Created with BioRender.com (**B,C**) Number of (**B**) transcripts and (**C**) unique features detected per cell within the Xenium and CosMx datasets, calculated using the complete gene panel for each platform (Xenium, 290 genes; CosMx, 1,000 genes; left) and limited to the 159 overlapping genes across both panels (right). (**D**) Number of negative probes detected per cell within the Xenium and CosMx (Xenium mean=0.03 and CosMx mean=0.37). (**E**) Correlation between average transcript counts in Xenium and CosMx for the 159 overlapping genes. (**F,G**) Number of (**F**) transcripts and (**G**) unique features detected per cell per core or FOV within the Xenium and CosMx datasets split by prospectively collected HC and retrospectively collected UC. For panels **B, C, D, F** and **G** box and whisker plots, the band indicates the median, the box indicates

the first and third quartiles, and the whiskers indicate minimum and maximum value within the upper/lower fence (upper fence=Q3+1.5xIQR and lower fence= Q1-1.5xIQR), only outlier points are shown. Mann-Whitney, two-tailed tests, p-values are indicated.

Fig. 2| Cell type recovery across spatial transcriptomics platforms. (**A,B**) UMAP visualization of Xenium dataset (313,940 cells), colored by coarse (**A**) and fine (**B**) annotations. (**C**) Heatmap displaying gene expression of the top 5 landmark genes for each coarse annotation cell type within the Xenium dataset. (**D**) Correlation matrix displaying the correlation between coarse annotation cell types identified for Xenium. (**E,F**) UMAP visualization of CosMx dataset (126,368 cells), colored by coarse (**E**) and fine (**F**) annotations. (**G**) Heatmap displaying gene expression of the top 5 landmark genes for each coarse annotation cell type within the CosMx dataset. (**H**) Correlation matrix displaying the correlation between coarse annotation cell types identified for CosMx. (**I**) Stacked bar plots for coarse annotation displaying cell frequency (percent of total) for Xenium and CosMx.

Fig. 3| Pseudobulk DE gene analysis comparing UC PRE versus HC in both platforms and gene set enrichment analysis (GSEA) of an external, publicly available, bulk transcriptomic dataset using Xenium transcriptomic signatures. (**A**) Volcano plot of pseudobulk DE genes identified by DESeq2 with log_2fc >0.4 or <-0.4 and q < 0.1 in UC PRE vs HC for Xenium dataset. (**B**) Volcano plot of pseudobulk DE genes identified by DESeq2 with log_2fc >0.4 or <-0.4 and q < 0.1 in UC PRE vs HC for CosMx dataset. (**C**) Heatmap of expression z-scores for the indicated genes in UC PRE (Up/Down) relative to HC for Xenium dataset. (**D**) Heatmap of expression z-scores for the indicated genes in UC PRE (Up/Down) relative to HC for CosMx dataset. (**E**) Number of pseudobulk DE genes in the indicated platform with log2fc > 0.4 or <-0.4 in UC PRE relative to HC identified by DESeq2 analysis. (**F**) Volcano plot of significant overlapping genes identified by DESeq2 with log_2fc >0.4 or <-0.4 for Xenium and CosMx; genes are color coded (green, significant in both panels; blue, significant in Xenium panel only; orange, significant in CosMx panel only). (**G**) GSEA of Xenium HC and UC PRE spatial gene signatures in an external cohort of patients and relative Normalized Enrichment Scores (NES). (**H**) Representative spatial transcript scatter plots highlighting a subset of genes relatively increased in HC and UC PRE in Xenium dataset. For panels **B** and **D**, some genes are off-scale for visualization purposes, z-score set from -1 to 1.

Fig. 4| Xenium enabled identification and spatial localization of distinct fibroblast subsets in colon mucosal biopsies and identified increased myeloid and stromal cell subsets in UC. (A) Dot plot representation of landmark genes for the indicated subsets. (B) Transcriptionally distinct fibroblast subsets identified by relative spatial localization in colon tissue from representative cores for the indicated cell subsets.

Fig. 5| Neighborhood enrichment analysis of Xenium dataset reveals higher proximity of IAFs and monocytes in UC PRE biopsies. (**A,B**) Heatmaps displaying neighborhood enrichment z-scores for fine

annotation cell pairs within (**A**) HC and (**B**) UC PRE biopsies. Spatial enrichment of IAFs cells to all other cell types in (**C**) HC and (**D**) UC PRE biopsies. (**E**) Violin plots comparing the spatial enrichment of IAFs and monocytes by patient, each dot represents a core; nd, not defined. (**F**) Spatial scatter plot of representative cores highlighting IAF, crypt top (CT) colonocytes, and monocytes in HC and UC PRE biopsies. For panel **E**, Mann-Whitney test, p-value is indicated. For panels **A** and **B**, several values exceed the scale for visualization purposes and are denoted by a white asterisk.

Supplemental Fig. 1| MERSCOPE dataset analysis. (**A**,**B**) UMAP visualization of MERSCOPE dataset (212 cells), highlighting (**A**) transcript count per cell, (**B**) number of genes per cell, and (**C**) area of TMA scanned showing DAPI and detected transcripts (**D**) spatial scatter plot depicting the spatial location of cells in the MERSCOPE dataset in relation to the TMA slide, colored based on leiden clustering.

Supplemental Fig. 2| Xenium and CosMx dataset quality control and cell segmentation-related metrics. (**A**) Bar plot comparing the percentage of nuclear versus non-nuclear transcripts within the Xenium and CosMx datasets. (**B**) Cell area plotted in μm^2 for each cell within the Xenium and CosMx dataset. (**C**) Representative Xenium cell segmentation visualization, displaying DAPI nuclei (white), nuclei outlines (red), cell borders (black), cells are pseudocolored by Xenium fine annotation labels. (**D**) Scatter plot of average transcript count per cell for genes specific to either the Xenium or CosMx (blue for Xenium, and orange for CosMx). (**E,F**) Number of (**E**) transcripts and (**F**) unique features detected per cell per Core or FOV within the Xenium and CosMx datasets, calculated using the complete gene panel for each platform (Xenium, 290 genes; CosMx, 1,000 genes; left) and limited to the 159 overlapping genes across both panels (right). Plotted points are categorized based on the age of FFPE blocks from which they originated. For panels **B, E,** and **F**, box and whisker plots, the band indicates the median, the box indicates the first and third quartiles, and the whiskers indicate minimum and maximum value within the upper/lower fence (upper fence=Q3+1.5xIQR and lower fence= Q1-1.5xIQR), only outlier points are shown; Mann-Whitney, two-tailed tests. Panels E and F compared the difference in population medians between 2-, 3-, 4-, and 5-year-old samples, averaged by core or FOV, with Kruskal-Wallis rank sum statistic (h-statistic) indicated.

Supplemental Fig. 3| Using mutually exclusive genes to evaluate platform specificity. (A-C) Scatter plots of gene expression level (transcript counts per cell) for two representative mutually exclusive lineage-specific genes within (**A**) Xenium, (**B**) CosMx, and (**C**) scRNA-seq datasets generated from colon biopsies collected from HC and UC patients (GSE250487). Genes were selected based on cell types of interest and the overlapping genes between Xenium and CosMx panels. The mutually exclusive co-expression rate (MECR) value is listed for each scatter plot, with lower rates corresponding to greater technology specificity.

Supplemental Fig. 4| Reproducibility of Xenium replicates. (**A**) Scatter plot showing the gene expression level (transcript counts per cell) for all genes between Xenium replicates. (**B**) Cell frequency as a percent of

dataset total for fine annotations within Xenium replicates. (**C**) UMAP visualization of two integrated Xenium replicate runs, colored by fine annotations (582,188 total cells: 313,940 from replicate 1 and 268,248 from replicate 2). Xenium replicate data were obtained from different runs of different sections from same TMA block.

Supplemental Fig. 5| Xenium dataset landmark gene heatmap and correlation matrix for fine annotations, and DEGs between UC and HC. (**A**,**B**) Fine cell annotation (**A**) heatmap displaying gene expression of the top 3 landmark genes and (**B**) correlation matrix in Xenium replicate 1. (**C**) Dot plot representation of a subset of genes from pseudobulk DEG analysis by coarse annotations.

Supplemental Fig. 6| GSEA of an external, publicly-available, bulk transcriptomic dataset using a CosMx transcriptomic signature associated with UC PRE biopsies. (**A**) GSEA of CosMx UC PRE spatial gene signature in an external cohort of patients and relative NES. (**B**) Number of DE genes in the UC PRE signature for Xenium and CosMx that are concordantly or discordantly expressed to the UC PRE patients from the publicly available dataset.

Supplemental Fig. 7| Quantitation of differential cell abundance in the Xenium integrated dataset. Cell frequencies of the indicated subsets comparing HC and UC PRE, each dot represents one patient; Mann–Whitney, two-tailed test with FDR correction; q<0.1 threshold for discovery. Only statistically significant cell subsets are shown with exact p-value and q-value displayed.

Supplemental Fig. 8| Unsupervised Neighborhood enrichment analysis in Xenium FFPE colon biopsies and dot plot of neutrophil versus monocyte landmark genes. (**A**,**B**) Heatmaps displaying neighborhood enrichment z-scores for fine annotation cell pairs within (**A**) HC and (**B**) UC PRE biopsies. (**C**) Dot plot representation of landmark genes for the indicated subsets. For panels **A** and **B**, several values exceed the scale for visualization purposes (values greater than 200)..

Supplemental Fig. 9| Pseudobulk DE gene analysis comparing UC PRE Non-Responders (UC PRE NR) versus UC PRE Responders (UC PRE R) in the Xenium dataset. (**A**) Volcano plot of pseudobulk DE genes identified by DESeq2 with log2fc >0.4 or <-0.4 and q < 0.1 in UC PRE NR vs UC PRE R. (**B**) Heatmap of expression z-scores for the indicated genes in UC PRE NR (Up/Down) relative to UC PRE R. (**C**) Representative spatial transcript scatter plots highlighting a subset of genes relatively increased in UC PRE R (left) and UC PRE NR (right). (**D**) GSEA of Xenium signatures in external cohort of patients pre-VDZ stratified by UC PRE NR and UC PRE R with relative Normalized Enrichment Scores (NES) and FDR q-value. For panel **B**, some genes are off-scale for visualization purposes, z-score set from -1 to 1.

Supplementary Table 1. Baseline demographic and clinical data for study participants. Categorical variables were analyzed by Chi-square test and continuous variables were compared using one-way ANOVA with FDR

correction or Mann-Whitney test where appropriate. ns, not significant; n/a, not applicable; pre, pre-VDZ treatment; post, post-VDZ treatment. VDZ-vedolizumab.

Supplementary Table 2. Gene panels for the different spatial transcriptomic platforms.

Supplementary Table 3. Summarized QC results.

Supplementary Table 4. Pseudobulk DE gene analysis of Xenium data comparing colon biopsies in UC PRE versus HC. Significance was set as log2fc >0.4 or <-0.4, p-adj < 0.1 and baseMean >500.

Supplementary Table 5. Pseudobulk DE gene analysis of CosMx data comparing colon biopsies in UC PRE versus HC. Significance was set as log2fc >0.4 or <-0.4, p-adj < 0.1 and baseMean >400.

Supplementary Table 6. Pseudobulk DE gene analysis of Xenium data comparing colon biopsies in UC PRE Non-Responders versus UC PRE Responders. Significance was set as log2fc >0.4 or <-0.4, p-adj < 0.1 and baseMean >500.

Supplementary Table 7. iSCST gene signatures used for Gene Set Enrichment Analysis (GSEA). Numeric ID, Affymetrix numeric probe identifier corresponding to each gene.

REFERENCES

1. Kinchen, J. *et al.* Structural Remodeling of the Human Colonic Mesenchyme in Inflammatory Bowel Disease. *Cell* **175**, 372-386.e17 (2018).
2. Parikh, K. *et al.* Colonic epithelial cell diversity in health and inflammatory bowel disease. *Nature* **567**, 49–55 (2019).
3. Boland, B. S. *et al.* Heterogeneity and clonal relationships of adaptive immune cells in ulcerative colitis revealed by single-cell analyses. *Sci. Immunol.* **5**, eabb4432 (2020).
4. Smillie, C. S. *et al.* Intra- and Inter-cellular Rewiring of the Human Colon during Ulcerative Colitis. *Cell* **178**, 714-730.e22 (2019).
5. Konnikova, L. *et al.* High-dimensional immune phenotyping and transcriptional analyses reveal robust recovery of viable human immune and epithelial cells from frozen gastrointestinal tissue. *Mucosal Immunol.* **11**, 1684–1693 (2018).
6. Martin, J. C. *et al.* Single-Cell Analysis of Crohn's Disease Lesions Identifies a Pathogenic Cellular Module Associated with Resistance to Anti-TNF Therapy. *Cell* **178**, 1493-1508.e20 (2019).
7. Mitsialis, V. *et al.* Single-Cell Analyses of Colon and Blood Reveal Distinct Immune Cell Signatures of Ulcerative Colitis and Crohn's Disease. *Gastroenterology* (2020) doi:10.1053/j.gastro.2020.04.074.
8. Friedrich, M. *et al.* IL-1-driven stromal-neutrophil interactions define a subset of patients with inflammatory bowel disease that does not respond to therapies. *Nat. Med.* **27**, 1970–1981 (2021).
9. Mennillo, E. *et al.* Single-cell and spatial multi-omics highlight effects of anti-integrin therapy across cellular compartments in ulcerative colitis. *Nat. Commun.* **15**, 1493 (2024).

10. Garrido-Trigo, A. *et al.* Macrophage and neutrophil heterogeneity at single-cell spatial resolution in human inflammatory bowel disease. *Nat. Commun.* **14**, 4506 (2023).
11. Eshghi, S. T. *et al.* Molecular characterization of response to etrolizumab and anti-TNF reveals treatment resistance in ulcerative colitis is associated with an abundance of residual neutrophil subsets and inflammatory fibroblast populations. Preprint at https://doi.org/10.1101/2024.07.02.601267 (2024).
12. Cadinu, P. *et al.* Charting the cellular biogeography in colitis reveals fibroblast trajectories and coordinated spatial remodeling. *Cell* **187**, 2010-2028.e30 (2024).
13. Kumar, T. *et al.* A spatially resolved single-cell genomic atlas of the adult human breast. *Nature* **620**, 181–191 (2023).
14. Cervilla, S. *et al.* Comparison of spatial transcriptomics technologies across six cancer types. Preprint at https://doi.org/10.1101/2024.05.21.593407 (2024).
15. Cook, D. P. *et al.* A Comparative Analysis of Imaging-Based Spatial Transcriptomics Platforms. Preprint at https://doi.org/10.1101/2023.12.13.571385 (2023).
16. Wang, H. *et al.* Systematic benchmarking of imaging spatial transcriptomics platforms in FFPE tissues. Preprint at https://doi.org/10.1101/2023.12.07.570603 (2023).
17. Janesick, A. *et al.* High resolution mapping of the tumor microenvironment using integrated single-cell, spatial and in situ analysis. *Nat. Commun.* **14**, 8353 (2023).
18. Arijs, I. *et al.* Effect of vedolizumab (anti-α4β7-integrin) therapy on histological healing and mucosal gene expression in patients with UC. *Gut* **67**, 43–52 (2018).
19. Fawkner-Corbett, D. *et al.* Spatiotemporal analysis of human intestinal development at single-cell resolution. *Cell* (2021) doi:10.1016/j.cell.2020.12.016.
20. Brügger, M. D. & Basler, K. The diverse nature of intestinal fibroblasts in development, homeostasis, and disease. *Trends Cell Biol.* **33**, 834–849 (2023).
21. Canales, P. *et al.* Gut-associated lymphoid tissue attrition associates with response to anti-α4β7 therapy in ulcerative colitis. *C E N C E M M U N O O G* (2024).
22. Hartman, A. & Satija, R. Comparative analysis of multiplexed in situ gene expression profiling technologies. Preprint at https://doi.org/10.7554/eLife.96949.1 (2024).
23. Boden, E. K. *et al.* Vedolizumab Efficacy Is Associated With Decreased Intracolonic Dendritic Cells, Not Memory T Cells. *Inflamm. Bowel Dis.* **30**, 704–717 (2024).
24. He, S. *et al.* High-plex imaging of RNA and proteins at subcellular resolution in fixed tissue by spatial molecular imaging. *Nat. Biotechnol.* (2022) doi:10.1038/s41587-022-01483-z.
25. Stringer, C., Wang, T., Michaelos, M. & Pachitariu, M. Cellpose: a generalist algorithm for cellular segmentation. *Nat. Methods* **18**, 100–106 (2021).
26. Wolf, F. A., Angerer, P. & Theis, F. J. SCANPY: large-scale single-cell gene expression data analysis. *Genome Biol.* **19**, 15 (2018).
27. Palla, G. *et al.* Squidpy: a scalable framework for spatial omics analysis. *Nat. Methods* **19**, 171–178 (2022).
28. Megill, C. *et al.* cellxgene: a performant, scalable exploration platform for high dimensional sparse matrices. Preprint at https://doi.org/10.1101/2021.04.05.438318 (2021).
29. Kim, Y.-J. *et al. Tutorial: Guidelines for Manual Cell Type Annotation of Single-Cell Multi-Omics Datasets Using Interactive Software*. http://biorxiv.org/lookup/doi/10.1101/2023.07.11.548639 (2023) doi:10.1101/2023.07.11.548639.
30. Korsunsky, I. *et al.* Fast, sensitive and accurate integration of single-cell data with Harmony. *Nat. Methods* **16**, 1289–1296 (2019).
31. Love, M. I., Huber, W. & Anders, S. Moderated estimation of fold change and dispersion for RNA-seq data with DESeq2. *Genome Biol.* **15**, 550 (2014).
32. Subramanian, A. *et al.* Gene set enrichment analysis: A knowledge-based approach for interpreting genome-wide expression profiles. *Proc. Natl. Acad. Sci.* **102**, 15545–15550 (2005).

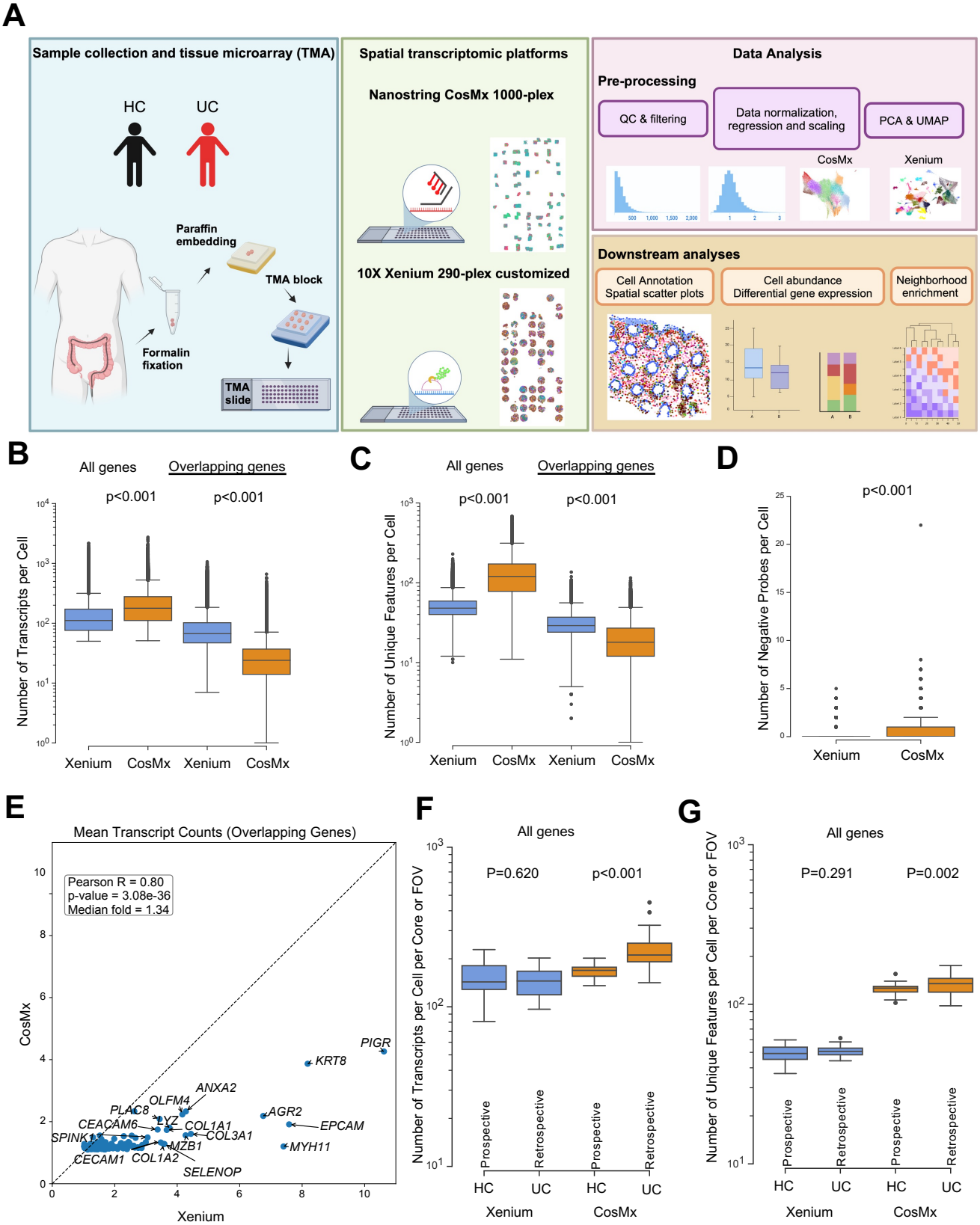


Fig. 1| Schematic of study design and technical performance comparison between Xenium and CosMx platforms. (**A**) Schematic of study design. Created with BioRender.com (**B,C**) Number of (**B**) transcripts and (**C**) unique features detected per cell within the Xenium and CosMx datasets, calculated using the complete gene panel for each platform (Xenium, 290 genes; CosMx, 1,000 genes; left) and limited to the 159 overlapping genes across both panels (right). (**D**) Number of negative probes detected per cell within the Xenium and CosMx (Xenium mean=0.03 and CosMx mean=0.37). (**E**) Correlation between average transcript counts in Xenium and CosMx for the 159 overlapping genes. (**F,G**) Number of (**F**) transcripts and (**G**) unique features detected per cell per core or FOV within the Xenium and CosMx datasets split by prospectively collected HC and retrospectively collected UC. For panels **B, C, D, F** and **G** box and whisker plots, the band indicates the median, the box indicates the first and third quartiles, and the whiskers indicate minimum and maximum value within the upper/lower fence (upper fence=Q3+1.5xIQR and lower fence= Q1-1.5xIQR), only outlier points are shown. Mann-Whitney, two-tailed tests, p-values are indicated.

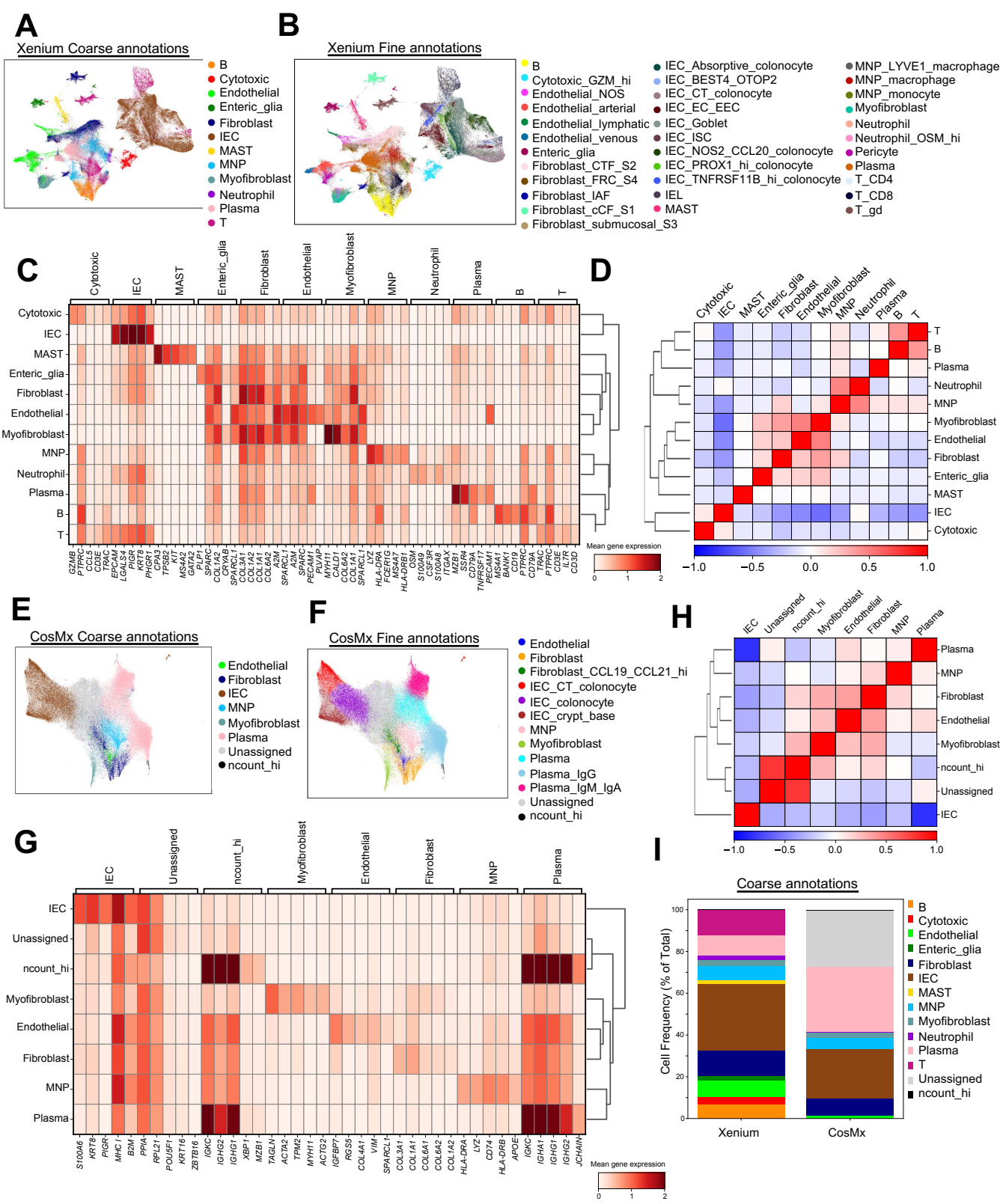


Fig. 2| Cell type recovery across spatial transcriptomics platforms. (**A,B**) UMAP visualization of Xenium dataset (313,940 cells), colored by coarse **(A)** and fine **(B)** annotations. **(C)** Heatmap displaying gene expression of the top 5 landmark genes for each coarse annotation cell type within the Xenium dataset. **(D)** Correlation matrix displaying the correlation between coarse annotation cell types identified for Xenium. (**E,F**) UMAP visualization of CosMx dataset (126,368 cells), colored by coarse **(E)** and fine **(F)** annotations. **(G)** Heatmap displaying gene expression of the top 5 landmark genes for each coarse annotation cell type within the CosMx dataset. **(H)** Correlation matrix displaying the correlation between coarse annotation cell types identified for CosMx. **(I)** Stacked bar plots for coarse annotation displaying cell frequency (percent of total) for Xenium and CosMx.

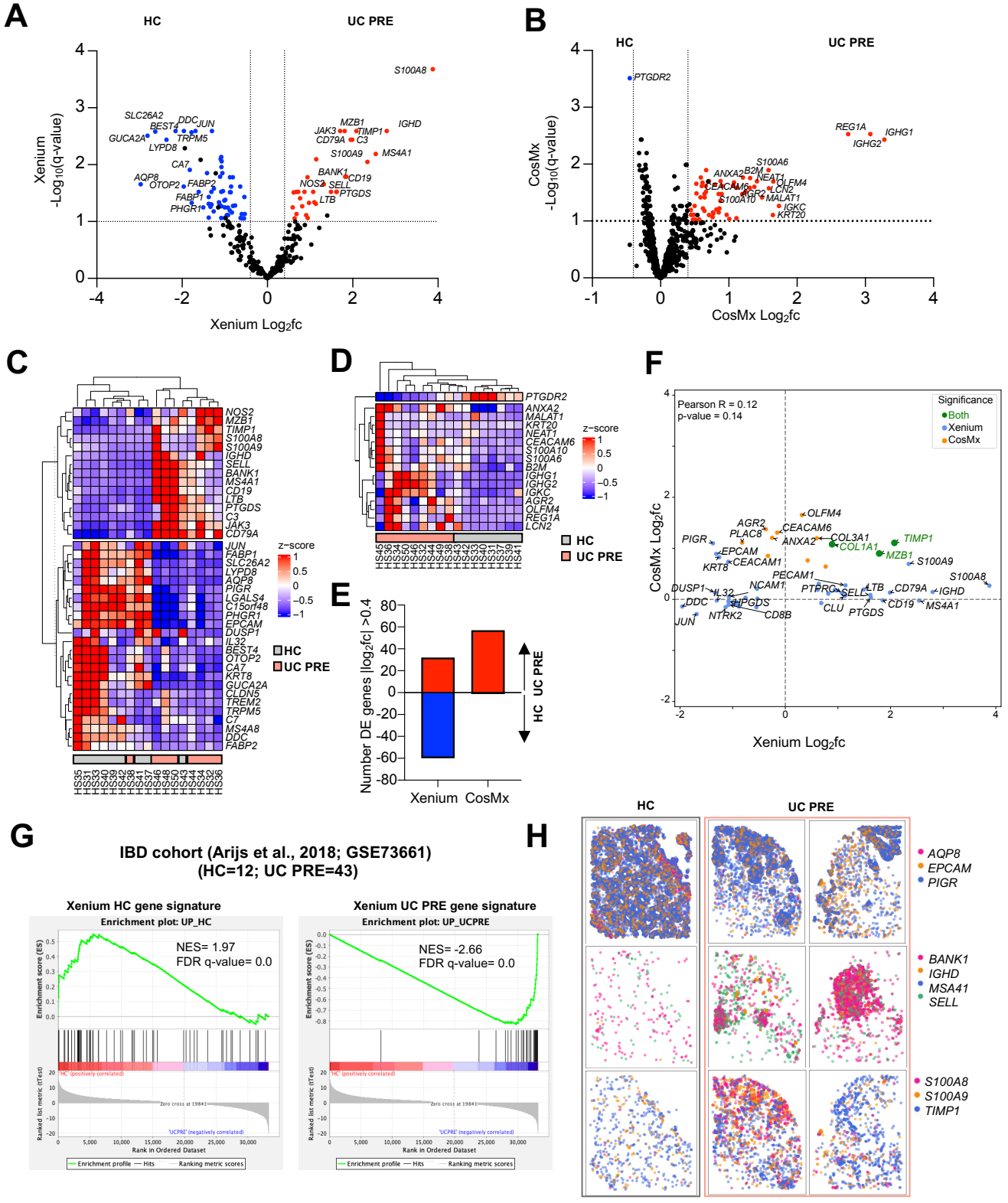


Fig. 3| Pseudobulk DE gene analysis comparing UC PRE versus HC in both platforms and gene set enrichment analysis (GSEA) of an external, publicly available, bulk transcriptomic dataset using Xenium transcriptomic signatures. (**A**) Volcano plot of pseudobulk DE genes identified by DESeq2 with log_2fc >0.4 or <-0.4 and q < 0.1 in UC PRE vs HC for Xenium dataset. (**B**) Volcano plot of pseudobulk DE genes identified by DESeq2 with log_2fc >0.4 or <-0.4 and q < 0.1 in UC PRE vs HC for CosMx dataset. (**C**) Heatmap of expression z-scores for the indicated genes in UC PRE (Up/Down) relative to HC for Xenium dataset. (**D**) Heatmap of expression z-scores for the indicated genes in UC PRE (Up/Down) relative to HC for CosMx dataset. (**E**) Number of pseudobulk DE genes in the indicated platform with log2fc > 0.4 or <-0.4 in UC PRE relative to HC identified by DESeq2 analysis. (**F**) Volcano plot of significant overlapping genes identified by DESeq2 with log_2fc >0.4 or <-0.4 for Xenium and CosMx; genes are color coded (green, significant in both panels; blue, significant in Xenium panel only; orange, significant in CosMx panel only). (**G**) GSEA of Xenium HC and UC PRE spatial gene signatures in an external cohort of patients and relative Normalized Enrichment Scores (NES). (**H**) Representative spatial transcript scatter plots highlighting a subset of genes relatively increased in HC and UC PRE in Xenium dataset. For panels **B** and **D,** some genes are off-scale for visualization purposes, z-score set from -1 to 1.

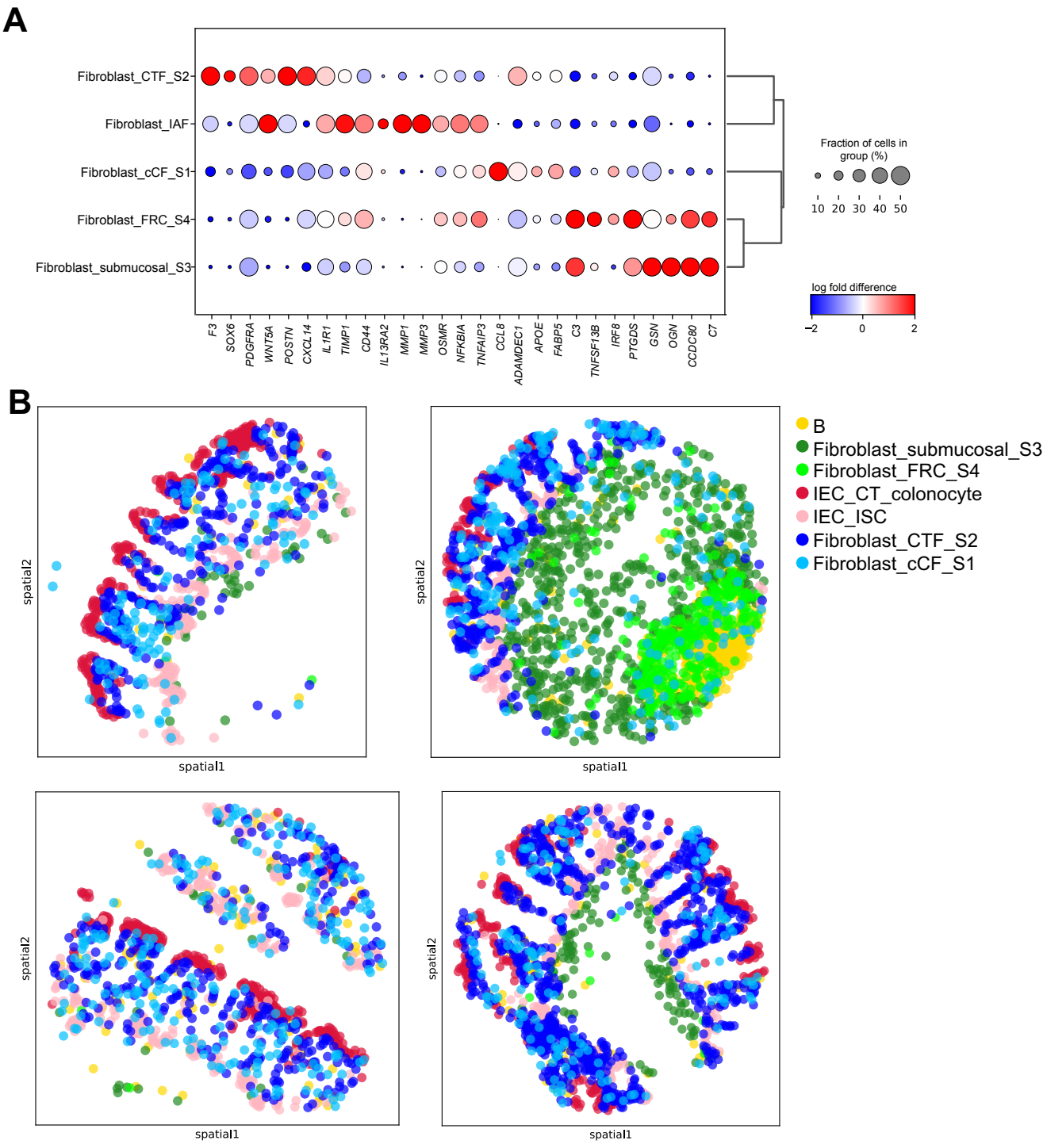


Fig. 4| Xenium enabled identification and spatial localization of distinct fibroblast subsets in colon mucosal biopsies and identified increased myeloid and stromal cell subsets in UC. (**A**) Dot plot representation of landmark genes for the indicated subsets. **(B)** Transcriptionally distinct fibroblast subsets identified by relative spatial localization in colon tissue from representative cores for the indicated cell subsets

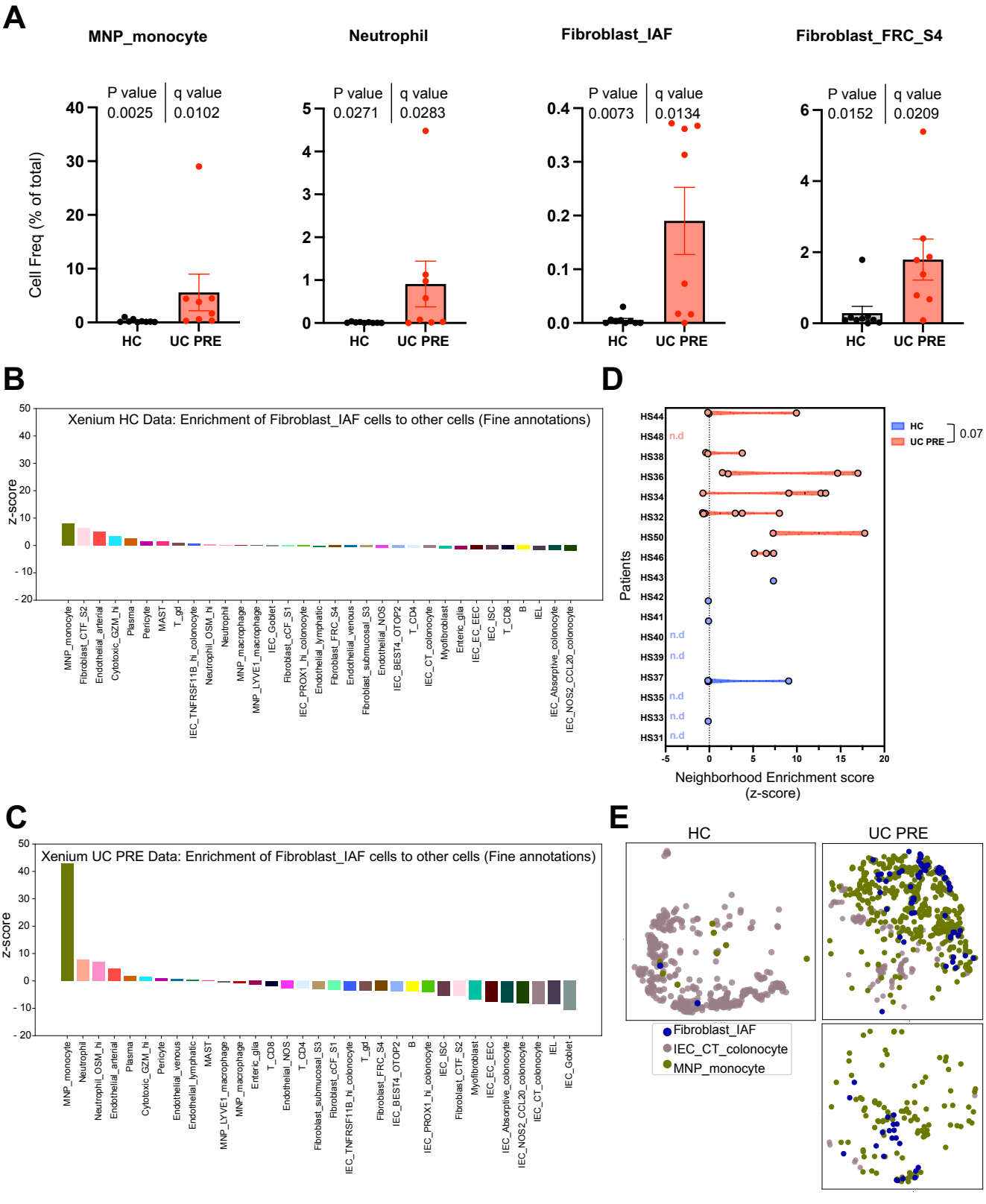
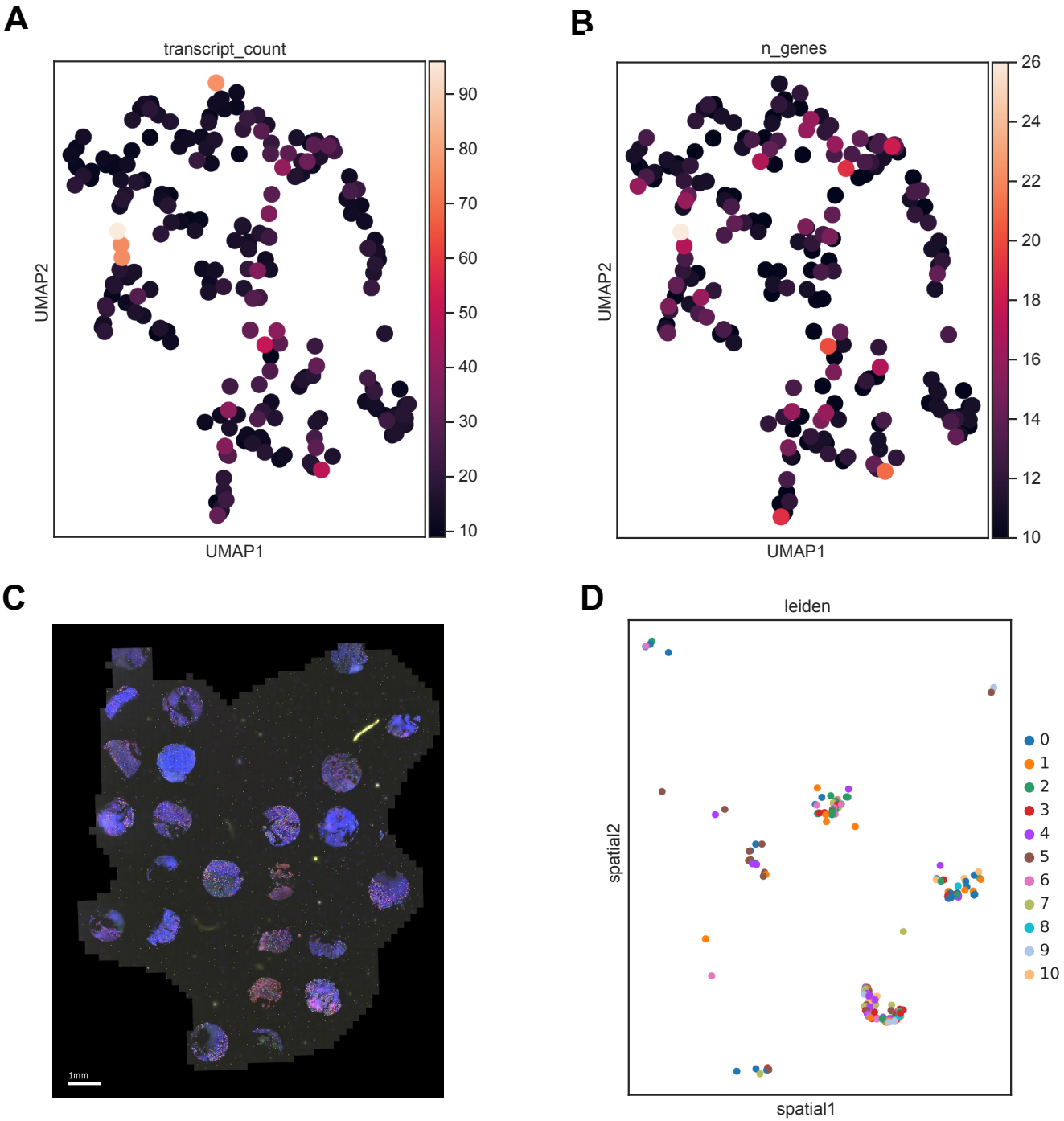
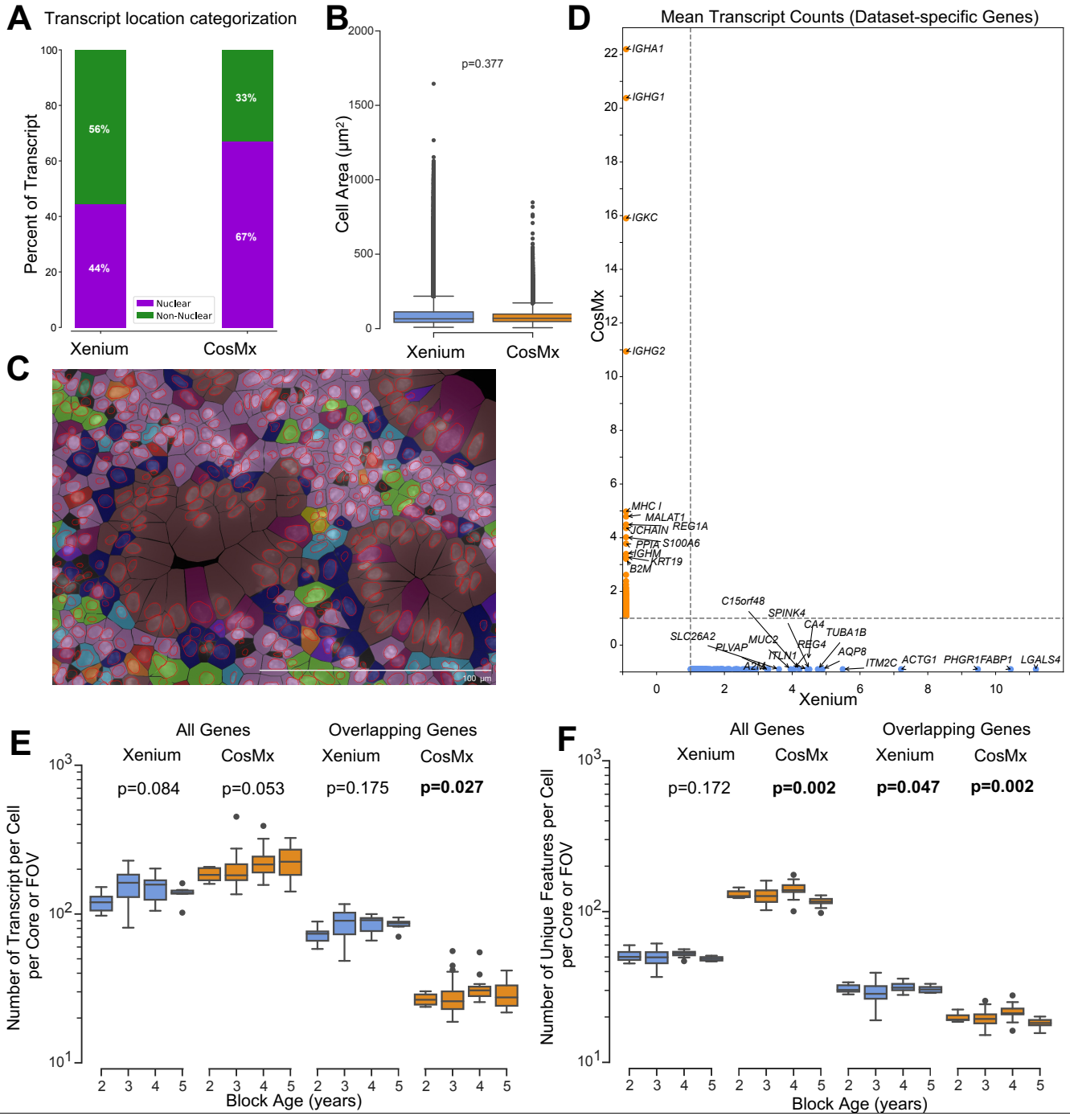


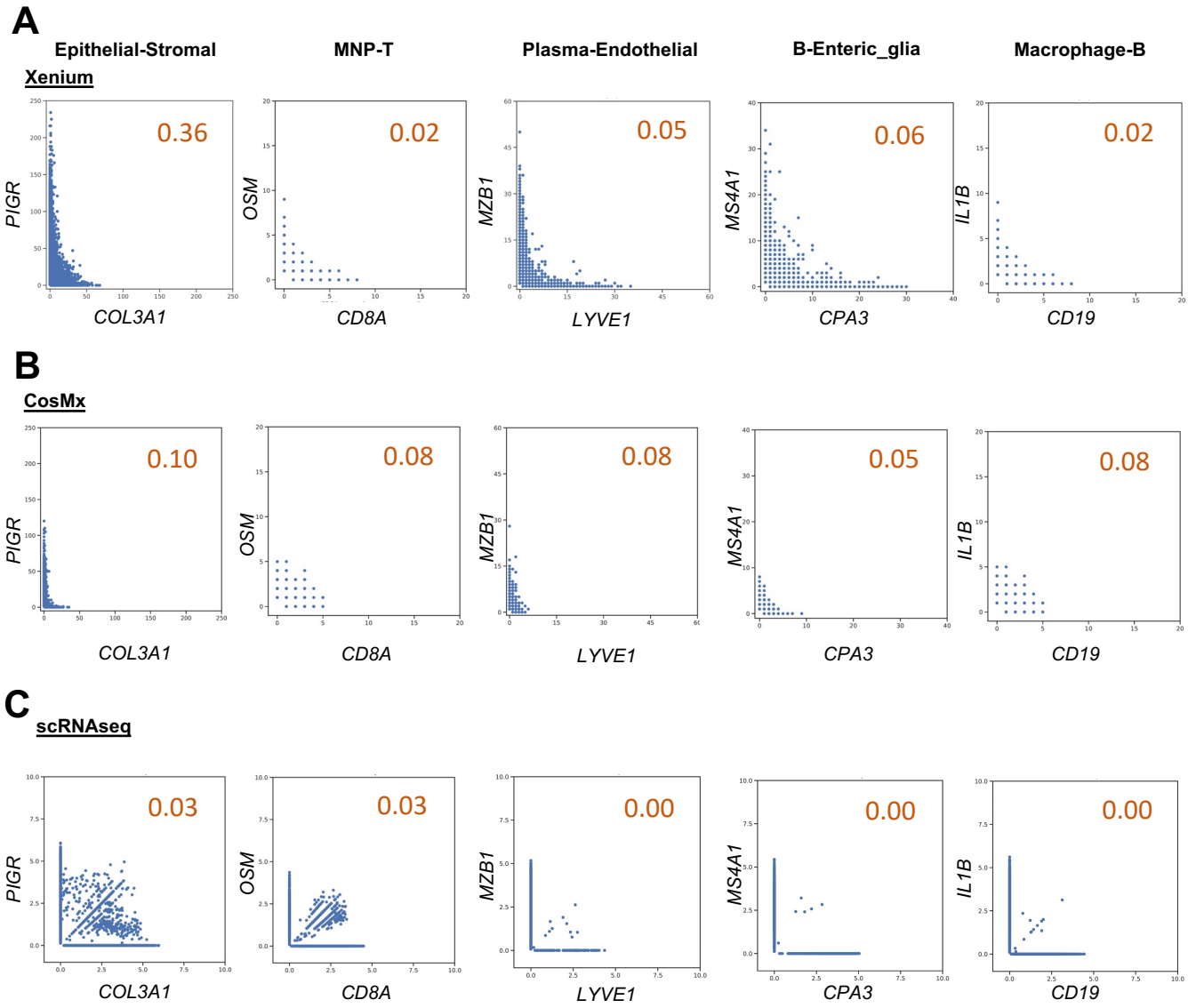
Fig. 5| Neighborhood enrichment analysis of Xenium dataset reveals higher proximity of IAFs and monocytes in UC PRE biopsies. (A) Cell frequencies of selected subsets comparing HC and UC PRE, each dot represents one patient; Mann–Whitney, two-tailed test with FDR correction; q<0.1 threshold for discovery, exact p-value and q-value are shown. Spatial enrichment of IAFs cells to all other cell types in (**B**) HC and (**C**) UC PRE biopsies. (**D**) Violin plots comparing the spatial enrichment of IAFs and monocytes by patient, each dot represents a core; nd, not defined. (**E**) Spatial scatter plot of representative cores highlighting IAF, crypt top (CT) colonocytes, and monocytes in HC and UC PRE biopsies. For panel **D,** Mann-Whitney test, p-value is indicated.



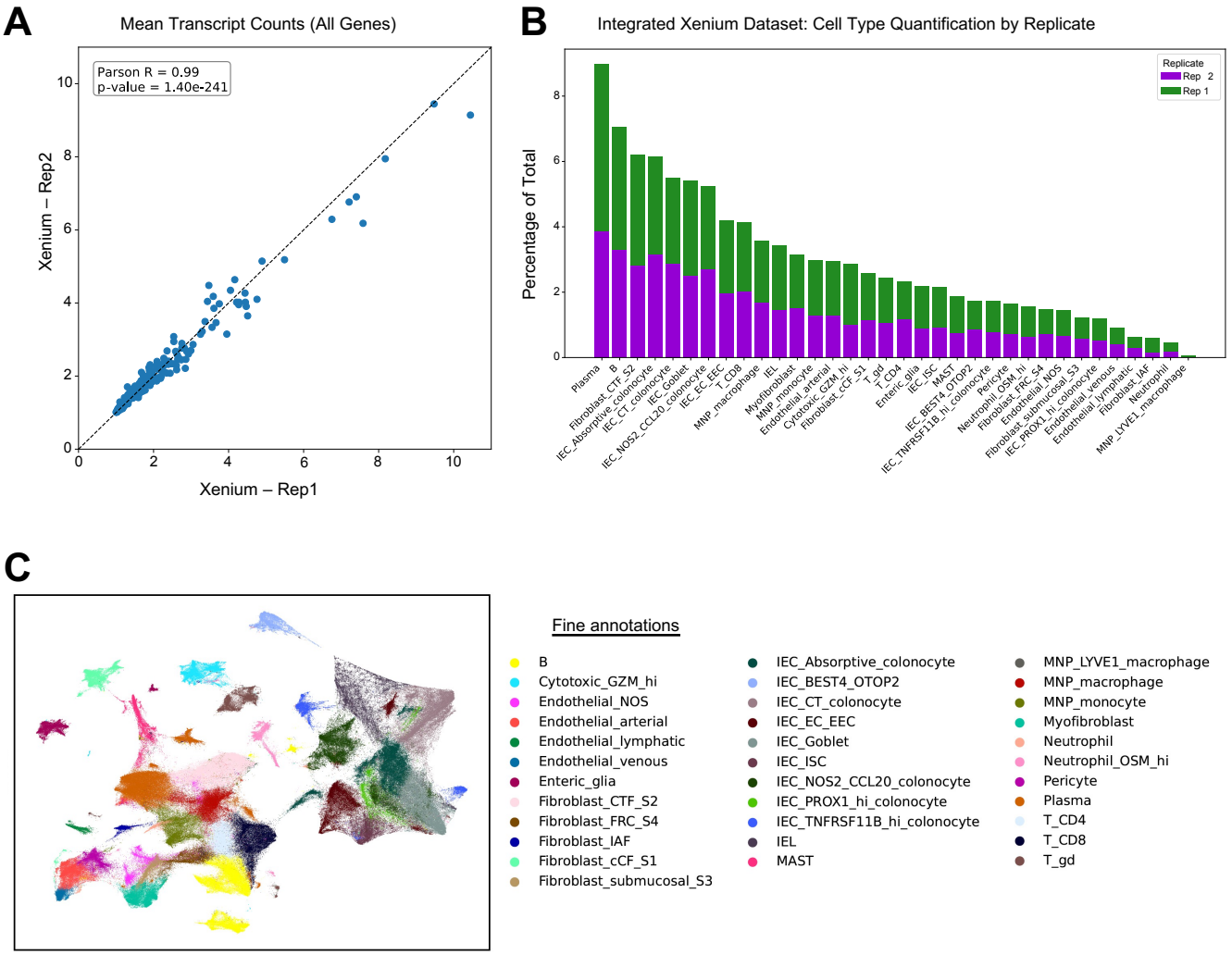
Supplemental Fig. 1| MERSCOPE dataset analysis. (**A**,**B**) UMAP visualization of MERSCOPE dataset (212 cells), highlighting (**A**) transcript count per cell, (**B**) number of genes per cell, and (**C**) area of TMA scanned showing DAPI and detected transcripts (**D**) spatial scatter plot depicting the spatial location of cells in the MERSCOPE dataset in relation to the TMA slide, colored based on leiden clustering.



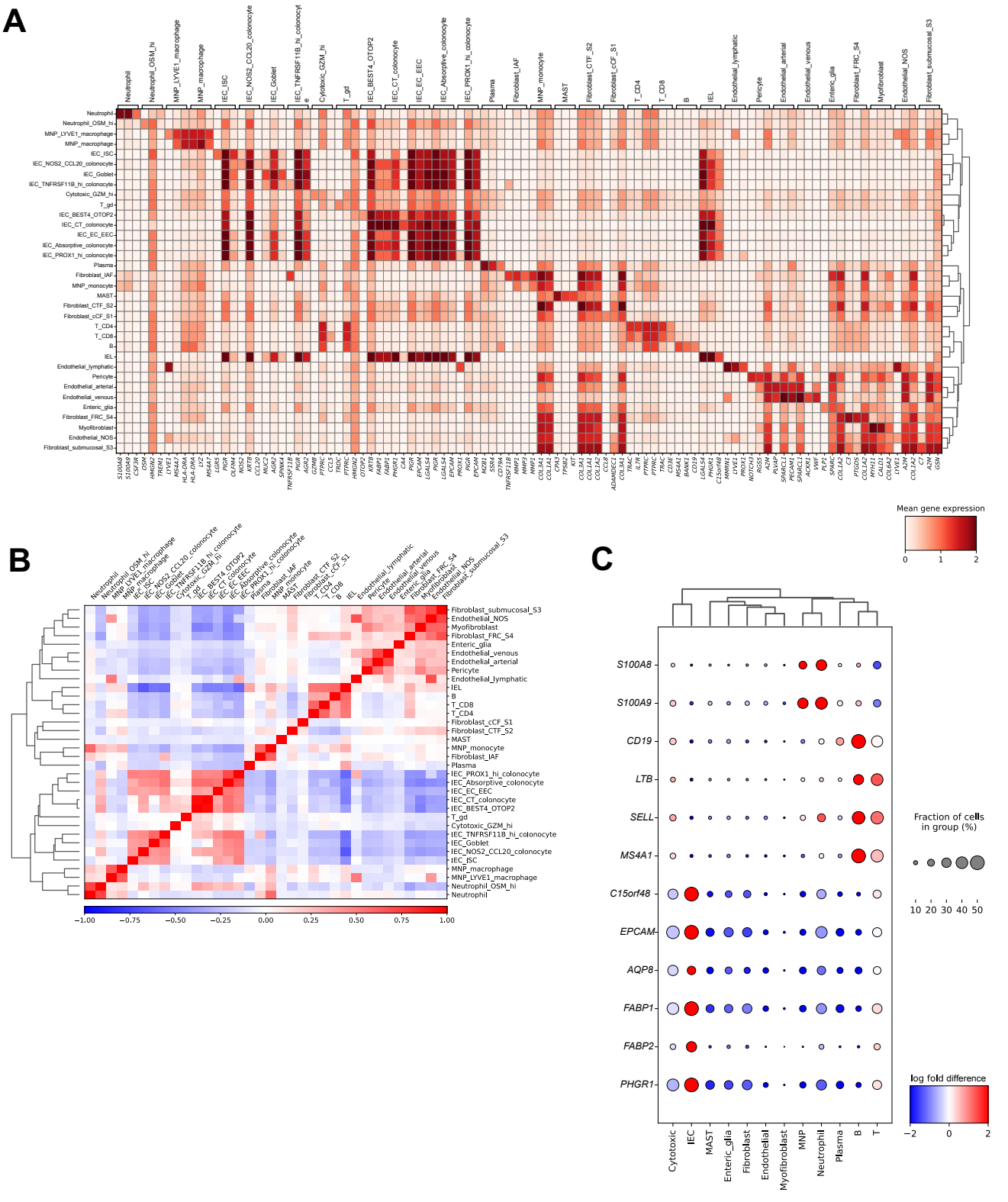
Supplemental Fig. 2| Xenium and CosMx dataset quality control and cell segmentation-related metrics. (A) Bar plot comparing the percentage of nuclear versus non-nuclear transcripts within the Xenium and CosMx datasets. **(B)** Cell area plotted in µm² for each cell within the Xenium and CosMx dataset. **(C)** Representative Xenium cell segmentation visualization, displaying DAPI nuclei (white), nuclei outlines (red), cell borders (black), cells are pseudocolored by Xenium fine annotation labels. **(D)** Scatter plot of average transcript count per cell for genes specific to either the Xenium or CosMx (blue for Xenium, and orange for CosMx). (**E,F**) Number of (**E**) transcripts and (**F**) unique features detected per cell per Core or FOV within the Xenium and CosMx datasets, calculated using the complete gene panel for each platform (Xenium, 290 genes; CosMx, 1,000 genes; left) and limited to the 159 overlapping genes across both panels (right). Plotted points are categorized based on the age of FFPE blocks from which they originated. For panels **B**, **E,** and **F**, box and whisker plots, the band indicates the median, the box indicates the first and third quartiles, and the whiskers indicate minimum and maximum value within the upper/lower fence (upper fence=Q3+1.5xIQR and lower fence= Q1-1.5xIQR), only outlier points are shown; Mann-Whitney, two-tailed tests. Panels **E** and **F** compared the difference in population medians between 2-, 3-, 4-, and 5-year-old samples, averaged by core or FOV, with Kruskal-Wallis rank sum statistic (h-statistic) indicated.



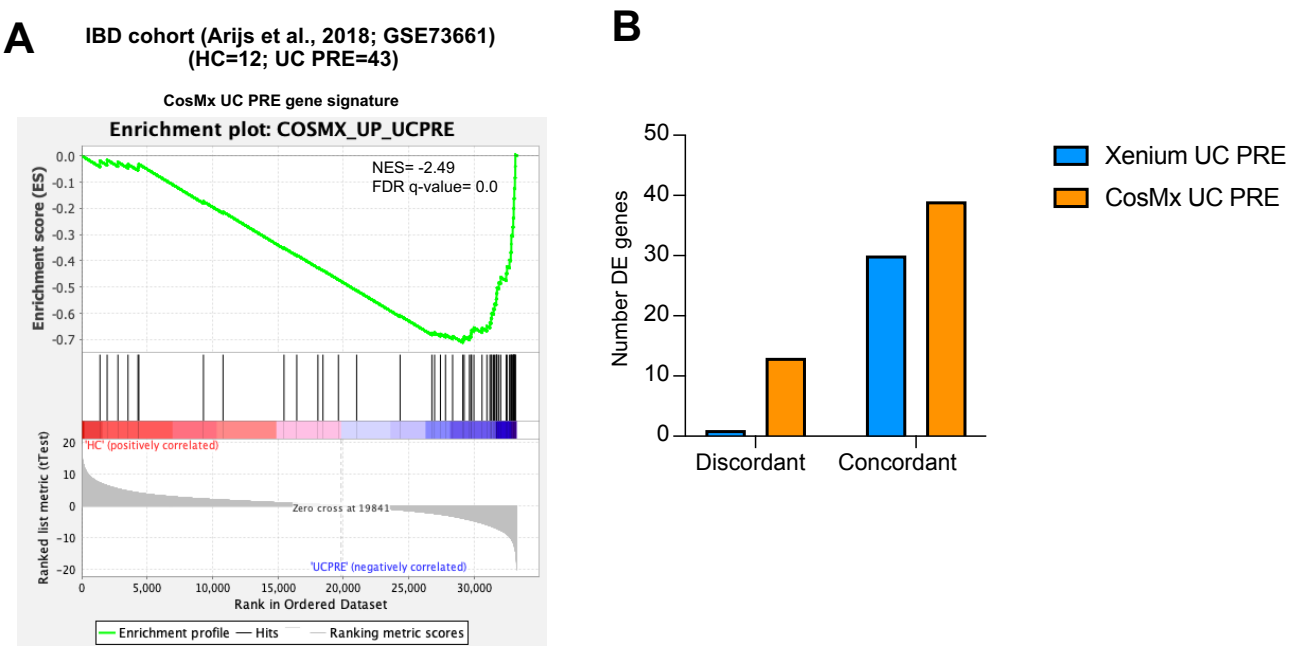
Supplemental Fig. 3| Using mutually exclusive genes to evaluate platform specificity. (A-C) Scatter plots of gene expression level (transcript counts per cell) for two representative mutually exclusive lineage-specific genes within (**A**) Xenium, (**B**) CosMx, and (**C**) scRNA-seq datasets generated from colon biopsies collected from HC and UC patients (GSE250487). Genes were selected based on cell types of interest and the overlapping genes between Xenium and CosMx panels. The mutually exclusive co-expression rate (MECR) value is listed for each scatter plot, with lower rates corresponding to greater technology specificity.



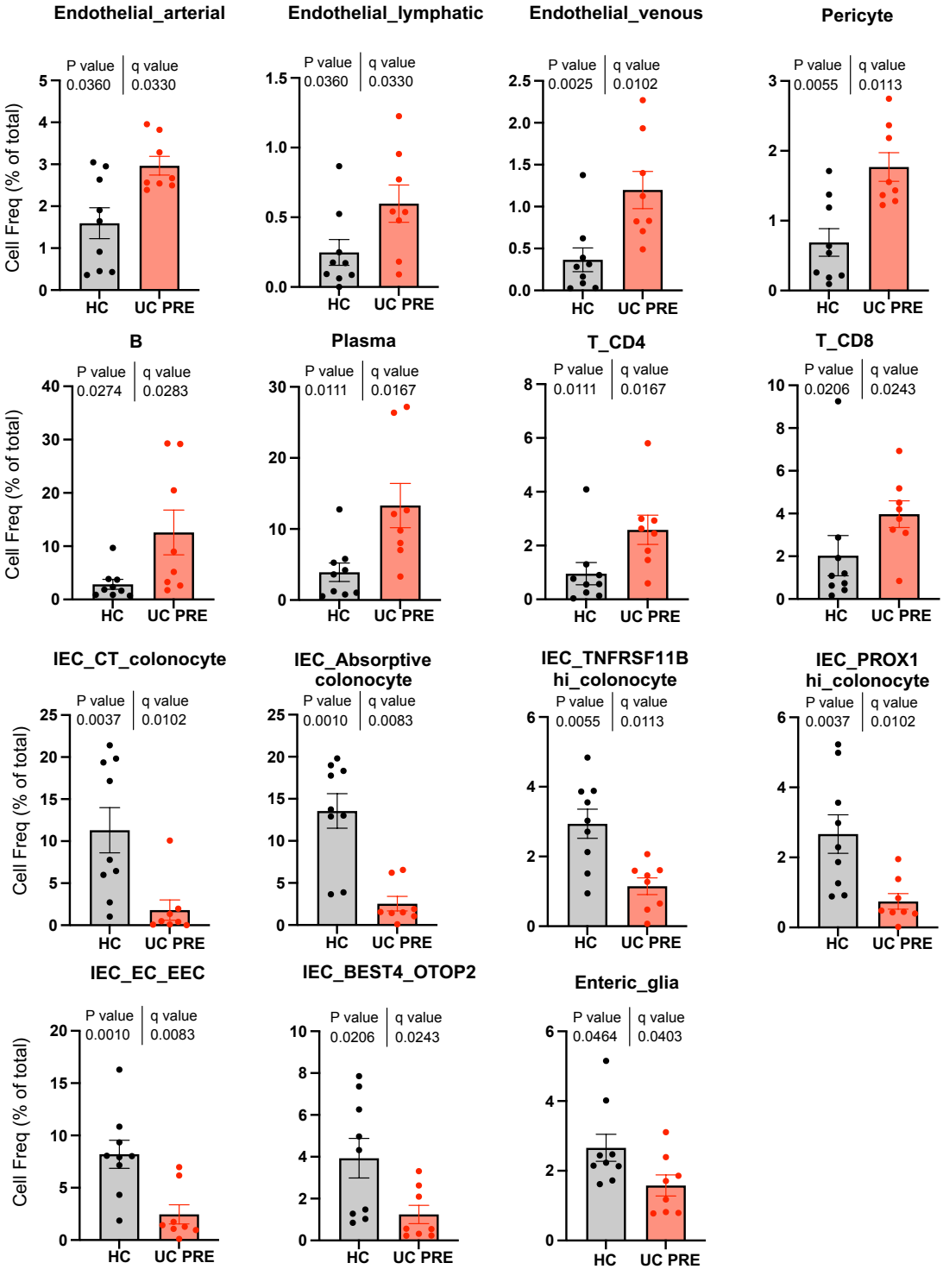
Supplemental Fig. 4| Reproducibility of Xenium replicates. (**A**) Scatter plot showing the gene expression level (transcript counts per cell) for all genes between Xenium replicates. (**B**) Cell frequency as a percent of dataset total for fine annotations within Xenium replicates. (**C**) UMAP visualization of two integrated Xenium replicate runs, colored by fine annotations (582,188 total cells: 313,940 from replicate 1 and 268,248 from replicate 2). Xenium replicate data were obtained from different runs of different sections from same TMA block.



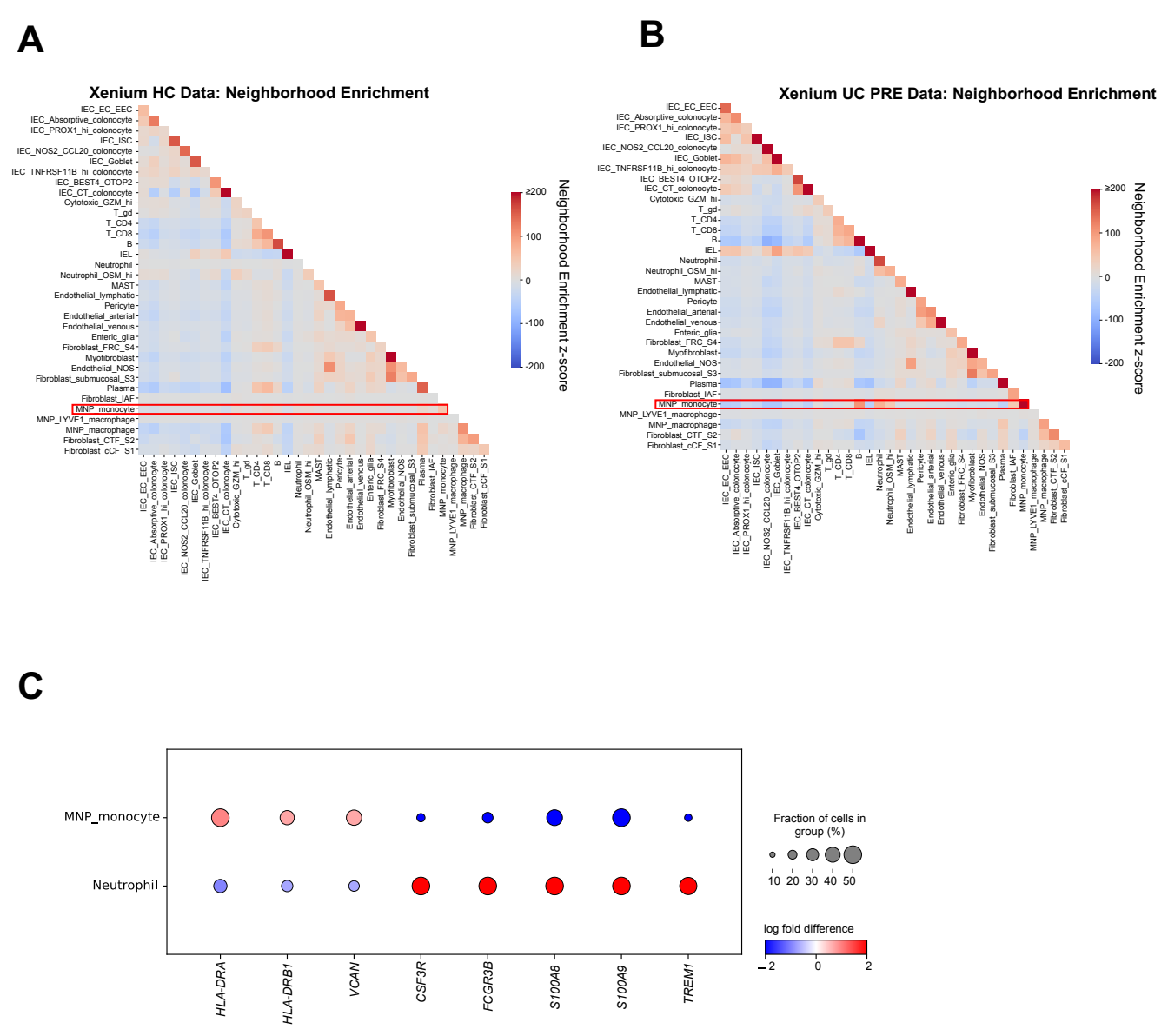
Supplemental Fig. 5| Xenium dataset landmark gene heatmap and correlation matrix for fine annotations, and DEGs between UC and HC. (**A,B**) Fine cell annotation (**A**) heatmap displaying gene expression of the top 3 landmark genes and (**B**) correlation matrix in Xenium replicate 1. (**C**) Dot plot representation of a subset of genes from pseudobulk DEG analysis by coarse annotations.



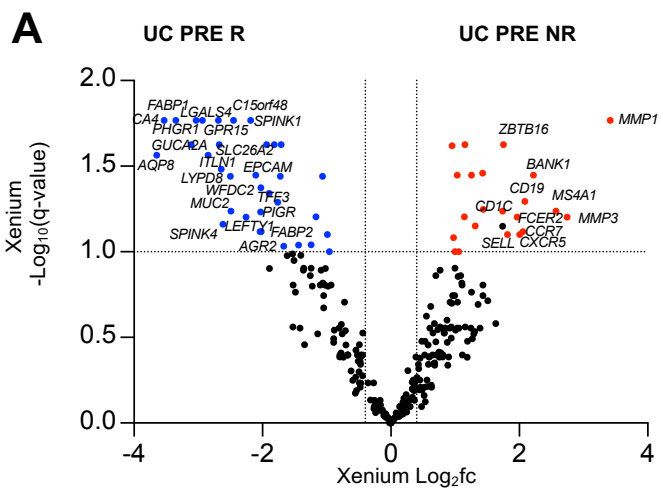
Supplemental Fig. 6| GSEA of an external, publicly-available, bulk transcriptomic dataset using a CosMx transcriptomic signature associated with UC PRE biopsies. (**A**) GSEA of CosMx UC PRE spatial gene signature in an external cohort of patients and relative NES. (**B**) Number of DE genes in the UC PRE signature for Xenium and CosMx that are concordantly or discordantly expressed to the UC PRE patients from the publicly available dataset.

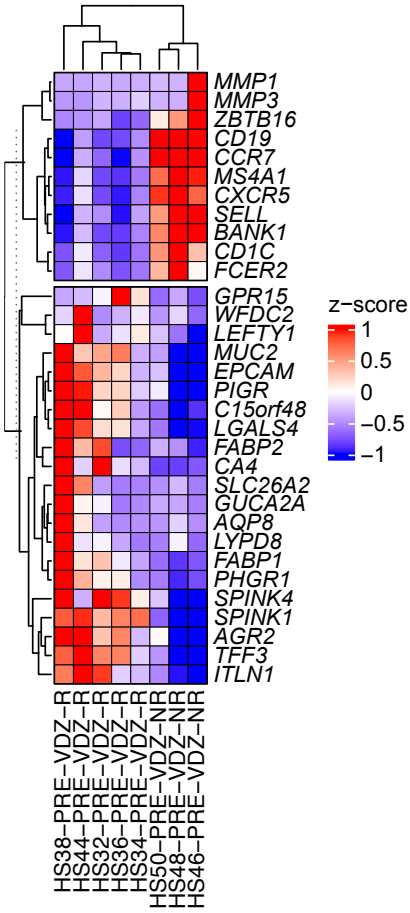


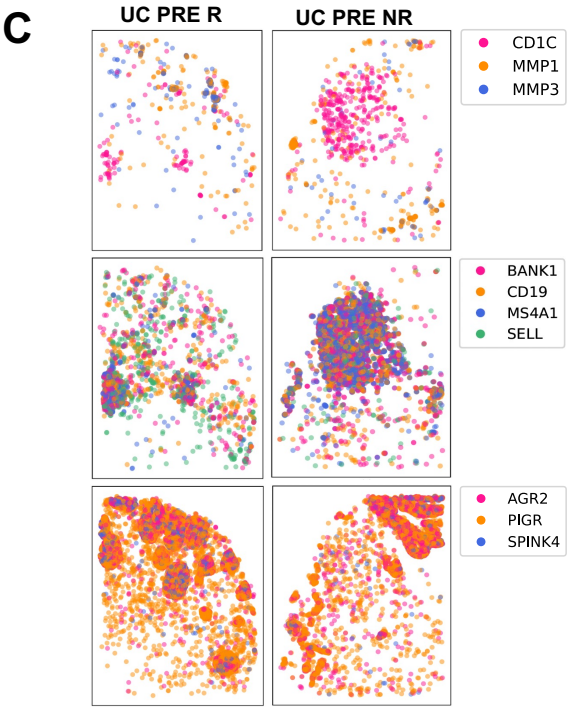
Supplemental Fig. 7| Quantitation of differential cell abundance in the Xenium integrated dataset. Cell frequencies of the indicated subsets comparing HC and UC PRE, each dot represents one patient; Mann–Whitney, two-tailed test with FDR correction; q<0.1 threshold for discovery. Only statistically significant cell subsets are shown with exact p-value and q-value displayed.



Supplemental Fig. 8| Unsupervised Neighborhood enrichment analysis in Xenium FFPE colon biopsies and dot plot of neutrophil versus monocyte landmark genes. (**A**,**B**) Heatmaps displaying neighborhood enrichment *z*-scores for fine annotation cell pairs within (**A**) HC and (**B**) UC PRE biopsies. (**C**) Dot plot representation of landmark genes for the indicated subsets. For panels **A** and **B,** several values exceed the scale for visualization purposes (values greater than 200).







D

Xenium Gene Signature	NES	FDR q-value	Significance
UC PRE R	-2.02	0	yes
UC PRE NR	0.88	0.6	no
IAF-monocyte-neutrophil	1.88	0	yes
GALT-B-DC-S4_fibroblast	0.57	0.96	no

Supplemental Fig. 9| Pseudobulk DE gene analysis comparing UC PRE Non-Responders (UC PRE NR) versus UC PRE Responders (UC PRE R) in the Xenium dataset. (**A**) Volcano plot of pseudobulk DE genes identified by DESeq2 with log2fc >0.4 or <-0.4 and q < 0.1 in UC PRE NR vs UC PRE R. (**B**) Heatmap of expression z-scores for the indicated genes in UC PRE NR (Up/Down) relative to UC PRE R. (**C**) Representative spatial transcript scatter plots highlighting a subset of genes relatively increased in UC PRE R (left) and UC PRE NR (right). (**D**) GSEA of Xenium signatures in external cohort of patients pre-VDZ stratified by UC PRE NR and UC PRE R with relative Normalized Enrichment Scores (NES) and FDR q-value. For panel **B**, some genes are off-scale for visualization purposes, z-score set from -1 to 1.

Patient ID	Age (y)	Sex	Disease status	UC Medication	Disease duration (y)	Duration VDZ (mo)	Prior anti-TNF exposure	Montreal classification	Mayo Endoscopic subscore	Responder to VDZ
HS31	60-69	F	HC	None	n/a	n/a	No	n/a	0	n/a
HS33	30-39	M	HC	None	n/a	n/a	No	n/a	0	n/a
HS35	20-29	F	HC	None	n/a	n/a	No	n/a	0	n/a
HS37	20-29	M	HC	None	n/a	n/a	No	n/a	0	n/a
HS39	20-29	F	HC	None	n/a	n/a	No	n/a	0	n/a
HS40	60-69	M	HC	None	n/a	n/a	No	n/a	0	n/a
HS41	50-59	M	HC	None	n/a	n/a	No	n/a	0	n/a
HS42	40-49	M	HC	None	n/a	n/a	No	n/a	0	n/a
HS43	50-59	M	HC	None	n/a	n/a	No	n/a	0	n/a
HS32	20-29	F	UC	VDZ	2	4	No	E2	pre 2 ; post 0	Yes
HS34	30-39	F	UC	VDZ	1	6	No	E1	pre 2; post 0	Yes
HS36	40-49	M	UC	VDZ	3	2	Yes	E2	pre 3; post 0	Yes
HS38	50-59	M	UC	VDZ	25	7	Yes	E3	pre 2; post 0	Yes
HS44	30-39	F	UC	VDZ	2	2	No	E1	pre 1	Yes
HS45	40-49	M	UC	VDZ	14	19	Yes	E2	pre 1; post 3	No
HS46	40-49	n/a	UC	VDZ	21	2	Yes	E2	pre 3; post 3	No
HS47	30-39	M	UC	VDZ	11	5	Yes	E2	post 3	No
HS48	70-79	M	UC	VDZ	8	6	Yes	E3	pre 2; post 2	No
HS49	30-39	F	UC	VDZ	2	3	Yes	E2	pre 2; post 3	No
HS50	20-29	M	UC	VDZ	0	5	Yes	E2	pre 2; post 2	No
					3 (2-14)					
p-value	ns	ns	p<0.0001	p<0.0001	n/a	n/a	p=0.0010	ns	pre, ns; post, p=0.0016	

Supplementary Table 1. Baseline demographic and clinical data for study participants. Categorical variables were analyzed by Chi-square test and continuous variables were compared using one-way ANOVA with FDR correction or Mann-Whitney test where appropriate. ns, not significant; n/a, not applicable; pre, pre-VDZ treatment; post, post-VDZ treatment. VDZ-vedolizumab.

Assay type	Target	Vendor
Xenium 290-plex custom panel	*A2M*	10x Genomics
	ABCC9	10x Genomics
	ACKR1	10x Genomics
	ACTG1	10x Genomics
	ADAMDEC1	10x Genomics
	ADGRB3	10x Genomics
	AGR2	10x Genomics
	ALOX5	10x Genomics
	ALOX5AP	10x Genomics
	ANXA2	10x Genomics
	APOE	10x Genomics
	APP	10x Genomics
	AQP8	10x Genomics
	ASCL2	10x Genomics
	ASPN	10x Genomics
	BANK1	10x Genomics
	BASP1	10x Genomics
	BATF	10x Genomics
	BEST4	10x Genomics
	C15orf48	10x Genomics
	C1QA	10x Genomics
	C1QB	10x Genomics
	C1QC	10x Genomics
	C3	10x Genomics
	C7	10x Genomics
	CA4	10x Genomics
	CA7	10x Genomics
	CACNA1A	10x Genomics
	CALD1	10x Genomics
	CAV1	10x Genomics
	CCDC80	10x Genomics
	CCL20	10x Genomics
	CCL23	10x Genomics
	CCL4	10x Genomics
	CCL5	10x Genomics
	CCL8	10x Genomics
	CCR6	10x Genomics
	CCR7	10x Genomics
	CCSER1	10x Genomics
	CD14	10x Genomics
	CD19	10x Genomics
	CD1C	10x Genomics
	CD1D	10x Genomics
	CD209	10x Genomics
	CD28	10x Genomics
	CD3D	10x Genomics
	CD3E	10x Genomics
	CD4	10x Genomics
	CD40	10x Genomics
	CD44	10x Genomics
	CD59	10x Genomics
	CD69	10x Genomics
	CD7	10x Genomics
	CD79A	10x Genomics
	CD80	10x Genomics
	CD86	10x Genomics
	CD8A	10x Genomics
	CD8B	10x Genomics
	CDH5	10x Genomics
	CEACAM1	10x Genomics
	CEACAM6	10x Genomics
	CLDN5	10x Genomics
	CLEC10A	10x Genomics
	CLEC9A	10x Genomics
	CLU	10x Genomics
	COL1A1	10x Genomics
	COL1A2	10x Genomics
	COL3A1	10x Genomics
	COL6A2	10x Genomics
	CPA3	10x Genomics
	CPE	10x Genomics
	CRYAB	10x Genomics
	CSF3R	10x Genomics
	CSPG4	10x Genomics
	CST3	10x Genomics
	CTLA4	10x Genomics
	CTSL	10x Genomics
	CXCL14	10x Genomics
	CXCR1	10x Genomics
	CXCR5	10x Genomics
	CYTH1	10x Genomics
	DDC	10x Genomics
	DUSP1	10x Genomics
	DUSP23	10x Genomics
	EPCAM	10x Genomics
	F3	10x Genomics
	FABP1	10x Genomics
	FABP2	10x Genomics
	FABP5	10x Genomics
	FCER1A	10x Genomics
	FCER1G	10x Genomics
	FCER2	10x Genomics
	FCGR3A	10x Genomics
	FCGR3B	10x Genomics
	FCN1	10x Genomics
	FLT3	10x Genomics
	FOLR3	10x Genomics
	FOXP3	10x Genomics
	FXYD5	10x Genomics
	FYB1	10x Genomics
	GATA2	10x Genomics
	GATA3	10x Genomics
	GLIS3	10x Genomics
	GPR15	10x Genomics
	GSN	10x Genomics
	GUCA2A	10x Genomics
	GZMA	10x Genomics
	GZMB	10x Genomics
	GZMK	10x Genomics
	HAND2	10x Genomics
	HLA-DRA	10x Genomics
	HLA-DRB1	10x Genomics
	HMGB2	10x Genomics
	HMGN2	10x Genomics
	HPGDS	10x Genomics
	ICOS	10x Genomics
	IFITM2	10x Genomics
	IFNG	10x Genomics
	IGHA2	10x Genomics
	IGHD	10x Genomics
	IGHE	10x Genomics
	IL10	10x Genomics
	IL10RA	10x Genomics
	IL13RA2	10x Genomics
	IL18R1	10x Genomics
	IL1B	10x Genomics
	IL1R1	10x Genomics
	IL1R2	10x Genomics
	IL1RL1	10x Genomics
	IL32	10x Genomics
	IL3RA	10x Genomics
	IL7R	10x Genomics
	INAVA	10x Genomics
	INSM1	10x Genomics
	IRF7	10x Genomics
	IRF8	10x Genomics
	ITGAX	10x Genomics
	ITLN1	10x Genomics
	ITM2C	10x Genomics
	JAK1	10x Genomics
	JAK2	10x Genomics
	JAK3	10x Genomics
	JUN	10x Genomics
	KCNJ8	10x Genomics
	KIT	10x Genomics
	KLF2	10x Genomics

	KLRB1	10x Genomics
	KLRC2	10x Genomics
	KLRF1	10x Genomics
	KRT8	10x Genomics
	LAMP3	10x Genomics
	LEF1	10x Genomics
	LEFTY1	10x Genomics
	LGALS4	10x Genomics
	LGR5	10x Genomics
	LILRA4	10x Genomics
	LST1	10x Genomics
	LTA	10x Genomics
	LTB	10x Genomics
	LTBR	10x Genomics
	LYPD8	10x Genomics
	LYVE1	10x Genomics
	LYZ	10x Genomics
	MAF	10x Genomics
	MCAM	10x Genomics
	MEF2C	10x Genomics
	MGLL	10x Genomics
	MKI67	10x Genomics
	MMP1	10x Genomics
	MMP3	10x Genomics
	MMRN1	10x Genomics
	MRC1	10x Genomics
	MS4A1	10x Genomics
	MS4A2	10x Genomics
	MS4A7	10x Genomics
	MS4A8	10x Genomics
	MT1G	10x Genomics
	MUC1	10x Genomics
	MUC2	10x Genomics
	MYH11	10x Genomics
	MZB1	10x Genomics
	NCAM1	10x Genomics
	NEUROD1	10x Genomics
	NFKBIA	10x Genomics
	NKG7	10x Genomics
	NOS2	10x Genomics
	NOTCH3	10x Genomics
	NOTCH4	10x Genomics
	NPC2	10x Genomics
	NTRK2	10x Genomics
	NUPR1	10x Genomics
	OGN	10x Genomics
	OLFM4	10x Genomics
	OSM	10x Genomics
	OSMR	10x Genomics
	OTOP2	10x Genomics
	PDGFRA	10x Genomics
	PECAM1	10x Genomics
	PHGR1	10x Genomics
	PHLDA2	10x Genomics
	PIGR	10x Genomics
	PLAC8	10x Genomics
	PLP1	10x Genomics
	PLVAP	10x Genomics
	POSTN	10x Genomics
	PROX1	10x Genomics
	PTGDS	10x Genomics
	PTPRC	10x Genomics
	PYY	10x Genomics
	QDPR	10x Genomics
	REG4	10x Genomics
	RGCC	10x Genomics
	RGS5	10x Genomics
	RORC	10x Genomics
	RTKN2	10x Genomics
	S100A11	10x Genomics
	S100A12	10x Genomics
	S100A16	10x Genomics
	S100A4	10x Genomics
	S100A8	10x Genomics
	S100A9	10x Genomics
	S100B	10x Genomics
	S100P	10x Genomics
	S1PR1	10x Genomics
	S1PR5	10x Genomics
	SEC61B	10x Genomics
	SELENOP	10x Genomics
	SELL	10x Genomics
	SERPINF1	10x Genomics
	SH2D6	10x Genomics
	SLC26A2	10x Genomics
	SOX6	10x Genomics
	SOX8	10x Genomics
	SOX9	10x Genomics
	SPARC	10x Genomics
	SPARCL1	10x Genomics
	SPINK1	10x Genomics
	SPINK4	10x Genomics
	SSR4	10x Genomics
	STAT4	10x Genomics
	STMN1	10x Genomics
	TCF4	10x Genomics
	TFF3	10x Genomics
	TGFB1	10x Genomics
	TGFBR1	10x Genomics
	TGFBR2	10x Genomics
	TIGIT	10x Genomics
	TIMP1	10x Genomics
	TINAGL1	10x Genomics
	TLE4	10x Genomics
	TMIGD1	10x Genomics
	TMEM176A	10x Genomics
	TMEM176B	10x Genomics
	TNF	10x Genomics
	TNFAIP3	10x Genomics
	TNFRSF11A	10x Genomics
	TNFRSF11B	10x Genomics
	TNFRSF13B	10x Genomics
	TNFRSF17	10x Genomics
	TNFRSF1A	10x Genomics
	TNFRSF1B	10x Genomics
	TNFSF13B	10x Genomics
	TNFSF15	10x Genomics
	TNFSF9	10x Genomics
	TOP2A	10x Genomics
	TPH1	10x Genomics
	TPSAB1	10x Genomics
	TPSB2	10x Genomics
	TRAC	10x Genomics
	TRAV1-2	10x Genomics
	TRDC	10x Genomics
	TRDV2	10x Genomics
	TREM1	10x Genomics
	TREM2	10x Genomics
	TRGC1	10x Genomics
	TRGC2	10x Genomics
	TRGV9	10x Genomics
	TRPM5	10x Genomics
	TUBA1B	10x Genomics
	TUBB	10x Genomics
	TYK2	10x Genomics
	TYROBP	10x Genomics
	UBE2C	10x Genomics
	VCAN	10x Genomics
	VWF	10x Genomics
	WFDC2	10x Genomics
	WNT5A	10x Genomics
	XCR1	10x Genomics
	ZBTB16	10x Genomics
	ZFP36L1	10x Genomics
MERSCOPE 280-plex panel	*TMEM176A*	Vizgen
	CD4	Vizgen
	TNFRSF17	Vizgen

TRPM5	Vizgen
TNFRSF1A	Vizgen
CEACAM6	Vizgen
OSM	Vizgen
GZMB	Vizgen
NFKBIA	Vizgen
TIMP1	Vizgen
OLFM4	Vizgen
MMP2	Vizgen
AQP8	Vizgen
TGFB1	Vizgen
CD79A	Vizgen
NKG7	Vizgen
SEC61B	Vizgen
COL1A1	Vizgen
NFKB1	Vizgen
IL10RA	Vizgen
CD69	Vizgen
LTBR	Vizgen
IFNG	Vizgen
KLRB1	Vizgen
GZMK	Vizgen
IL18R1	Vizgen
SELL	Vizgen
TNFAIP3	Vizgen
ADGRB3	Vizgen
KCNJ8	Vizgen
FLT3	Vizgen
IL13RA2	Vizgen
TREM1	Vizgen
SOX9	Vizgen
TNFSF9	Vizgen
CCR7	Vizgen
KLF2	Vizgen
TPH1	Vizgen
APOE	Vizgen
PLVAP	Vizgen
SERPINF1	Vizgen
CLEC10A	Vizgen
LYVE1	Vizgen
ADAMDEC1	Vizgen
REG4	Vizgen
PDGFRA	Vizgen
ABCC9	Vizgen
LYZ	Vizgen
VWF	Vizgen
PROX1	Vizgen
TNFRSF13B	Vizgen
TYROBP	Vizgen
IL1B	Vizgen
NOTCH3	Vizgen
CD44	Vizgen
MCAM	Vizgen
MMRN1	Vizgen
LAMP3	Vizgen
LGR5	Vizgen
ITGAX	Vizgen
IRF8	Vizgen
IFNAR1	Vizgen
TINAGL1	Vizgen
S100A11	Vizgen
LEFTY1	Vizgen
FABP2	Vizgen
OSMR	Vizgen
GZMA	Vizgen
QDPR	Vizgen
GPR15	Vizgen
SLC26A2	Vizgen
BATF	Vizgen
KIT	Vizgen
FCER1G	Vizgen
IL10RB	Vizgen
S100B	Vizgen
LILRA4	Vizgen
CXCR5	Vizgen
SOX8	Vizgen
NEUROD1	Vizgen
HPGDS	Vizgen
CXCR1	Vizgen
TGFBR2	Vizgen
CTLA4	Vizgen
CPA3	Vizgen
S100P	Vizgen
SPINK1	Vizgen
COL1A2	Vizgen
TNFRSF11B	Vizgen
MMP3	Vizgen
MS4A8	Vizgen
NOD2	Vizgen
CD3D	Vizgen
CA4	Vizgen
MZB1	Vizgen
IL7R	Vizgen
COL3A1	Vizgen
S1PR1	Vizgen
TMSF1	Vizgen
CSPG4	Vizgen
XCR1	Vizgen
INSM1	Vizgen
IL1RL1	Vizgen
CD7	Vizgen
C7	Vizgen
NOS2	Vizgen
RGS5	Vizgen
PHLDA2	Vizgen
MMP1	Vizgen
CD209	Vizgen
ICOS	Vizgen
SOX6	Vizgen
NCAM1	Vizgen
A2M	Vizgen
BASP1	Vizgen
DUOXA2	Vizgen
CD28	Vizgen
NLRP12	Vizgen
GLIS3	Vizgen
CD19	Vizgen
ITLN1	Vizgen
TMEM176B	Vizgen
CD86	Vizgen
IL3RA	Vizgen
ASCL2	Vizgen
OTOP2	Vizgen
F3	Vizgen
ZBTB16	Vizgen
IL21R	Vizgen
CA7	Vizgen
CTSL	Vizgen
GATA2	Vizgen
CDH5	Vizgen
CCR6	Vizgen
JAK1	Vizgen
VCAN	Vizgen
FCER2	Vizgen
APP	Vizgen
IL23R	Vizgen
PTPRC	Vizgen
FYB1	Vizgen
CD8A	Vizgen
CLEC9A	Vizgen
UBE2C	Vizgen
RORC	Vizgen
MS4A7	Vizgen
CCL20	Vizgen
HAND2	Vizgen
NTRK2	Vizgen
HLA-DRB1	Vizgen

CYTH1	Vizgen
MUC2	Vizgen
CSF3R	Vizgen
CD3E	Vizgen
CALD1	Vizgen
INAVA	Vizgen
IFNGR1	Vizgen
DUSP23	Vizgen
FCER1A	Vizgen
ACKR1	Vizgen
CD1C	Vizgen
CD1D	Vizgen
IL6R	Vizgen
MKI67	Vizgen
S100A16	Vizgen
S100A4	Vizgen
S100A8	Vizgen
S100A12	Vizgen
S100A9	Vizgen
JUN	Vizgen
PTGDS	Vizgen
FCN1	Vizgen
BEST4	Vizgen
CD40	Vizgen
MMP9	Vizgen
WFDC2	Vizgen
TREM2	Vizgen
RTKN2	Vizgen
TNFSF15	Vizgen
STMN1	Vizgen
ALOX5	Vizgen
C1QC	Vizgen
TGFBR1	Vizgen
NOTCH4	Vizgen
ASPN	Vizgen
OGN	Vizgen
TNFSF13B	Vizgen
FOXP3	Vizgen
TNFRSF1B	Vizgen
TLE4	Vizgen
GATA3	Vizgen
RGCC	Vizgen
SPINK4	Vizgen
IL2RA	Vizgen
ALOX5AP	Vizgen
JAK2	Vizgen
IFNAR2	Vizgen
TIGIT	Vizgen
TRDV2	Vizgen
TRDC	Vizgen
IGHE	Vizgen
IGHD	Vizgen
CD8B	Vizgen
NLRP3	Vizgen
FXYD5	Vizgen
STAT4	Vizgen
MAF	Vizgen
IL1R2	Vizgen
CCL8	Vizgen
HLA-DRA	Vizgen
NUPR1	Vizgen
CD59	Vizgen
FABP5	Vizgen
IRF7	Vizgen
MGLL	Vizgen
IFITM2	Vizgen
CD14	Vizgen
NLRC4	Vizgen
C1QA	Vizgen
CPE	Vizgen
CEACAM1	Vizgen
CLU	Vizgen
CAV1	Vizgen
IFNGR2	Vizgen
IL1R1	Vizgen
PLAC8	Vizgen
LTA	Vizgen
AGR2	Vizgen
TOP2A	Vizgen
IL10	Vizgen
LTB	Vizgen
FCGR3A	Vizgen
LST1	Vizgen
HMGB2	Vizgen
CCDC80	Vizgen
ZFP36L1	Vizgen
TRGC1	Vizgen
DDC	Vizgen
BANK1	Vizgen
TRGV9	Vizgen
TNF	Vizgen
JAK3	Vizgen
WNT5A	Vizgen
CD80	Vizgen
MUC1	Vizgen
LEF1	Vizgen
CCSER1	Vizgen
C1QB	Vizgen
CXCL14	Vizgen
SELENOP	Vizgen
TYK2	Vizgen
CRYAB	Vizgen
IL32	Vizgen
MS4A1	Vizgen
POSTN	Vizgen
NPC2	Vizgen
PECAM1	Vizgen
MRC1	Vizgen
ACTG1	Vizgen
TNFRSF11A	Vizgen
CACNA1A	Vizgen
LYPD8	Vizgen
PYY	Vizgen
C3	Vizgen
CCL5	Vizgen
DUOX2	Vizgen
TRAC	Vizgen
CCL4	Vizgen
FCGR3B	Vizgen
CCL23	Vizgen
CCL18	Vizgen
IKBKG	Vizgen
MS4A2	Vizgen
S1PR5	Vizgen
KLRF1	Vizgen
CLDN5	Vizgen
PLP1	Vizgen
TCF4	Vizgen
MEF2C	Vizgen
SH2D6	Vizgen

Supplementary Table 2. Gene panels for the different spatial transcriptomic platforms.

Run		Xenium	CosMx
Panel size (Num. genes; num. neg probes)		290; 20	1000; 10
		(Custom panel)	(Pre-designed panel)
Overlapping genes across panels		159	
Percent of cells that passed QC		72%	78%
Mean transcripts per cell (Sensitivity)	All genes	148	219
	Overlapping genes	85	29
Mean unique genes counted per cell (Genomic Breadth)	All genes	51	132
	Overlapping genes	31	20
Mean expression of each gene within cells	All genes	2	1.33
	Overlapping genes	2	1.3
Mean negative probe counts per cell		0.034	0.37
Mean signal detected per cell above background		59	4

Supplementary Table 3. Summarized QC results.

	baseMean	log2FoldChange	lfcSE	stat	pvalue	padj	-log10 (padj)	Significance
S100A8	1912.86507	3.877071757	0.78254345	-4.9544492	7.25E-07	0.00021035	3.67705129	yes
IGHD	555.955821	2.7995075	0.696344	-4.0202939	5.81E-05	0.00255326	2.59290428	yes
MS4A1	5393.16287	2.541605012	0.7152485	-3.5534573	0.0003802	0.00648581	2.18803551	yes
S100A9	3473.14706	2.344774824	0.69231803	-3.3868464	0.00070701	0.00891447	2.04990452	yes
TIMP1	4973.32528	2.086217495	0.52557312	-3.9694144	7.20E-05	0.00255326	2.59290428	yes
CD79A	6817.54988	1.988670369	0.53065281	-3.7475923	0.00017854	0.00363757	2.43918912	yes
C3	8969.74854	1.95141288	0.52254809	-3.7344178	0.00018815	0.00363757	2.43918912	yes
CD19	3401.9927	1.850081789	0.59046468	-3.1332641	0.00172874	0.01630356	1.78771753	yes
BANK1	4178.99064	1.823652303	0.58247153	-3.1308866	0.00174279	0.01630356	1.78771753	yes
MZB1	15536.3626	1.812298856	0.45136199	-4.0151783	5.94E-05	0.00255326	2.59290428	yes
JAK3	4521.55009	1.703751567	0.43113513	-3.9517809	7.76E-05	0.00255326	2.59290428	yes
PTGDS	7751.66236	1.625414177	0.58242248	-2.790782	0.00525809	0.03002352	1.52253846	yes
SELL	2560.14415	1.616523274	0.56725529	-2.849728	0.00437566	0.03002352	1.52253846	yes
LTB	1866.54329	1.493209523	0.53337272	-2.7995611	0.00511721	0.03002352	1.52253846	yes
S100A12	414.708353	1.403679815	0.62201356	-2.2566708	0.02402865	0.07829562	1.10626256	no
NOS2	4415.26132	1.321676825	0.44145556	-2.9939068	0.0027543	0.02218742	1.65389322	yes
IL1B	1957.75188	1.214190665	0.62098928	-1.9552522	0.05055331	0.12973858	0.88693086	no
PECAM1	9946.17504	1.142853852	0.33090956	-3.4536743	0.00055301	0.00801857	2.09590313	yes
CLU	5555.10391	1.133578759	0.44529262	-2.545694	0.01090608	0.04893374	1.3103916	yes
SSR4	10887.252	1.099170797	0.42466536	-2.5883222	0.00964447	0.04585076	1.33865343	yes
PTPRC	13970.3792	1.074416383	0.38313502	-2.8042761	0.00504297	0.03002352	1.52253846	yes
REG4	15966.2714	1.02886571	0.67728103	-1.5191119	0.12873432	0.25396567	0.59522499	no
IL7R	6618.94046	0.974229392	0.37835684	-2.5748957	0.01002703	0.0468846	1.3289698	yes
TRAC	6948.11474	0.945210701	0.43059747	-2.1951144	0.02815539	0.08675302	1.06171539	yes
BASP1	4239.58352	0.940309996	0.30325814	-3.1006917	0.00193069	0.01662429	1.77925689	yes
COL1A1	27985.0535	0.90730443	0.40001618	-2.2681693	0.02331889	0.07723413	1.11219073	yes
TNFRSF17	2792.8458	0.87596328	0.42961753	-2.0389375	0.04145627	0.11559921	0.93704514	no
ALOX5	3354.62151	0.867041813	0.30673357	-2.8266936	0.00470313	0.03002352	1.52253846	yes
MRC1	3356.91078	0.816368591	0.33015494	-2.4726832	0.0134103	0.05401369	1.26749616	yes
SPINK4	10731.9425	0.790681008	0.72035586	-1.0976256	0.27236802	0.44126663	0.35529892	no
TCF4	2331.13703	0.767445287	0.28785708	-2.6660636	0.00767452	0.03904579	1.4084258	yes
COL1A2	24033.8077	0.765825491	0.39521009	-1.9377681	0.05265152	0.13162881	0.88064905	no
HLA-DRB1	9531.98169	0.756374509	0.45318256	-1.6690283	0.09511178	0.20121698	0.69633538	no
SEC61B	2324.72837	0.747724586	0.3799327	-1.9680448	0.04906288	0.12703782	0.89606698	no
FYB1	3987.67501	0.736294259	0.37231454	-1.9776135	0.04797232	0.12647249	0.89800393	no
FCER1G	6285.04915	0.72922225	0.37980601	-1.9199861	0.05485966	0.13482458	0.87023092	no
SERPINF1	6266.924	0.721190193	0.2585434	-2.7894357	0.00528	0.03002352	1.52253846	yes
FCGR3A	1237.2805	0.710101793	0.4076122	-1.7421014	0.0814907	0.18462737	0.73370392	no
S100A11	10790.127	0.709428326	0.34734401	-2.0424372	0.04110818	0.11559921	0.93704514	no
CCL20	1862.03197	0.698841203	0.36016724	-1.9403242	0.05234031	0.13162881	0.88064905	no
CCR7	1745.05622	0.683942802	0.59985592	-1.1401785	0.25421196	0.42290132	0.37376096	no
VWF	2640.62439	0.683547581	0.29572971	-2.311393	0.02081116	0.07357857	1.13324868	yes
CD1D	1611.36803	0.676243014	0.24119119	-2.8037633	0.005051	0.03002352	1.52253846	yes
CD3D	2876.52694	0.66733552	0.34928375	-1.9105828	0.05605822	0.13661246	0.86450969	no
SPARC	16800.0698	0.666501158	0.43245795	-1.541193	0.12326982	0.24653964	0.60811324	no
IL10RA	5656.27472	0.65260346	0.30879271	-2.113403	0.03456629	0.10024223	0.99894928	no
MMP3	518.286632	0.642093989	0.58123327	-1.1047096	0.26928543	0.43883121	0.35770249	no
CD44	22491.6212	0.635630985	0.29248921	-2.1731776	0.02976696	0.08808589	1.05509365	yes
HLA-DRA	16413.3057	0.627693207	0.37933941	-1.6547008	0.09798522	0.20296937	0.69256949	no
FCER2	1164.9854	0.626284012	0.56105117	-1.116269	0.26430702	0.43550589	0.36100597	no
ITGAX	3566.65599	0.625895494	0.38019082	-1.6462667	0.09970886	0.20507495	0.68808738	no
OSMR	2661.85795	0.616225186	0.22295788	-2.7638637	0.00571214	0.03067631	1.51319695	yes
VCAN	4267.30924	0.615826417	0.34688374	-1.7753107	0.0758466	0.17596411	0.75457591	no
COL3A1	35487.2811	0.598611296	0.40345989	-1.4836947	0.13788994	0.26658722	0.57416068	no
MEF2C	3166.64943	0.595413511	0.24323126	-2.4479317	0.01436789	0.05630659	1.24944081	yes
S100P	5597.95965	0.594878565	0.60142623	-0.9891131	0.32260781	0.49500669	0.30538893	no
CTLA4	1716.01122	0.576267846	0.42670238	-1.3505147	0.17685093	0.32255831	0.49139177	no
C1QB	2214.65925	0.57351651	0.39973295	-1.4347492	0.15135859	0.28318704	0.54792662	no
CXCR5	1502.46352	0.554916287	0.60895445	-0.9112608	0.362158	0.52776794	0.277557	no
CD40	2964.34461	0.55178545	0.33124179	-1.6658087	0.09575153	0.20121698	0.69633538	no
COL6A2	9314.92282	0.523772485	0.43920322	-1.1925516	0.23304505	0.40298668	0.39470931	no
NOTCH3	2021.86666	0.51846979	0.2550454	-2.0328529	0.04206738	0.11618611	0.93484579	no
CD1C	870.394762	0.500083519	0.49480352	-1.0106709	0.31217397	0.4859094	0.3134447	no
TNFRSF1B	5545.37429	0.492326925	0.26504261	-1.8575387	0.06323454	0.15155387	0.81943298	no
ICOS	712.35705	0.488258905	0.33857912	-1.4420821	0.1492792	0.28312927	0.54801523	no
IL1R1	6092.98725	0.481839517	0.28669859	-1.6806484	0.09283124	0.20090342	0.69701267	no
ALOX5AP	1967.02909	0.468476406	0.33076371	-1.4163477	0.15667374	0.29125247	0.53573038	no
CCDC80	3139.17565	0.456909155	0.46904628	-0.9741238	0.32999506	0.5008332	0.30030689	no
C1QA	3218.33667	0.431689435	0.34505197	-1.2510853	0.21090337	0.36844565	0.43362657	no
CD28	1851.17888	0.43024337	0.38951666	-1.1045571	0.26935157	0.43883121	0.35770249	no
NFKBIA	6678.05303	0.430112392	0.3294757	-1.305445	0.19174138	0.34324074	0.46440117	no
LYZ	27013.2345	0.42383674	0.43430122	-0.975905	0.32911154	0.5008332	0.30030689	no
TNFRSF13B	1217.16313	0.412392961	0.39341779	-1.0482316	0.29453192	0.47190196	0.32614822	no
RGCC	1611.68025	0.402344956	0.23813367	-1.6895761	0.09110909	0.19865891	0.70189195	no
CAV1	3118.44421	0.384585441	0.32277211	-1.1915077	0.23345435	0.40298668	0.39470931	no
SPARCL1	10113.9213	0.369652816	0.38072271	-0.970924	0.33158612	0.5008332	0.30030689	no
CCR6	1063.59855	0.362211737	0.41738856	-0.8678047	0.38550128	0.55071611	0.25907222	no
WNT5A	3349.41961	0.349187366	0.44121659	-0.7914194	0.4286993	0.60000541	0.22184484	no
CD4	3278.25061	0.34617996	0.24901295	-1.3902087	0.16446552	0.30186709	0.52018423	no
CD80	589.995259	0.343685733	0.37686656	-0.911956	0.36179186	0.52776794	0.277557	no
ZFP36L1	12275.9423	0.343468865	0.39226995	-0.8755931	0.38125127	0.54734093	0.26174207	no
CALD1	12046.6369	0.335531377	0.42235337	-0.7944328	0.4269435	0.60000541	0.22184484	no
TGFBR2	7579.67825	0.333138574	0.28998669	-1.1488064	0.2506358	0.4221352	0.37454844	no
OLFM4	25435.5281	0.314916332	0.63090143	-0.499153	0.61767161	0.7311215	0.13601045	no
GPR15	3900.81575	0.309105497	0.58515506	-0.5282454	0.59732899	0.72177253	0.14159965	no
LST1	515.700859	0.307866377	0.30134352	-1.0216459	0.30694851	0.48116253	0.3177082	no
IL3RA	870.508283	0.307005814	0.30448954	-1.0082639	0.31332779	0.4859094	0.3134447	no
C1QC	4069.13535	0.306134287	0.39341742	-0.7781412	0.43648581	0.60276611	0.21985117	no
CTSL	5683.08235	0.295792977	0.31727063	-0.9323049	0.35117896	0.51941117	0.28448872	no
F3	7352.51271	0.292489392	0.45251801	-0.6463597	0.51804645	0.65891873	0.18116814	no
CD69	1516.25797	0.286078531	0.36403299	-0.7858588	0.43195021	0.60000541	0.22184484	no
IL18R1	1253.08496	0.276143106	0.24269664	-1.1378118	0.25519907	0.42290132	0.37376096	no
TNFSF13B	1863.35862	0.272824023	0.27245712	-1.0013466	0.31665925	0.48846374	0.31116767	no
RGS5	5353.96751	0.272693261	0.331521	-0.822552	0.41076281	0.58392752	0.23364106	no
FCGR3B	2307.78612	0.258865367	0.48620922	-0.5324156	0.5944382	0.72128484	0.1418932	no
CD3E	3772.72142	0.25585611	0.3414956	-0.7492223	0.45372324	0.61774526	0.20919058	no
IL1R2	177.225688	0.254478739	0.49926909	-0.5097026	0.61025985	0.72605935	0.13902788	no
JAK2	5120.8998	0.249018248	0.21399918	-1.1636411	0.24456948	0.41564604	0.38127635	no

MMP1	1314.51458	0.244594878	0.38533706	-0.6347557	0.52558779	0.66269765	0.17868457	no
MAF	9653.17113	0.241740252	0.25578591	-0.9450882	0.34461384	0.51250264	0.29030389	no
TNFAIP3	7131.71415	0.229911582	0.26169584	-0.878545	0.37964801	0.54734093	0.26174207	no
KLRB1	1985.69773	0.215872798	0.29544362	-0.7306734	0.46497865	0.62482141	0.2042441	no
MMRN1	1987.36669	0.209470394	0.35410667	-0.591546	0.55415462	0.68095272	0.16688304	no
MKI67	7800.26954	0.207285928	0.29121312	-0.7118015	0.47658772	0.63628163	0.19635061	no
ABCC9	636.055213	0.206281516	0.30954416	-0.6664042	0.5051528	0.65399247	0.18442725	no
GZMK	1222.45935	0.199227499	0.44570975	-0.4469893	0.65488277	0.76433939	0.11671376	no
MCAM	3740.74407	0.182268832	0.28161011	-0.6472382	0.51747777	0.65891873	0.18116814	no
TGFB1	20332.6947	0.165467989	0.44300208	-0.3735151	0.70876507	0.80035742	0.09671603	no
JAK1	11059.4691	0.159933609	0.28179863	-0.5675457	0.57034346	0.69788863	0.15621388	no
TYK2	5738.73775	0.130997963	0.21334874	-0.6140086	0.53920964	0.6711193	0.17320027	no
NKG7	583.099906	0.128220446	0.38985349	-0.3288939	0.74223587	0.82294613	0.08462859	no
TGFBR1	4446.9934	0.115757565	0.1854311	-0.6242619	0.53245563	0.66573551	0.17669828	no
CD59	17776.8393	0.114739025	0.36018975	-0.3185516	0.75006655	0.82542311	0.08332337	no
LAMP3	3485.7638	0.111537098	0.2172795	-0.5133347	0.60771725	0.72605935	0.13902788	no
PLVAP	5503.58908	0.100715693	0.29239391	-0.3444521	0.73050632	0.81679119	0.08788896	no
IFITM2	2616.48229	0.099663191	0.25482371	-0.3911064	0.69571856	0.79746397	0.09828893	no
MUC1	8206.29814	0.094807607	0.39581826	-0.2395231	0.81070001	0.87075186	0.06010559	no
LYVE1	1537.22231	0.094490719	0.43618356	-0.2166306	0.82849621	0.88008755	0.05547412	no
IRF8	4519.44282	0.091292825	0.25308109	-0.3607256	0.7183046	0.80739664	0.09291306	no
CD8A	1127.59325	0.089263831	0.33926602	-0.2631087	0.79246682	0.86170569	0.06464104	no
FXYD5	5369.07009	0.077229423	0.23600515	-0.3272362	0.74348926	0.82294613	0.08462859	no
TUBB	8071.50028	0.072557631	0.19160592	-0.3786816	0.70492434	0.80035742	0.09671603	no
TNF	1069.46083	0.068719602	0.41367144	-0.1661212	0.86806156	0.91209367	0.03996056	no
KLF2	1876.11788	0.067079451	0.2926839	-0.2291874	0.81872329	0.87612456	0.05743415	no
CYTH1	4619.9569	0.063904798	0.28387189	-0.2251184	0.82188713	0.87627672	0.05735872	no
A2M	18885.8881	0.060866797	0.42583506	-0.1429351	0.8863414	0.92460074	0.03404576	no
S100A4	1685.74879	0.05850637	0.23621184	-0.247686	0.80437735	0.86717261	0.06189445	no
PDGFRA	6603.12943	0.051086071	0.28465802	-0.1794647	0.85757282	0.90434952	0.04366369	no
NPC2	5980.98134	0.050343408	0.19638699	-0.256348	0.79768215	0.86316352	0.06390692	no
SPINK1	10616.1579	0.04361875	0.47363258	-0.0920941	0.9266233	0.94619985	0.02401712	no
ACKR1	1261.60761	0.03260274	0.34354704	-0.0949004	0.92439396	0.94619985	0.02401712	no
STMN1	7112.84912	0.03235154	0.29810948	-0.1085223	0.91358135	0.94284197	0.02556109	no
ZBTB16	709.078541	0.022426795	0.43009456	-0.0521439	0.95841406	0.96506971	0.01544132	no
TPSB2	1488.32088	0.021534502	0.3587389	-0.0600283	0.95213306	0.96506971	0.01544132	no
CD209	3280.26477	0.003264054	0.24106837	-0.01354	0.98919701	0.98919701	0.0047172	no
CDH5	2144.0873	-0.004045773	0.25734635	0.01572112	0.98745688	0.98919701	0.0047172	no
HMGB2	7935.80976	-0.016049411	0.29463083	0.05447295	0.95655836	0.96506971	0.01544132	no
KIT	2108.29862	-0.029515672	0.26991548	0.10935153	0.91292367	0.94284197	0.02556109	no
CSF3R	1189.80923	-0.034883345	0.57737823	0.0604168	0.95182368	0.96506971	0.01544132	no
CD7	46.6169971	-0.037133241	0.33447304	0.11102013	0.91160038	0.94284197	0.02556109	no
S1PR1	1096.0719	-0.037891277	0.37594074	0.10079056	0.91971672	0.94580798	0.02419703	no
BATF	409.524264	-0.045188924	0.21545566	0.20973654	0.8338733	0.88256664	0.05425249	no
CD14	5297.90012	-0.045593991	0.2981742	0.15291058	0.87846879	0.91969657	0.03635544	no
TLE4	3245.07062	-0.053038496	0.20247918	0.26194543	0.79336351	0.86170569	0.06464104	no
STAT4	1540.00042	-0.095074739	0.23952759	0.39692605	0.69142199	0.79568404	0.09925935	no
LEF1	3583.37577	-0.109466333	0.24323861	0.45003683	0.65268389	0.76433939	0.11671376	no
GZMA	1227.09625	-0.121277875	0.32529856	0.37282021	0.70928226	0.80035742	0.09671603	no
TOP2A	3752.54684	-0.132913266	0.24951889	0.53267818	0.59425638	0.72128484	0.1418932	no
CCL4	2162.1315	-0.139184019	0.37279479	0.37335291	0.7088858	0.80035742	0.09671603	no
NOTCH4	739.349007	-0.142234533	0.32222474	0.44141406	0.65891326	0.76433939	0.11671376	no
CPA3	3586.24516	-0.146333261	0.24320614	0.60168408	0.54738445	0.67838243	0.16852541	no
TNFRSF11B	1085.42105	-0.150590658	0.33871685	0.44459157	0.65661494	0.76433939	0.11671376	no
UBE2C	1475.25515	-0.153055307	0.24525749	0.62405966	0.53258841	0.66573551	0.17669828	no
CEACAM6	23845.8847	-0.154245261	0.49276587	0.31301937	0.75426595	0.82542311	0.08332337	no
TPSAB1	676.972831	-0.154742995	0.48903784	0.31642336	0.75168119	0.82542311	0.08332337	no
IGHA2	769.55433	-0.172278342	0.36303966	0.47454414	0.63511193	0.74870919	0.12568684	no
GZMB	859.258529	-0.185799038	0.4353451	0.42678564	0.66953546	0.77356687	0.11150214	no
TMEM176A	12356.3759	-0.194352895	0.29780004	0.65262884	0.51399559	0.65891873	0.18116814	no
TIGIT	2064.10891	-0.196532574	0.38319932	0.51287298	0.60804018	0.72605935	0.13902788	no
MS4A7	5283.47913	-0.212709637	0.22244176	0.95624867	0.33894662	0.50929802	0.29302801	no
MYH11	20743.4326	-0.214850742	0.62808348	0.34207354	0.73229555	0.81679119	0.08788896	no
CLEC10A	1867.66406	-0.217331768	0.31241281	0.69565574	0.48664445	0.6428948	0.19186008	no
TMEM176B	19200.2275	-0.229330042	0.33047035	0.69395042	0.4877133	0.6428948	0.19186008	no
POSTN	6799.184	-0.241187528	0.37975855	0.63510757	0.52535826	0.66269765	0.17868457	no
CD86	2135.88046	-0.248732818	0.3168324	0.78506119	0.43241769	0.60000541	0.22184484	no
TUBA1B	57892.879	-0.249738573	0.3243354	0.77000098	0.44129931	0.60652512	0.21715121	no
ANXA2	51690.1993	-0.251112634	0.35416556	0.70902613	0.47830826	0.63628163	0.19635061	no
GATA3	338.898803	-0.256220104	0.34931743	0.7334879	0.46326091	0.62482141	0.2042441	no
APOE	2353.41664	-0.276739333	0.37908991	0.73000976	0.46538422	0.62482141	0.2042441	no
CXCL14	8732.76611	-0.277760178	0.46516198	0.59712571	0.55042346	0.67924597	0.16797293	no
TM4SF1	4506.98939	-0.290386777	0.42434747	0.68431368	0.49377711	0.64794281	0.18846332	no
TNFRSF1A	6989.81671	-0.294922097	0.31154763	0.94663567	0.34382446	0.51250264	0.29030389	no
FOXP3	506.931456	-0.296153861	0.44051069	0.67229665	0.50139486	0.65203816	0.18572698	no
SELENOP	34314.8266	-0.3299702	0.37567706	0.87833472	0.3797621	0.54734093	0.26174207	no
MUC2	12916.4213	-0.334779382	0.65797631	0.50880157	0.61089132	0.72605935	0.13902788	no
LTBR	4714.62655	-0.33737116	0.3301577	1.02184852	0.3068526	0.48116253	0.3177082	no
FCN1	684.105916	-0.347226043	0.45306938	0.76638602	0.44344665	0.60660154	0.21709649	no
ACTG1	105448.403	-0.357071893	0.2771673	1.28829013	0.19764499	0.35067859	0.45509075	no
AGR2	47284.3389	-0.369422326	0.57093239	0.64705092	0.51759899	0.65891873	0.18116814	no
QDPR	2915.60647	-0.369851475	0.21519058	1.71871593	0.08566611	0.19110132	0.71873631	no
DUSP23	915.194974	-0.387868082	0.26902734	1.44174225	0.1493751	0.28312927	0.54801523	no
OSM	540.695673	-0.38869551	0.57151941	0.68010902	0.49643543	0.64849674	0.18809221	no
TYROBP	1596.51563	-0.394821971	0.33967168	1.16236351	0.24508784	0.41564604	0.38127635	no
IFNG	487.783311	-0.395817413	0.37889083	1.04467405	0.29617364	0.47192503	0.32612698	no
TNFSF15	451.778802	-0.426436468	0.37213241	1.14592671	0.25182548	0.4221352	0.37454844	no
S100A16	8527.96765	-0.42647993	0.45902871	0.92909206	0.35284138	0.51941117	0.28448872	no
PROX1	1646.78975	-0.43845515	0.2816277	1.5568609	0.11950352	0.2406668	0.61858381	no
LEFTY1	3988.95609	-0.500070209	0.6139855	0.81446583	0.41537814	0.5876081	0.23091222	no
KLRF1	670.003887	-0.51090705	0.28489865	1.79329404	0.07292592	0.17193916	0.7646252	no
S100B	1431.59288	-0.530535892	0.23046795	2.30199424	0.0213355	0.07365826	1.13277853	yes
HMGN2	32112.0311	-0.538534208	0.20022304	2.68967156	0.00715224	0.03703837	1.43134811	yes
CRYAB	2098.64151	-0.543559278	0.32490441	1.67298214	0.09433081	0.20121698	0.69633538	no
RTKN2	1858.83013	-0.547455394	0.31950076	1.71347134	0.08662586	0.19176717	0.71722573	no
IL1RL1	1153.38695	-0.549690879	0.25264318	2.17575983	0.02957322	0.08808589	1.05509365	yes
FLT3	867.918626	-0.556636898	0.36853436	1.51040707	0.13093959	0.25657081	0.59079275	no
KCNJ8	882.613362	-0.566022534	0.40292067	1.40479896	0.16008107	0.29569115	0.52916168	no
XCR1	582.639676	-0.568342817	0.35167409	1.61610658	0.10607127	0.21662443	0.66429257	no

MS4A2	1147.41002	-0.589241169	0.27041282	2.179043	0.02932847	0.08808589	1.05509365	yes
ASPN	1211.93258	-0.596651486	0.40157785	1.48576791	0.13734052	0.26658722	0.57416068	no
TRGC2	1582.5655	-0.601106693	0.26056558	2.30693053	0.02105869	0.07357857	1.13324868	yes
APP	28138.247	-0.616961251	0.35868978	1.72004135	0.08542493	0.19110132	0.71873631	no
IL13RA2	854.347269	-0.621057006	0.52444508	1.18421744	0.236327	0.40553154	0.39197537	no
CST3	10473.5316	-0.63099466	0.28715909	2.19736958	0.02799406	0.08675302	1.06171539	yes
HAND2	636.828897	-0.632897053	0.38077529	1.66212744	0.09648722	0.20130428	0.69614699	no
LILRA4	1838.12172	-0.635626594	0.21497609	2.95673165	0.00310919	0.02422279	1.61577591	yes
TREM1	1611.896	-0.639966607	0.61534959	1.04000493	0.29833761	0.47277545	0.32534509	no
INSM1	994.016817	-0.64477586	0.40269384	1.6011565	0.10934226	0.22174305	0.65414999	no
CPE	2511.08592	-0.647535058	0.34588864	1.87209112	0.061194	0.1478855	0.83007441	no
GSN	26004.6796	-0.64997153	0.37230866	1.74578675	0.08084802	0.18461358	0.73373636	no
IRF7	100.856079	-0.655020781	0.35584164	1.84076484	0.06565603	0.15606761	0.80668723	no
TFF3	10832.0483	-0.664245276	0.50813307	1.30722701	0.19113563	0.34324074	0.46440117	no
CXCR1	657.025772	-0.670383819	0.63427229	1.05693379	0.29054181	0.46809513	0.32966588	no
CCL5	3433.52566	-0.670668446	0.33106816	2.02577149	0.04278821	0.11695823	0.93196923	no
OGN	1294.86949	-0.691371608	0.51448883	1.34380295	0.17901211	0.32445946	0.48883956	no
ADAMDEC1	10264.2272	-0.693746814	0.47111741	1.4725561	0.14087077	0.27054651	0.56775806	no
PYY	288.419992	-0.695341775	0.40813538	1.70370375	0.08843645	0.19429219	0.71154465	no
TNFRSF11A	7263.14539	-0.719036375	0.43020082	1.67139704	0.09464328	0.20121698	0.69633538	no
NUPR1	5388.12845	-0.756354225	0.30258011	2.49968257	0.01243046	0.05224398	1.28196379	yes
LTA	791.260317	-0.771573334	0.53706366	1.43665154	0.15081703	0.28318704	0.54792662	no
KLRC2	1351.28228	-0.808269276	0.32462583	2.48984893	0.01277974	0.05294464	1.27617801	yes
SOX6	1718.78727	-0.8100739	0.26147542	3.09808816	0.00194774	0.01662429	1.77925689	yes
PLAC8	26890.5595	-0.819407735	0.41563114	1.97147823	0.0486692	0.12703782	0.89606698	no
WFDC2	1460.19394	-0.82854165	0.64409398	1.28636764	0.19831479	0.35067859	0.45509075	no
TRGC1	907.388359	-0.831968936	0.35601342	2.33690332	0.01944421	0.06961508	1.15729668	yes
ITLN1	13676.6227	-0.841688292	0.65713417	1.28084695	0.20024743	0.35195003	0.45351899	no
SOX8	492.621655	-0.850512269	0.42612964	1.99590028	0.04594478	0.12253574	0.91173722	no
CCSER1	2486.56767	-0.851418043	0.28903669	2.94570926	0.00322215	0.02422279	1.61577591	yes
ITM2C	59915.0621	-0.862029806	0.44197187	1.95041779	0.05112634	0.13005824	0.88586212	no
TRDC	982.418259	-0.86215405	0.3107555	2.77438066	0.00553069	0.03047716	1.51602555	yes
S1PR5	221.729939	-0.863489115	0.56294302	1.53388367	0.12505827	0.24840342	0.60484243	no
NEUROD1	791.465371	-0.878235624	0.43429266	2.02222074	0.04315355	0.11695823	0.93196923	no
GLIS3	1096.79648	-0.878573281	0.31693667	2.77207833	0.00556996	0.03047716	1.51602555	yes
FABP5	12212.1062	-0.879388743	0.28386724	3.09788739	0.00194906	0.01662429	1.77925689	yes
ADGRB3	556.980907	-0.8804005	0.37013578	2.37858797	0.01737909	0.06379666	1.19520207	yes
ASCL2	1023.18462	-0.896728423	0.42958023	2.08745271	0.03684723	0.10579898	0.97551852	no
TNFSF9	233.517645	-0.920825108	0.43441774	2.11967657	0.03403333	0.09969359	1.00133275	no
CSPG4	2330.574	-0.920839821	0.40632897	2.2662421	0.02343656	0.07723413	1.11219073	yes
CCL8	795.427419	-0.92668492	0.3822066	2.42456543	0.01532672	0.05698396	1.24424735	yes
SOX9	4574.56688	-0.928899879	0.4656432	1.99487479	0.04605654	0.12253574	0.91173722	no
INAVA	4294.78486	-0.93599246	0.41195267	2.27208739	0.02308123	0.07723413	1.11219073	yes
TPH1	2162.42886	-0.95446585	0.42009332	2.27203293	0.02308452	0.07723413	1.11219073	yes
TRAV1-2	415.503525	-0.979896722	0.44623069	2.19594204	0.02809609	0.08675302	1.06171539	no
TINAGL1	3562.7049	-0.988860877	0.37468292	2.6391939	0.00831034	0.04155172	1.38141102	yes
FCER1A	1467.9427	-0.996139113	0.40953658	2.43235685	0.01500092	0.05649697	1.24797484	yes
IL10	695.611225	-0.998995837	0.45218367	2.20927007	0.02715586	0.08654066	1.0627798	yes
CLEC9A	681.956717	-1.010777522	0.38547552	2.62215753	0.0087375	0.04294705	1.36706665	yes
FOLR3	190.086772	-1.028690102	0.58152192	1.76896186	0.07690024	0.17699262	0.75204485	no
LGR5	1818.8912	-1.038843835	0.50935902	2.03951202	0.04139895	0.11559921	0.93704514	no
MGLL	6414.94017	-1.040525273	0.36287338	2.86746101	0.0041378	0.02926735	1.5336166	yes
CCL23	584.543271	-1.055967304	0.32774724	3.22189537	0.00127346	0.01407847	1.85144466	yes
NCAM1	1040.62283	-1.072975749	0.31516595	3.40447861	0.00066291	0.00873829	2.05857345	yes
RORC	2441.77639	-1.076352143	0.32447686	3.31719228	0.00090927	0.01098702	1.95912028	yes
CD8B	1926.92698	-1.076930465	0.43470723	2.47736957	0.01323548	0.05401369	1.26749616	yes
HPGDS	935.045685	-1.081433936	0.30848182	3.5056651	0.00045547	0.00733809	2.13441673	yes
CEACAM1	21259.322	-1.083730291	0.49452612	2.19145209	0.02841909	0.08675302	1.06171539	yes
TRGV9	716.779404	-1.083847352	0.38261772	2.83271603	0.00461544	0.03002352	1.52253846	yes
GATA2	2043.52493	-1.095175286	0.31568336	3.46922079	0.00052197	0.00796692	2.09870982	yes
PLP1	686.667114	-1.110634786	0.35401713	3.13723458	0.0017055	0.01630356	1.78771753	yes
CACNA1A	960.236156	-1.12006772	0.44448851	2.51990252	0.01173873	0.05039473	1.2976149	yes
NTRK2	1115.41481	-1.134323876	0.43789356	2.59041006	0.00958617	0.04585076	1.33865343	yes
TRDV2	198.094352	-1.154833903	0.47369223	2.4379414	0.01477117	0.05649697	1.24797484	no
PHLDA2	358.524149	-1.21110305	0.37835647	3.20095766	0.00136972	0.01418635	1.84812933	no
KRT8	97907.0904	-1.255598483	0.43175457	2.90813017	0.00363597	0.02636078	1.57904176	yes
C7	2206.58325	-1.259853661	0.53363456	2.36089218	0.01823103	0.06608748	1.17988078	yes
IL32	5750.57097	-1.301140683	0.32410249	4.01459635	5.95E-05	0.00255326	2.59290428	yes
EPCAM	57971.1687	-1.312016935	0.52085126	2.51898584	0.01176934	0.05039473	1.2976149	yes
MS4A8	1287.98924	-1.313573162	0.4702177	2.79354257	0.00521342	0.03002352	1.52253846	yes
C15orf48	26739.1836	-1.314316204	0.52205713	2.51757161	0.0118167	0.05039473	1.2976149	yes
IGHE	97.0412267	-1.326356501	0.74521104	1.77984011	0.07510213	0.17564208	0.75537142	no
DUSP1	7987.84709	-1.334020115	0.54240834	2.4594388	0.01391544	0.05528052	1.25742785	yes
CA4	10499.4036	-1.355132063	0.70416733	1.92444609	0.05429869	0.1345865	0.8709985	no
TREM2	853.424568	-1.374656617	0.51063852	2.69203472	0.00710176	0.03703837	1.43134811	yes
PIGR	117128.085	-1.374798454	0.54046775	2.54371966	0.01096791	0.04893374	1.3103916	yes
LGALS4	94777.0134	-1.376957257	0.62043026	2.21935866	0.02646233	0.08526752	1.06921636	yes
CLDN5	889.083778	-1.413466752	0.43983701	3.21361484	0.00131075	0.01407847	1.85144466	yes
PHGR1	74019.8639	-1.506143806	0.61823876	2.43618471	0.0148431	0.05649697	1.24797484	yes
SH2D6	207.044499	-1.565720391	0.45609034	3.43291721	0.00059712	0.008246	2.08375646	no
FABP2	5896.1976	-1.61008423	0.56715757	2.83886579	0.00452742	0.03002352	1.52253846	yes
JUN	13975.4846	-1.68586719	0.40952534	4.11663711	3.84E-05	0.00255326	2.59290428	yes
FABP1	63313.6438	-1.777128568	0.69163101	2.56947498	0.01018528	0.0468846	1.3289698	yes
TRPM5	803.841932	-1.778431142	0.45782584	3.8845146	0.00010254	0.00270318	2.56812455	yes
CA7	1298.27157	-1.821126865	0.55630216	3.273629	0.00106176	0.01231641	1.909516	yes
MT1G	237.253781	-1.935739452	0.53328129	3.62986566	0.00028357	0.00513968	2.28906358	no
DDC	5190.05703	-1.958693357	0.49628768	3.94668944	7.92E-05	0.00255326	2.59290428	yes
OTOP2	738.768648	-1.964202761	0.66756758	2.94232798	0.00325755	0.02422279	1.61577591	yes
BEST4	551.312459	-2.154949713	0.53770077	4.00771177	6.13E-05	0.00255326	2.59290428	yes
LYPD8	8786.16714	-2.365349345	0.6323874	3.74034861	0.00018377	0.00363757	2.43918912	yes
SLC26A2	20711.8808	-2.627487213	0.67124898	3.91432583	9.07E-05	0.00262906	2.5802	yes
GUCA2A	1260.16858	-2.809367372	0.73362335	3.82944106	0.00012844	0.00310384	2.50810109	yes
AQP8	10362.8134	-2.971248595	0.99182156	2.99574914	0.00273772	0.02218742	1.65389322	yes

Supplementary Table 4. Pseudobulk DE gene analysis of Xenium data comparing colon biopsies in UC PRE versus HC.
Significance was set as log2fc >0.4 or <-0.4, p-adj < 0.1 and baseMean >500.

	baseMean	log2FoldChange	lfcSE	stat	pvalue	padj	-log$_{10}$(q-value)	Significance
IGHG1	28446.8984	3.280360379	0.78683878	-4.2777706	1.89E-05	0.00369552	2.432324904	yes
IGHG2	13449.7281	3.073380342	0.68111804	-4.5122712	6.41E-06	0.00296199	2.528416428	yes
REG1A	1327.72378	2.749684998	0.61899724	-4.442645	8.89E-06	0.00296199	2.528416428	yes
IGKC	24238.2781	1.735131765	0.61375071	-2.8270953	0.00469723	0.05445155	1.263989714	yes
OLFM4	1024.66082	1.652131755	0.48685389	-3.3934858	0.00069009	0.02018712	1.694925714	yes
KRT20	1259.97142	1.644757596	0.63526515	-2.5890098	0.00962532	0.07825463	1.106489984	yes
LCN2	774.995768	1.587421999	0.49976183	-3.1827127	0.00145902	0.02652769	1.576300598	yes
S100A8	5423.16483	1.581263097	0.42917658	-3.6844114	0.00022923	0.0127351	1.8949977	yes
MALAT1	12095.2239	1.489272916	0.49543525	-3.0039706	0.00266481	0.03831656	1.416813509	yes
NEAT1	2078.89566	1.413462698	0.41536332	-3.4054131	0.00066064	0.0200194	1.698549818	yes
AGR2	1286.01099	1.374648887	0.42487409	-3.235426	0.00121461	0.02496068	1.602743639	yes
B2M	6219.27166	1.311810071	0.37743363	-3.4756046	0.0005097	0.01757597	1.755080715	yes
CEACAM6	818.584109	1.307417782	0.40627516	-3.2022956	0.00136337	0.0260685	1.583384414	yes
S100A10	1604.14229	1.24940864	0.39960073	-3.1266425	0.00176815	0.03043526	1.516622942	yes
ANXA2	2705.06415	1.206548921	0.34159925	-3.5320596	0.00041234	0.01718068	1.764959598	yes
COL3A1	860.298456	1.197114988	0.39057948	-3.0649716	0.00217691	0.03348159	1.47519397	yes
TIMP1	602.95769	1.117584791	0.35003988	-3.1927356	0.00140932	0.0260985	1.583384414	yes
PLAC8	2314.7905	1.11197201	0.44542771	-2.4964141	0.0125456	0.0895716	1.047826982	yes
PIGR	4303.68823	1.098307012	0.5429795	-2.0227412	0.04309984	0.18820889	0.725359873	no
JCHAIN	3124.38258	1.07895279	0.57219869	-1.8856261	0.0593456	0.2206147	0.656365547	no
COL1A1	1379.01178	1.07650724	0.31956523	-3.3683457	0.00075821	0.02100575	1.677981801	yes
XBP1	1230.1811	1.062193618	0.32199504	-3.2987887	0.00097103	0.02345423	1.629778778	yes
LGALS3	1511.44043	1.009487503	0.40708947	-2.4723988	0.01342097	0.09192446	1.036568804	yes
IGHA1	39977.4172	0.970642253	0.84418812	-1.5067652	0.13187085	0.35544703	0.449225108	no
DMBT1	753.707716	0.969411119	0.36877606	-2.626014	0.00863913	0.07782996	1.108853193	yes
KRT19	3323.30888	0.93364239	0.44115159	-2.1163754	0.03431289	0.16576225	0.780513084	no
SOD2	676.85997	0.908163623	0.2784797	-3.2611484	0.00110962	0.02421819	1.616585253	yes
MZB1	951.358379	0.899293009	0.29228101	-3.0865455	0.00216548	0.03348159	1.47519397	yes
EPCAM	1696.35012	0.890549631	0.44913609	-1.9828058	0.04738913	0.1966354	0.706338304	no
CD63	1044.02404	0.878606295	0.25727761	-3.4150243	0.00063776	0.0199301	1.700490454	yes
SH3BGRL3	1463.93165	0.876330027	0.29910194	-2.9298707	0.00339103	0.04403935	1.356159053	yes
CD74	2307.08604	0.875823529	0.39743373	-2.2020947	0.02759512	0.1453748	0.837921285	no
PFN1	3975.3532	0.861395156	0.31118825	-2.7680838	0.0056387	0.05998612	1.221949224	yes
SELENOP	475.095381	0.852167292	0.2784494	-3.0604855	0.00220978	0.03348159	1.47519397	yes
EZR	1086.54509	0.852020079	0.31662267	-2.6909087	0.00712581	0.07026314	1.153272452	yes
KRT8	7524.25128	0.826570308	0.43137374	-1.916135	0.05534792	0.21336929	0.670868085	no
MYL12A	1160.67198	0.816910856	0.29768177	-2.7442422	0.00606508	0.06299724	1.20067454	yes
HSP90B1	506.42238	0.799428248	0.24110065	-3.3157449	0.00091399	0.0228498	1.641117553	yes
FCGBP	1176.92456	0.797190501	0.34511693	-2.3099142	0.0208929	0.11803901	0.927974449	no
ENO1	1509.80236	0.774698148	0.29165947	-2.6570992	0.00788162	0.07366371	1.132744432	yes
CSTB	812.204594	0.76888559	0.28628526	-2.6857324	0.0072371	0.07026314	1.153272452	yes
LYZ	1186.49451	0.763186907	0.30014658	-2.542714	0.01099952	0.08526761	1.069215899	yes
CEACAM1	673.708459	0.736408659	0.35138676	-2.0957211	0.03616994	0.17031574	0.76874521	no
MHC I	14251.5668	0.731845931	0.32493691	-2.2522706	0.02430516	0.13354484	0.874372904	no
CLDN4	1776.29492	0.726099825	0.42288468	-1.7220871	0.08505374	0.27197319	0.565473907	no
IGHM	2099.01896	0.71277151	0.46583689	-1.5300882	0.12599491	0.34331038	0.464313062	no
SOD1	896.877388	0.709226791	0.27369012	-2.5913496	0.00956003	0.07825463	1.106489984	yes
SERPINA1	665.767487	0.709181531	0.29709472	-3.424927	0.00061496	0.0199301	1.700490454	yes
S100A9	393.970914	0.69500413	0.20519603	-3.3870252	0.00070655	0.02018712	1.694925714	no
SPINK1	626.056659	0.688294238	0.33617556	-2.047425	0.04061638	0.18117615	0.741894186	no
TPT1	2184.71726	0.669061139	0.18073165	-3.7019588	0.00021394	0.0127351	1.8949977	yes
FAU	1978.05002	0.665057205	0.21332917	-3.1175165	0.00182382	0.03043526	1.516622942	yes
IGFBP7	894.008509	0.663174593	0.20314599	-3.2645222	0.00109649	0.02421819	1.615852253	yes
ANXA4	732.339215	0.646004353	0.21519163	-3.0019958	0.00268216	0.03831656	1.416813509	yes
HLA-DRA	928.288821	0.644024941	0.29179143	-2.2072031	0.02729888	0.14468655	0.839571849	no
VIM	977.750905	0.64401959	0.23727402	-2.714244	0.00664272	0.06642722	1.177653954	yes
COL1A2	482.559047	0.642544232	0.20917009	-3.0718743	0.00212719	0.03348159	1.47519397	yes
SQSTM1	1115.58897	0.625413317	0.26216149	-2.3856033	0.01705113	0.10656959	0.97239672	no
ARF1	1592.28399	0.619815965	0.22369934	-2.7707546	0.00559268	0.05998612	1.221949224	yes
PSAP	1119.12239	0.615450642	0.18366693	-3.3500902	0.00080548	0.02119673	1.673731083	yes
PGK1	923.240216	0.605191675	0.18598971	-3.2537374	0.00113898	0.02423351	1.61583894	yes
TUBB4B	1466.32801	0.599854767	0.30898038	-1.9421174	0.05212289	0.2065615	0.684950812	no
HSP90AA1	912.016124	0.590587939	0.25084177	-2.3544242	0.01855143	0.10945093	0.960780536	no
CALM3	797.449402	0.589764653	0.16755212	-3.5188878	0.00043173	0.01719418	1.764618539	yes
CRIP1	1378.27245	0.584933658	0.30464463	-1.9200524	0.05485128	0.21336929	0.670868085	no
GSTP1	845.178733	0.58375392	0.19479762	-2.9967199	0.00272901	0.0384368	1.415252732	yes
CALM1	723.940149	0.565775312	0.22965108	-2.4636301	0.0137538	0.09356324	1.028894757	yes
IFI27	1252.23652	0.554763526	0.33772736	-1.6426372	0.10045802	0.29898221	0.524354654	no
FKBP11	335.380756	0.541375453	0.20983634	-2.5924177	0.0095304	0.07825463	1.106489984	no
CTNNB1	594.424807	0.528980023	0.1707482	-3.098182	0.00202745	0.03270075	1.485442252	yes
S100P	863.366594	0.524924861	0.28573433	-1.8371081	0.06619393	0.23438335	0.630073251	no
COL6A3	565.933646	0.523136016	0.15698956	-3.3322882	0.00088132	0.02208511	1.655900483	yes
HLA-DRB	2309.83177	0.522397251	0.31049074	-1.682489	0.09247406	0.2870993	0.541967866	no
KRT18	4195.30308	0.51525137	0.26365496	-1.9542639	0.05067002	0.20442491	0.689466176	no
HAC3	1926.6561	0.515185939	0.29068012	-1.7722466	0.07633703	0.25028536	0.601564557	no
SAT1	609.994213	0.514766091	0.21725775	-2.3693797	0.01781795	0.10864604	0.963988094	yes
ATP5F1B	939.015704	0.51044914	0.29673625	-1.9136949	0.05568042	0.21336929	0.670868085	no
SFN	1073.09092	0.506777811	0.27815852	-1.8219029	0.06846972	0.23913719	0.621352881	no
ITM2B	1229.6976	0.505786967	0.20588497	-2.4566483	0.01402399	0.09412074	1.026314679	yes
SRGN	629.111214	0.48745821	0.17659516	-2.8207109	0.00479174	0.05445155	1.263989714	yes
CTSD	958.028296	0.487985729	0.24731546	-1.9731307	0.04848067	0.19869128	0.701821199	no
EIF3AL1	2339.76378	0.487926941	0.19779736	-2.598156	0.00937259	0.07810493	1.107321556	yes
MIF	1224.95284	0.477189473	0.2570385	-1.8564903	0.06338571	0.22799896	0.642067143	no
COL6A2	604.138337	0.475052904	0.21789913	-2.1801506	0.0292463	0.14921583	0.826185597	no
RACK1	841.084943	0.473461101	0.19339507	-2.4481549	0.01435899	0.09509265	1.021853045	yes
LDHA	1670.80192	0.472529752	0.214149	-2.2065465	0.02734576	0.14468655	0.839571849	no
ATP5F1E	775.592429	0.465577672	0.17912848	-2.599127	0.00934612	0.07810493	1.107321556	yes
IGFBP5	561.311592	0.463674729	0.22507882	-2.0601281	0.03938629	0.178477	0.748477735	no
MMP2	489.294934	0.459858981	0.27454024	-1.6754775	0.09384059	0.28813368	0.540405978	no
LMNA	500.363296	0.459604765	0.2128721	-2.1424356	0.03215845	0.15841599	0.800200994	no
ACTA2	422.322919	0.45437099	0.19288403	-2.3559135	0.01847722	0.10945093	0.960780536	no
HSP90AB1	1519.66647	0.447765972	0.21647238	-2.068467	0.03859613	0.17786237	0.74991593	no
RBM47	717.63587	0.44639987	0.24957882	-1.7896128	0.0736772	0.24890946	0.603958595	no
IRF4	554.408851	0.4454594	0.16924001	-2.6321164	0.00848548	0.07782996	1.108853193	yes
UBA52	1463.63676	0.442282333	0.16181673	-2.73323	0.00627165	0.06399645	1.193844106	yes
TAGLN	826.899445	0.43725946	0.24003355	-1.8216222	0.0685132	0.23913719	0.621352881	no
OAS1	588.271886	0.43430248	0.26093276	-1.664423	0.09602793	0.29099372	0.53611638	no
CALM2	1059.02396	0.43342064	0.23960208	-1.8089185	0.07048366	0.24131391	0.617417638	no
TPI1	1588.02338	0.426081152	0.20387084	-2.0997609	0.03574724	0.17031574	0.76874521	no
ITGB1	305.279367	0.423751291	0.14752525	-2.8777179	0.00400563	0.0505561	1.29627022	no
RPL37	2504.86947	0.395556436	0.19288885	-2.0507429	0.04029199	0.18068158	0.743086122	no
CD55	502.698872	0.394222544	0.19268798	-2.0459115	0.04076508	0.18117815	0.741894186	no
BGN	417.830126	0.392358554	0.1836596	-2.1363357	0.03265206	0.15927836	0.797943231	no
RGS5	420.242112	0.389907459	0.14329499	-2.7215821	0.00649702	0.06562851	1.18260988	no
IFITM3	1389.02311	0.389480337	0.13702389	-2.8424286	0.00447715	0.05445155	1.263989714	no
CHI3L1	491.699117	0.384839744	0.20615851	-1.8667177	0.06194102	0.22524007	0.647354339	no
JAK1	493.271944	0.3827341	0.09857434	-3.8826952	0.00010331	0.0102604	1.988851011	yes
CD9	699.705052	0.38187827	0.30291817	-1.2606648	0.20742965	0.44241229	0.35417282	no
RAC1	973.665869	0.379221069	0.16059035	-2.3614187	0.01820516	0.10945093	0.960780536	no
FN1	468.451629	0.372699951	0.26032985	-1.4293403	0.15290644	0.38348011	0.416257153	no
APP	557.756705	0.371812836	0.14546238	-2.5560757	0.01058601	0.08335441	1.070671422	no
CALD1	325.027607	0.371999741	0.09618662	-3.8611374	0.00011286	0.01026034	1.988851011	yes
COL4A1	433.861896	0.371130592	0.14271578	-2.6004875	0.00930914	0.07810493	1.107321556	no
GSN	846.910269	0.36884832	0.15142224	-2.4358926	0.01485509	0.09646164	1.015845362	no
TPM2	718.435768	0.36831866	0.18760176	-1.9526398	0.0508623	0.20442491	0.689466176	no
ANXA1	480.736002	0.358363736	0.13621356	-2.6308862	0.008516	0.07782996	1.108853193	no
MMP9	583.529078	0.358320792	0.17562768	-2.0402296	0.04132746	0.18205931	0.739787109	no
CDH1	700.655008	0.35291052	0.27491177	-1.2837229	0.19923891	0.43125306	0.365267809	no
DCN	729.637944	0.351358944	0.16237313	-2.1639038	0.03047173	0.15235866	0.817132857	no
IL3RG	340.556552	0.347008817	0.18478301	-1.8779152	0.06039277	0.22285154	0.651984364	no
COL6A1	772.741164	0.346284063	0.18117743	-1.911298	0.0559863	0.21336929	0.670868085	no
ITGA6	392.811351	0.341735888	0.1360391	-2.5120416	0.01200349	0.08826098	1.054231262	no
CDKN1A	865.725998	0.340946972	0.24625201	-1.3841389	0.16631594	0.39599033	0.402315415	no
MMP12	443.52695	0.334000424	0.17086181	-1.9547986	0.05080685	0.20442491	0.689466176	no
SEC23A	335.225027	0.330315389	0.17453444	-1.8925514	0.05841756	0.21961488	0.658338245	no
NDRG1	802.321168	0.328072389	0.37962346	-0.8642047	0.38747544	0.61518749	0.210992505	no
IFITM1	1729.19938	0.327367378	0.16330681	-2.0046181	0.0450039	0.19179581	0.71716088	no
CYSTM1	898.320268	0.324061881	0.21533632	-1.5049105	0.1323471	0.35577176	0.448828524	no
NACA	658.428148	0.313482211	0.11136534	-2.8146892	0.00487925	0.05475886	1.261537672	no
MYL9	541.987511	0.307211796	0.12499463	-2.4578	0.0139791	0.09412074	1.026314679	no
CD44	611.550193	0.304611744	0.13712001	-2.2214973	0.0263173	0.14149084	0.849271676	no
COL28	430.176469	0.304538932	0.18213141	-1.6720836	0.09450785	0.28813368	0.540405978	no
HLA-DPA1	803.351852	0.301884047	0.17928885	-1.6837859	0.09222304	0.2870993	0.541967866	no
FKBP5	338.101572	0.300311224	0.14641888	-2.0516417	0.04026289	0.18068158	0.743086122	no
MYH11	321.755252	0.297070869	0.20862898	-1.4282333	0.15322471	0.38348011	0.416257153	no
CD24	1924.15652	0.297518645	0.32586954	-0.9126993	0.36124293	0.59414955	0.226104224	no
STAT1	609.171582	0.285084183	0.10103181	-2.8217271	0.00477658	0.05445155	1.263989714	no
IL4R	495.252051	0.284023865	0.12685595	-2.2389478	0.02515931	0.13718084	0.862706542	no
HSPA1A/B	1475.98047	0.279815179	0.1967707	-1.4072533	0.1593523	0.39169323	0.407053933	no
PECAM1	677.255093	0.274527361	0.203721	-1.3475653	0.17779823	0.4125249	0.384549835	no
BTF3	1275.14448	0.273697196	0.11535458	-2.37268	0.01768051	0.10834869	0.965184357	no
LGALS9B	816.841502	0.270917603	0.19907	-1.3609163	0.17354014	0.40738958	0.389990083	no
CCL21	619.388899	0.269571679	0.17524803	-1.5382294	0.12399253	0.3425208	0.465313046	no
S100A8	229.873618	0.269002726	0.11143078	-2.3533191	0.01860666	0.10945093	0.960780536	no
IFITM1	1201.7823	0.267815555	0.20624684	-1.2860498	0.19842811	0.43061529	0.36591055	no
YBX3	681.715231	0.267330202	0.10776209	-2.4807443	0.01311084	0.09041957	1.043737562	no
ARHGDIB	455.340504	0.266376051	0.11904064	-2.2376901	0.02534127	0.13718084	0.862706542	no
THBS1	750.480415	0.266286319	0.22984503	-1.1585472	0.24684079	0.48127291	0.317606586	no
IFNGR1	300.264211	0.258622208	0.1060163	-2.4422868	0.01459455	0.09538918	1.020500867	no
COL5A2	310.760283	0.255406807	0.11173655	-2.2859214	0.02226471	0.12438383	0.905238569	no
GLUL	875.702692	0.252418255	0.12494182	-2.0202863	0.0433537	0.18849435	0.724701663	no
CD53	476.465558	0.252196192	0.07892645	-3.1953316	0.0013967	0.0260985	1.583384414	no
TYROBP	415.559205	0.24918502	0.13304789	-1.8728971	0.06108259	0.22313525	0.651431816	no
CCL19	482.686132	0.247316159	0.21095003	-1.1723921	0.24103866	0.4748055	0.323484262	no
COTL1	1010.2279	0.241336403	0.12619623	-1.912393	0.05582619	0.21336929	0.670868085	no
DST	288.554425	0.238010864	0.14521085	-1.6390708	0.10119852	0.29940391	0.52374253	no
TPM1	1048.16519	0.237087993	0.24239549	-0.978104	0.3280229	0.55903067	0.252596363	no
MT2A	2111.81567	0.235474701	0.26707667	-0.8854121	0.37593439	0.60462837	0.218510758	no
STAT3	433.040648	0.235466413	0.11679683	-2.0160344	0.04379638	0.18959474	0.722173727	no
SPARCL1	324.024154	0.23329443	0.09974363	-2.3389407	0.0193385	0.11178324	0.951623312	no
CD81	753.104496	0.229076975	0.13662821	-1.6402146	0.10096058	0.29940391	0.52374253	no
FOS	714.941229	0.228167772	0.39160243	-0.5826516	0.56012788	0.7607094	0.118781216	no
CD163	256.577475	0.227200757	0.13196461	-1.7216794	0.08512761	0.22197319	0.565473907	no
FCER1G	250.840357	0.225309548	0.10770788	-2.0918576	0.03645126	0.17113267	0.766867066	no
HIF1A	394.323043	0.224091743	0.1085914	-2.0636232	0.03905345	0.17852627	0.748784669	no
PLD3	633.013587	0.221265359	0.11398878	-1.9408953	0.05226006	0.2065615	0.684950812	no
AIF	537.902346	0.219685171	0.11462925	-1.9190841	0.05497369	0.21336929	0.670868085	no
SAA1/2	1005.93256	0.21809427	0.2035653	-1.0713725	0.28400197	0.51743371	0.28614528	no
COL4A5	152.441233	0.215893893	0.14194458	-1.5195642	0.12862055	0.34856519	0.457715991	no
SLA	425.526322	0.215619806	0.07864228	-2.7417796	0.00611073	0.06299724	1.20067454	yes
BST2	633.757173	0.214015631	0.09774009	-3.1593643	0.00158114	0.02773924	1.556905377	no
ITGB4	475.114311	0.212959957	0.11278197	-1.8882359	0.05899429	0.22029248	0.657003518	no
NLRP1	383.813251	0.212308527	0.16843285	-1.2604936	0.20749136	0.44241229	0.35417282	no
HEXB	412.390963	0.210290832	0.11139832	-1.8870074	0.05903839	0.22029248	0.657003518	no
IDO1	399.427101	0.21028729	0.08314473	-2.5300845	0.01140351	0.0883902	1.06353553	no
TLR7	286.580314	0.208443307	0.15316746	-1.3608916	0.17354796	0.40738958	0.389990083	no
HMGN2	4708.4477	0.207898655	0.15160476	-1.3713201	0.17027518	0.40345569	0.394161096	no
SLFI	610.59536	0.205255345	0.13333812	-1.5393598	0.12371649	0.3425208	0.465313046	no
ITGAV	463.455857	0.202284089	0.05673829	-3.5652129	0.00036356	0.01635021	1.786476558	yes
RAC2	511.492853	0.197975025	0.10765035	-1.8390659	0.06590696	0.23438335	0.630073251	no
MZT2A/B	1584.09639	0.196423779	0.12236872	-1.6051797	0.10845426	0.31253155	0.505106141	no
RSPO3	143.914325	0.196219445	0.14721722	-1.3328598	0.18257887	0.4140104	0.382988081	no
PTGES3	703.672261	0.196100567	0.10266332	-1.9101327	0.05611612	0.21336929	0.670868085	no
LTB	652.481105	0.194507659	0.15660875	-1.2419974	0.21423753	0.44913527	0.347622834	no
MMP14	486.266457	0.193091175	0.1027499	-1.8792347	0.06021246	0.22285154	0.651984364	no
LAMP2	310.73234	0.192904712	0.12028074	-1.6037872	0.10876098	0.31253155	0.505106141	no
HLA-DQA1	485.515157	0.192093234	0.15366041	-1.2501153	0.21125742	0.44635009	0.350324377	no
PARP1	477.232321	0.191973213	0.0732045	-2.6288879	0.00856646	0.07782996	1.108853193	no
OSMR	398.677184	0.189442253	0.06746228	-2.8081212	0.00498315	0.05475886	1.261537672	no
FYB1	222.560078	0.185441294	0.10362785	-1.7894929	0.07353548	0.24890946	0.603958595	no
ITGA9	312.588371	0.18502031	0.17388856	-1.064084	0.28729066	0.5161295	0.28440626	no
IL6ST	413.202927	0.184141093	0.08536282	-2.1571581	0.03099335	0.15343241	0.814082895	no
BASP1	638.493947	0.183989464	0.07858111	-2.3413371	0.01921481	0.11178324	0.951623312	no
GCG	386.633485	0.182059949	0.17971205	-1.0132651	0.31093355	0.54359012	0.26472847	no
LYN	289.706541	0.17855101	0.08175192	-2.1840589	0.02895792	0.14850215	0.828267252	no
CSF2RB	404.059081	0.178023356	0.09818938	-1.8130612	0.06982239	0.24131391	0.617417638	no
CXCL14	989.277974	0.177007207	0.24698432	-0.7166739	0.47357535	0.69337533	0.159031617	no
TNFRSF17	436.263427	0.176667127	0.08379664	-2.1092841	0.03500642	0.16830009	0.773915647	no
IL7R	343.112347	0.175144431	0.07162287	-2.44537	0.01447036	0.09519973	1.02135427	no
VEGFD	342.945831	0.173274834	0.1337499	-1.2955137	0.19514307	0.42888587	0.36765826	no
TUBB	1804.10795	0.17288846	0.12790761	-1.3509722	0.17679433	0.4125249	0.384549835	no
COL17A1	352.564298	0.17148735	0.13337039	-1.2857978	0.19851365	0.43061529	0.36591055	no
ATF3	544.420923	0.170209226	0.26057941	-0.6531952	0.51363042	0.71937034	0.143047475	no
CTLA4	256.177507	0.167832213	0.09853897	-2.4501858	0.01427826	0.09509265	1.021853045	no
CD38	582.683293	0.166058057	0.0654224	-2.5382448	0.011141	0.08570002	1.067019084	no
RPL22	1918.20582	0.165748883	0.12587587	-1.3167646	0.18791755	0.42228664	0.374392666	no

HLA-DPB1	419.549602	0.165520899	0.11764275	-1.4069775	0.15943407	0.39169323	0.407053933	no
COL4A2	466.182817	0.164521917	0.09776452	-1.6828387	0.09240631	0.2870993	0.541967886	no
LUM	410.653858	0.163576407	0.08343696	-1.5604791	0.04993982	0.20383602	0.692719078	no
MKI67	313.831385	0.161968414	0.0744653	-2.1750857	0.02962369	0.14950268	0.825351028	no
DUSP6	856.996436	0.159933581	0.1424953	-1.1183076	0.26343562	0.50169861	0.2995571	no
NFKBIA	514.299919	0.157776444	0.15144502	-1.0418067	0.29750129	0.53111884	0.274808529	no
LINC01781	360.094115	0.156356585	0.11921912	-1.311506	0.18968888	0.42422137	0.372407456	no
VCAN	260.700312	0.154021983	0.09258941	-1.6733776	0.09423298	0.28813368	0.540459578	no
SPOCK2	708.433886	0.154776906	0.10567291	-1.4646791	0.1430085	0.37287943	0.428431578	no
HMGB2	629.029578	0.153686773	0.13773728	-1.1157965	0.26450927	0.50169861	0.2995571	no
KLF2	892.492339	0.15103469	0.11231626	-1.3447268	0.17871347	0.4129255	0.394128301	no
RPL32	2758.83503	0.150634091	0.09828754	-1.5325859	0.12537792	0.34331038	0.464313062	no
VCAM1	325.375244	0.150204265	0.09808616	-1.5313502	0.12568286	0.34331038	0.464313062	no
TM4SF1	486.212869	0.148736208	0.12026444	-1.2373398	0.21596097	0.45028135	0.346516039	no
MMP1	466.18652	0.148663798	0.17553773	-0.8469051	0.39704803	0.62330931	0.20529639	no
FYN	435.909588	0.147935009	0.09662229	-1.5312255	0.12571367	0.34331038	0.464313062	no
BTK	290.691147	0.14597718	0.10985528	-1.3294234	0.18370832	0.41562868	0.381293442	no
IGHD	517.779101	0.145480164	0.14112667	-1.0308481	0.30261204	0.53465025	0.271930229	no
PTPRCAP	677.121544	0.144858753	0.12671675	-1.143154	0.25297467	0.49026099	0.309572662	no
BIRC3	438.263055	0.144728464	0.07981254	-1.813355	0.06977708	0.24131391	0.617417638	no
S100A4	505.671799	0.142821683	0.15061643	-0.9482477	0.34300337	0.57236873	0.240324103	no
GIPD	466.718773	0.141763931	0.13904564	-1.0195497	0.30794209	0.54024929	0.267405799	no
STMN1	4827.73007	0.140450199	0.15531802	-0.904275	0.3658496	0.59779346	0.223448843	no
C11orf96	667.355451	0.140331397	0.11775851	-1.1916879	0.23338364	0.46398337	0.333497583	no
SEC61G	622.779101	0.137582801	0.12468703	-1.1034251	0.26984261	0.5043787	0.297343261	no
PDGFRA	363.796765	0.136985724	0.1172498	-1.1683515	0.24266501	0.47674855	0.321710622	no
CYQC	528.945224	0.13687144	0.12514494	-1.0937033	0.27408512	0.50756504	0.294583502	no
MPO	476.714077	0.136786435	0.1345265	-1.0167918	0.3092525	0.54159807	0.266322891	no
COL12A1	302.126314	0.136104558	0.09856607	-1.380846	0.16732633	0.39744971	0.400717818	no
CD79A	551.07186	0.134117686	0.13584877	-0.9872718	0.32350941	0.55603622	0.254896916	no
IFI6	1082.92307	0.133432834	0.10849778	-1.2298208	0.2187642	0.45292623	0.343972529	no
CLEC2D	324.151535	0.133351443	0.08170259	-1.6321598	0.10264647	0.30279194	0.518855696	no
DUSP1	798.90527	0.131184682	0.21780707	-0.6020488	0.54714162	0.7540781	0.122238251	no
H2AZ1	1030.21179	0.130972279	0.1256049	-1.0427322	0.29707233	0.53111884	0.274808529	no
CLOCK	362.021771	0.130699044	0.09979965	-1.5724884	0.06113906	0.22313525	0.651431916	no
HSPG2	658.561976	0.129230374	0.07916093	-1.8968086	0.03973323	0.28217995	0.54947384	no
BTG1	693.825655	0.128366544	0.17397828	-0.7379458	0.46054737	0.68379431	0.165074519	no
PTPRC	253.843387	0.12701092	0.08757163	-1.4503601	0.14695814	0.37104851	0.423602772	no
CD4	379.140783	0.126478567	0.07771008	-1.6275696	0.10361617	0.30385974	0.571326841	no
RPL34	3058.62867	0.126244702	0.1074181	-1.1752648	0.23988881	0.47408855	0.324140532	no
KRT80	278.638424	0.124858076	0.08859154	-1.4063454	0.15873305	0.39169323	0.407053933	no
PDSS4	314.300367	0.124189338	0.10304852	-1.205154	0.22814388	0.45892872	0.338254761	no
TSC22D1	535.845402	0.123441119	0.15568284	-0.7791927	0.42768056	0.64889415	0.187765909	no
CXCR4	466.76053	0.121813959	0.09181902	-1.3266746	0.19461634	0.41674116	0.380133599	no
ADGRE2	313.428873	0.12134126	0.08471632	-1.4323245	0.15205097	0.38348011	0.416257153	no
COL21A1	213.722185	0.120428332	0.09800592	-1.2250161	0.22058917	0.45384603	0.343091459	no
FOXP3	222.572235	0.119527416	0.13116939	-0.9112447	0.36216645	0.5946904	0.225709074	no
CD93	447.722505	0.119520679	0.08170944	-1.4627524	0.14353515	0.37287943	0.428431578	no
HDAC1	667.511916	0.119390663	0.11515882	-1.0359959	0.30020405	0.5313346	0.274631904	no
ITGAM	368.187563	0.118301918	0.07375965	-1.603884	0.10873962	0.31253155	0.505106141	no
MSR1	233.480803	0.116256768	0.09705944	-1.1977894	0.230999	0.46015737	0.337093617	no
IER3	878.338888	0.115767183	0.19327603	-0.5989733	0.54919069	0.75542049	0.121811242	no
COL5A3	352.544135	0.115625828	0.09985571	-1.157929	0.246893	0.48127291	0.317608586	no
COL11A1	305.847759	0.115081331	0.0803398	-1.4324833	0.15200554	0.38348011	0.416257153	no
KIT	366.550545	0.114501362	0.07096088	-1.6135844	0.1096176	0.31083849	0.507465215	no
MMP7	400.160746	0.114447305	0.07375604	-1.5517007	0.12073386	0.33914006	0.469620912	no
ICAM1	399.869934	0.113415834	0.07754045	-1.4628668	0.14355858	0.37287943	0.428431578	no
MRC1	153.561104	0.112452376	0.10313333	-1.0903592	0.27555494	0.50840394	0.293791093	no
MARCKSL1	1092.40002	0.111609746	0.15235853	-0.7325467	0.46383492	0.6854487	0.164025041	no
OLR1	289.726035	0.110294873	0.09095081	-1.2126871	0.22524946	0.45782411	0.339301343	no
TNFRSF9	407.102382	0.110283861	0.08218376	-1.341918	0.17962259	0.4129255	0.384128301	no
BECN1	395.327171	0.109350993	0.07038288	-1.5536589	0.12036581	0.33677992	0.470081889	no
HMGCS1	471.162778	0.10931437	0.13074758	-0.8360719	0.40311448	0.6276349	0.202299217	no
TLR8	301.662931	0.109170571	0.14774259	-0.7389242	0.45995303	0.68379431	0.165074519	no
TTN	361.211522	0.109048124	0.07300538	-1.4936999	0.13525409	0.35876415	0.446190959	no
PPIA	11055.1771	0.107316793	0.07358174	-1.4584704	0.14471093	0.37489879	0.426089958	no
IFNG	287.138969	0.105925862	0.06959188	-1.5220981	0.12798451	0.34778399	0.458890411	no
CCDC80	221.244467	0.105643821	0.10504457	-1.0057047	0.31455763	0.5454708	0.263228824	no
FAM30A	313.651962	0.104933008	0.10092044	-1.0397597	0.29845156	0.53111884	0.274808529	no
P2RX5	470.146445	0.104701538	0.11568446	-0.9056614	0.36543285	0.59779346	0.223448843	no
CENPF	174.65815	0.104694218	0.0859981	-1.217403	0.22345094	0.45602233	0.341013893	no
RPL21	6319.71743	0.104538862	0.0792715	-1.3112983	0.189757	0.42422137	0.372407456	no
CXCL1/2/3	1003.13715	0.103616507	0.15183232	-0.6758546	0.44913302	0.71580055	0.146252244	no
SPP1	424.562752	0.102273874	0.0906079	-1.0645998	0.28705706	0.51951295	0.284403626	no
TGFBR2	535.791973	0.101708564	0.07022822	-1.4482577	0.14754498	0.37735289	0.423252316	no
MX1	388.48803	0.101465655	0.07238224	-1.401806	0.16097319	0.39169323	0.407053933	no
ST6GAL1	394.387843	0.100390971	0.08318278	-1.206872	0.22748143	0.45892872	0.338254761	no
TAP2	495.380047	0.099495175	0.07941194	-1.2528994	0.21024231	0.44542862	0.351221677	no
TWIST1	483.179828	0.099486811	0.09994589	-1.0054668	0.31467211	0.54547038	0.263228824	no
EGF	241.931899	0.098958009	0.12438321	-0.7955897	0.42627053	0.64889415	0.187765909	no
CD52	388.811356	0.09878449	0.11340386	-0.870395	0.38409458	0.61200436	0.213454587	no
FASN	626.29256	0.09843615	0.11657517	-0.8444007	0.39844556	0.62452282	0.204451688	no
CIITA	383.464038	0.099008715	0.07774849	-1.2464386	0.21260342	0.44758614	0.349123371	no
ENTPD1	393.967297	0.096808409	0.0870873	-1.4432057	0.14896254	0.37903955	0.421315467	no
CASP8	291.164704	0.096540752	0.06816043	-1.4163753	0.15666566	0.38971558	0.409252231	no
IGFBP3	401.021963	0.096317244	0.08399609	-1.1466872	0.25151093	0.48837074	0.311250363	no
MAP1LC3B2	848.91509	0.095935808	0.09929481	-0.9668145	0.33373877	0.5613451	0.250623552	no
HCK	301.525337	0.095586657	0.10795984	-0.8853908	0.37594587	0.60462937	0.218510758	no
STAT6	377.065815	0.095425044	0.10307622	-0.9257717	0.35459463	0.58657725	0.232059959	no
EOMES	231.497584	0.095375217	0.08630852	-1.1050498	0.26913799	0.50400373	0.297566248	no
VHL	1122.40272	0.09284902	0.10461213	-0.887555	0.37478015	0.60462937	0.218510758	no
SERPINA3	367.307243	0.092253527	0.08288242	-1.1139651	0.26568847	0.5616981	0.2995571	no
C1QA	533.74625	0.091185788	0.1048197	-0.8699299	0.38433874	0.61200436	0.213454587	no
IL6	416.739088	0.090534907	0.07326033	-1.2357975	0.21653384	0.45028135	0.346516039	no
KLRB1	212.339083	0.090348305	0.080238	-1.1290939	0.26016397	0.49885541	0.301990493	no
CCL18	402.185354	0.090253485	0.14816265	-0.6091514	0.5424241	0.75127991	0.124198222	no
CD5L	312.626615	0.090178596	0.07167268	-1.2546991	0.209588	0.44498515	0.351654486	no
CCL17	343.628715	0.088965574	0.11899791	-0.747623	0.4546876	0.68169056	0.166412719	no
RARRES2	884.422839	0.088761256	0.12037009	-0.7374029	0.46087736	0.68379431	0.165074519	no
IL13RA1	332.394044	0.087856595	0.12904333	-0.697019	0.48579092	0.70364429	0.152449369	no
CD68	507.74233	0.087461241	0.11831619	-0.7392161	0.45977576	0.68379431	0.165074519	no
SMAD3	264.21703	0.087396037	0.08252877	-1.0589766	0.28961044	0.52182061	0.282478772	no
DDX58	480.063983	0.086911975	0.09071062	-1.4315778	0.1522847	0.38348011	0.416257153	no
ADGRL2	347.203971	0.085019107	0.09947089	-0.8547134	0.39270982	0.61844067	0.203701959	no
SELL	265.357266	0.085018759	0.07951787	-1.109443	0.26723877	0.5616981	0.2995571	no
TLR2	388.617229	0.084826342	0.0654054	-1.2969318	0.19465466	0.42975477	0.367791037	no
NOTCH2	192.475085	0.084281645	0.09674795	-1.2626852	0.20670233	0.44241229	0.35417282	no
FGF13	274.523902	0.08423107	0.11995928	-0.7021639	0.48257698	0.70142002	0.154021941	no
ANGPT2	290.336613	0.083925667	0.0675525	-1.2423769	0.21409754	0.44913527	0.347622834	no
CCL18/AT	642.305332	0.083340191	0.08718216	-0.9559317	0.33910673	0.56897103	0.244909846	no
IGF1	550.890811	0.082471884	0.06879946	-1.1987286	0.2306335	0.46015737	0.337093617	no
RYR2	259.475978	0.081658507	0.11722067	-0.696855	0.48589354	0.70366429	0.152449369	no
AHR	344.102725	0.081388953	0.09466948	-1.2537319	0.20812717	0.44262376	0.35379908	no
ITGAL	267.535923	0.081296782	0.0601361	-1.3518799	0.17641372	0.4125249	0.384549835	no
BAG3	533.199732	0.079156865	0.05674887	-1.3948589	0.16305839	0.39201906	0.406692815	no
SERPINH1	602.044632	0.078021047	0.08350494	-0.9463039	0.34399361	0.57236873	0.240324103	no
COL5A1	479.78461	0.078664079	0.07288512	-1.0762886	0.28045911	0.51272232	0.290117779	no
SERPINB5	341.23897	0.078207235	0.1213825	-0.644304	0.5193783	0.72538869	0.139429218	no
MS4A4A	224.273442	0.07704403	0.08467933	-0.9098328	0.36291068	0.59403555	0.225530083	no
CD59	562.645662	0.076975425	0.1318393	-0.583858	0.55931588	0.7607094	0.118781216	no
FGF19	370.018931	0.076755669	0.08716116	-0.8806178	0.3785247	0.60758378	0.216393628	no
MGP	385.537019	0.076525765	0.08900927	-0.8597505	0.38992861	0.61547306	0.21079095	no
IL12B	417.754635	0.076353031	0.09930515	-1.1016934	0.27059498	0.50452292	0.297119101	no
PTGS2	272.841309	0.07592855	0.07634775	-0.9945093	0.31997498	0.55368993	0.259811822	no
LAIR1	484.535292	0.074977374	0.09410223	-0.7967651	0.42558748	0.64888415	0.187765909	no
MTOR	481.43162	0.073774788	0.05773728	-1.2777669	0.20133165	0.43484157	0.361668949	no
IL10RB	551.760171	0.073227568	0.09873542	-0.7315303	0.46445528	0.6854487	0.164025041	no
EFNB1	493.251533	0.071279606	0.12956105	-0.5501623	0.58220805	0.7825377	0.106494729	no
CLU	467.675366	0.070883923	0.1762024	-0.4022869	0.68747288	0.84873195	0.07122945	no
MYH6	231.691606	0.070534871	0.08853191	-0.8151313	0.41499715	0.64141754	0.192859171	no
EPHA7	209.746292	0.069701234	0.07136288	-0.9767155	0.32871004	0.55903067	0.252596363	no
TAP1	509.8395	0.069372941	0.09853614	-0.7056013	0.48049832	0.70142002	0.154021941	no
WNT3A	330.595959	0.069190714	0.10496516	-0.6592636	0.5097265	0.71792465	0.143621137	no
GZMK	397.674623	0.069040989	0.0801127	-0.8617883	0.38878849	0.61518749	0.210992505	no
LGALS1	719.0833	0.068809465	0.1535006	-0.4494671	0.65309476	0.82834109	0.082849652	no
IL17RA	496.753258	0.068674338	0.0700959	-0.9797197	0.3272245	0.55903067	0.252596363	no
CD22	206.285795	0.068573301	0.12838167	-0.5341362	0.59324729	0.78755247	0.1037205	no
SELPLG	526.629867	0.06757229	0.08193765	-1.0909728	0.27529465	0.50840394	0.293791093	no
AIF1	319.551564	0.066441211	0.10145316	-0.6548955	0.51253507	0.71884301	0.143365945	no
ACTG2	563.160598	0.066352148	0.15740618	-0.4213098	0.67352891	0.83772253	0.076898907	no
NR4N1	347.048302	0.066184687	0.1003612	-0.659465	0.50959722	0.71792465	0.143621137	no
FGR	297.93001	0.066169896	0.08773134	-0.754231	0.45071655	0.67674257	0.169576504	no
IFNG/R2	543.059093	0.065874847	0.09291969	-0.7090126	0.47831666	0.68920336	0.155340597	no
DDR2	401.220341	0.065156504	0.08912442	-0.7310736	0.46473422	0.6854487	0.164025041	no
ALCAM	500.299619	0.064255852	0.09614218	-0.9714807	0.33130896	0.56027198	0.251601094	no
APOE	948.988701	0.064226518	0.21679111	-0.2963028	0.78699883	0.89602867	0.047679063	no
SQLE	292.143606	0.064117009	0.1202001	-0.5334189	0.59374362	0.78755247	0.1037205	no
CAV1	799.023001	0.063316453	0.07437984	-0.8512685	0.3948202	0.62047201	0.207277805	no
CPA3	251.453164	0.061363784	0.07498895	-0.8181952	0.41324574	0.63969928	0.194024137	no
SMARCB1	593.383948	0.060239027	0.09581917	-0.8627864	0.38825494	0.61518749	0.210992505	no
IL23A	369.182504	0.060096229	0.07553503	-0.7956074	0.42626824	0.64889415	0.187765909	no
CD209	507.513194	0.059961344	0.06774198	-0.8851431	0.37607947	0.60462937	0.218510758	no
OAS3	381.778619	0.05912169	0.05381495	-1.0986108	0.27193785	0.50452292	0.297119101	no
CRYAB	519.080677	0.05881283	0.07401806	-0.794574	0.42688132	0.64889415	0.187765909	no
CDH11	213.412735	0.058084011	0.07811046	-0.7436137	0.45711021	0.68225404	0.166053884	no
GAS6	459.862459	0.056711669	0.12222416	-0.4639972	0.64264974	0.82075318	0.085787427	no
CD164	408.393854	0.055606412	0.11805339	-0.4710446	0.63765889	0.81712671	0.087710594	no
CXCL5	655.509543	0.055548044	0.11741236	-0.4731022	0.63614029	0.81681141	0.087984557	no
EPHA3	345.575947	0.053692328	0.09984114	-0.545343	0.58551761	0.78382545	0.105769838	no
VEGFC	263.045931	0.051691092	0.13021084	-0.39698	0.69138225	0.84936394	0.070906182	no
PDCD1LG2	330.822221	0.051661269	0.0639339	-0.8080419	0.41906649	0.64670755	0.189292072	no
CCL2	387.07232	0.051280653	0.08985	-0.5701286	0.58859051	0.76940529	0.113844631	no
HLA-DQB1/2	813.207305	0.051120527	0.10897411	-0.4691071	0.63899309	0.81712671	0.087710594	no
HGF	287.728884	0.050776205	0.07435528	-0.8828863	0.4946787	0.70972554	0.148909568	no
DDIT3	387.775115	0.04991668	0.08791959	-0.5677538	0.57202214	0.77054343	0.113202876	no
LAMA4	296.116521	0.049029943	0.0904808	-0.5418823	0.58789959	0.78491266	0.105178663	no
NCAM1	345.798152	0.049000804	0.09937994	-0.5236204	0.60123843	0.79264936	0.100918889	no
ESR1	327.99971	0.047916184	0.08085659	-0.5925448	0.55348588	0.75871078	0.11923745	no
CXCL12	606.772162	0.047039744	0.12160847	-0.386813	0.69889462	0.85449431	0.068290824	no
CCR2	389.618391	0.046031189	0.07028539	-0.8549183	0.51252304	0.71884301	0.143365945	no
WNT7B	550.167421	0.0452988	0.08824214	-0.5133466	0.6077089	0.79613944	0.099010863	no
ACACB	382.442742	0.044476039	0.07643416	-0.581887	0.56084283	0.7607094	0.118781216	no
TNFRSF13B	331.733751	0.043601766	0.05420987	-0.802081	0.42198571	0.64880572	0.187885329	no
ITGB2	614.586899	0.043506161	0.08162082	-0.5330278	0.59401437	0.78755247	0.1037205	no
CD40LG	308.721346	0.042238894	0.13346305	-0.3164838	0.73165349	0.88456367	0.053270904	no
CLEC4D	298.706135	0.041959084	0.07128721	-0.588592	0.556135	0.75871078	0.11923745	no
CDH19	316.688528	0.041873658	0.07868343	-0.5321789	0.59460212	0.78755247	0.1037205	no
COL15A1	476.322789	0.041723746	0.09509624	-0.4387528	0.66084064	0.832203	0.07072376	no
UBE2C	480.696822	0.040557517	0.11165346	-0.3632446	0.71642218	0.8673392	0.061811023	no
ACVRL1	573.998135	0.040233997	0.08966452	-0.448717	0.6536358	0.82634109	0.082840652	no
PTGDS	657.010136	0.039483301	0.15019692	-0.2626769	0.79264546	0.90795585	0.041935269	no
SLC2A1	520.087768	0.039383619	0.09104277	-0.4325837	0.66531724	0.83283275	0.070442207	no
LDLR	621.404414	0.038894051	0.11367575	-0.3426911	0.72309491	0.87263985	0.059070214	no
IL10RA	248.206221	0.038677798	0.08877873	-0.4456368	0.65585961	0.82810557	0.081914294	no
TOP2A	329.261557	0.037483712	0.10107666	-0.3708444	0.71075344	0.86256485	0.064208244	no
CCL4/L1/L2	636.870631	0.037049939	0.10453366	-0.3544307	0.72301611	0.86888985	0.061035277	no
BID	496.117189	0.03686675	0.05998675	-0.6469354	0.51767374	0.72401922	0.140249907	no
SRC	573.121941	0.039641787	0.06323502	-0.5794541	0.56228283	0.76190085	0.11810154	no
CD58	392.045057	0.039627324	0.08349072	-0.4410288	0.6991211	0.8312637	0.080261194	no
CCR5	475.827888	0.035585349	0.08622484	-0.4127042	0.67982338	0.84240816	0.074477436	no
COX4I2	348.921413	0.034894513	0.08025257	-0.434684	0.66379178	0.83283275	0.070442207	no
TLR5	370.791632	0.034502638	0.07600744	-0.4539376	0.64887373	0.82412285	0.083697238	no
IFIT3	288.868049	0.034197227	0.05697157	-0.6002507	0.54833917	0.75528811	0.121887352	no
IL1RAP	382.36413	0.033878986	0.07452022	-0.4546261	0.64937682	0.82412285	0.083697238	no
RAMP3	407.022832	0.033502117	0.08721711	-0.3841232	0.70088711	0.85578401	0.06763583	no
JAK2	223.609915	0.033500003	0.09059798	-0.5528238	0.58038409	0.78113606	0.107273313	no
CSF1R	521.625083	0.03347586	0.08911604	-0.4843429	0.62814257	0.80462207	0.091803496	no
ACP5	829.869594	0.0326319	0.09266379	-0.3521537	0.72472298	0.86888985	0.061035277	no
RELT	485.013584	0.032124791	0.0547247	-0.5870255	0.55718661	0.75910983	0.119695387	no
BMP3	413.388788	0.031826061	0.09247359	-0.3441638	0.73072312	0.87198463	0.05949117	no
TNFSF13B	435.710197	0.031774831	0.0698017	-0.4552157	0.64895405	0.82471285	0.083697238	no
NUPR1	864.005331	0.031574435	0.16968558	-0.1860783	0.85238333	0.93874816	0.027459303	no
NOD2	554.621651	0.031234842	0.09396863	-0.4680549	0.62551096	0.80842824	0.092358526	no
NRG1	273.714475	0.031121811	0.11229974	-0.2771316	0.78167903	0.90027887	0.045623908	no
RARA	438.551579	0.030922328	0.07477437	-0.4135418	0.6792097	0.84240816	0.074477436	no
HSPB1	1529.3305	0.030159263	0.18139526	-0.1662627	0.86795023	0.94342417	0.025293003	no
INHBA	324.017493	0.029725363	0.07616946	-0.390253	0.69634944	0.85336941	0.068862928	no

TP53	432.029446	0.02889516	0.08900682	-0.3246398	0.74545368	0.88122301	0.054914172	no
SOX4	806.946732	0.028469437	0.08222982	-0.3462179	0.72917894	0.87118153	0.059891341	no
TCL1A	358.914476	0.028266532	0.08488164	-0.3339896	0.73906663	0.87775134	0.059826501	no
ADGRE5	556.020501	0.027964769	0.07816297	-0.3577752	0.73051158	0.86808624	0.061437127	no
SMO	547.85591	0.027644341	0.05618408	-0.4920316	0.62269702	0.80764853	0.092777592	no
AKT1	517.586218	0.026522377	0.06790689	-0.3905697	0.69611531	0.85336941	0.068862028	no
CLEC1A	340.314881	0.026178625	0.08387061	-0.3121311	0.75494091	0.88608088	0.052526635	no
MAP	558.961454	0.025977568	0.09152868	-0.2838189	0.77654919	0.89878378	0.046344773	no
HCST	512.461605	0.025485903	0.09861083	-0.2584493	0.78606016	0.91082398	0.040565545	no
CD40	434.086261	0.0246937	0.05750883	-0.4293897	0.66763966	0.8334553	0.079117685	no
CLEC4E	234.964902	0.024350822	0.10786649	-0.2257496	0.82139615	0.9260385	0.033370956	no
OAS2	485.881273	0.024302424	0.09819016	-0.3565488	0.72142958	0.86814631	0.061407077	no
CLEC2B	182.813331	0.023785752	0.09494129	-0.2505312	0.80217661	0.91468257	0.038729598	no
TGFBI	408.425722	0.023592749	0.07378648	-0.3197002	0.74919562	0.88452848	0.053288179	no
YES1	454.102924	0.023520351	0.06507908	-0.3614119	0.71779158	0.86741077	0.06817519	no
IL22RA1	222.913227	0.023272777	0.08423921	-0.2762701	0.7823406	0.90027887	0.045623908	no
RAG1	254.703647	0.022535625	0.08826006	-0.2533321	0.78484863	0.9125333	0.03975128	no
CFLAR	431.486383	0.022314075	0.10089093	-0.2211703	0.82499584	0.92692117	0.032957198	no
TNFAIP6	387.760832	0.022039609	0.07320372	-0.3010722	0.76335941	0.85281802	0.049237052	no
ADGRG5	422.019051	0.021682997	0.05440756	-0.3985291	0.6902402	0.84936394	0.070906182	no
CD80	389.357111	0.021499338	0.07435164	-0.2891575	0.77246082	0.89743492	0.046997034	no
GZMA	317.203638	0.020783291	0.07190032	-0.2888561	0.77269147	0.89743492	0.046997034	no
COL27A1	327.25592	0.018899173	0.07503572	-0.251869	0.80114231	0.91454602	0.038794437	no
B3GNT7	674.458565	0.015676568	0.21543327	-0.0727676	0.94199103	0.97922938	0.009115563	no
TYK2	672.298644	0.0150423	0.07771319	-0.1935617	0.84651907	0.93874816	0.027450903	no
S100B	323.902646	0.014912155	0.0799968	-0.1864094	0.85212372	0.93874816	0.027450903	no
EPHA4	261.144856	0.014797304	0.08525237	-0.1735894	0.86220397	0.9243942	0.025746557	no
FCRLA	468.59673	0.013085618	0.06926263	-0.1889275	0.85014961	0.93874816	0.027450903	no
PGR	265.792547	0.012994547	0.08902766	-0.1459608	0.88395235	0.95459217	0.020182131	no
IGF2R	404.099448	0.012775907	0.08030324	-0.211861	0.83221544	0.93297696	0.030129083	no
ITGA5	402.26087	0.012764237	0.09540015	-0.1337968	0.89356324	0.96082069	0.017357654	no
STEGALANG1	287.868329	0.01265156	0.08266726	-0.153042	0.87836518	0.95061167	0.02199686	no
TNFRSF10A	214.900271	0.012615108	0.0734341	-0.1717881	0.86369409	0.94279522	0.025580785	no
FGF7	394.935719	0.012322731	0.06528051	-0.1887659	0.85027633	0.93874816	0.027450903	no
CXCL9	470.53655	0.011727926	0.05526034	-0.212225	0.8319315	0.93297696	0.030129083	no
RORT	443.471933	0.011682729	0.08181316	-0.1690008	0.85009216	0.93874816	0.027450903	no
MIR443-2HG	559.911391	0.011649582	0.08245475	-0.1412846	0.88764515	0.95568885	0.019983483	no
FAIT	365.30127	0.011204711	0.06404395	-0.1746535	0.8611162	0.9243942	0.025746557	no
TBX21	394.560534	0.01031819	0.0784657	-0.1314994	0.89538028	0.96174037	0.016942156	no
CCL15	646.655941	0.009522027	0.13328074	-0.0714434	0.94304488	0.97922938	0.009115563	no
CD33	317.756987	0.008767777	0.08007005	-0.1097291	0.91262658	0.97191329	0.012372479	no
RGCC	605.027627	0.008695573	0.04993228	-0.1734083	0.86233207	0.94243942	0.025746557	no
ITK	348.912545	0.008625601	0.07814757	-0.1103758	0.91211134	0.97191329	0.012372479	no
CLEC5A	265.555115	0.007988038	0.0778923	-0.1028163	0.91810674	0.97841117	0.011601071	no
NANOG	442.502313	0.007619079	0.07910192	-0.0963198	0.9232866	0.97503766	0.010978611	no
MET	422.779156	0.00744422	0.08390665	-0.0883627	0.92958838	0.97503766	0.010978611	no
IL2RB	346.859476	0.007332771	0.07211304	-0.1015457	0.91911726	0.97364117	0.011601071	no
RGS2	648.064888	0.007220574	0.10680206	-0.0676071	0.94609843	0.97922938	0.009115563	no
TTR	418.587949	0.006992662	0.07639061	-0.0876109	0.93018592	0.97503766	0.010978611	no
DNMT1	493.472197	0.006540238	0.07945534	-0.0823134	0.93439751	0.97712901	0.010048091	no
GSK3B	387.200593	0.006455658	0.07521221	-0.0858326	0.93159951	0.97549687	0.010774119	no
C1QB	604.17883	0.006207116	0.10328033	-0.0601115	0.95206882	0.98151219	0.008104303	no
FLT1	464.905874	0.00617001	0.06563028	-0.0940116	0.92509992	0.97503766	0.010978611	no
CRP	425.589963	0.005868207	0.08963751	-0.0665818	0.94691481	0.97922938	0.009115563	no
IFNAR1	388.290868	0.005909894	0.0577756	-0.102287	0.91852885	0.97364117	0.011601071	no
IL7	233.497978	0.005601321	0.08866254	-0.0631757	0.94962657	0.98000678	0.008770921	no
LY6D	403.173177	0.005241659	0.06587611	-0.0795684	0.9368805	0.97712901	0.010048091	no
GOS2	584.729492	0.004998106	0.09366205	-0.0533418	0.95745954	0.98402831	0.006992407	no
DDR1	660.736462	0.004670623	0.11126184	-0.0419787	0.96651571	0.98977712	0.00444259	no
TEK	236.787637	0.004159925	0.09311145	-0.0446768	0.96436849	0.98569221	0.00476322	no
XKR4	284.025312	0.004044046	0.09970781	-0.040559	0.9676475	0.98977712	0.00444259	no
AZGP1	521.047356	0.003754226	0.09982235	-0.0376091	0.96699937	0.98977712	0.00444259	no
TNFRSF21	377.767371	0.003159844	0.1128592	-0.0283525	0.97738098	0.99304433	0.003031362	no
NOTCH3	447.050094	0.00276576	0.07868729	-0.0351487	0.97196113	0.98977712	0.00444259	no
BMPR2	256.031823	0.002634658	0.06598319	-0.0399323	0.96814713	0.98977712	0.00444259	no
CD1C	464.069637	0.000811178	0.08404225	-0.009652	0.99229892	0.99986891	5.69353E-05	no
CSK	771.195547	0.000453968	0.0804339	-0.005644	0.99549677	0.99986891	5.69353E-05	no
FGF2	310.620015	0.000337257	0.07078097	-0.0047641	0.9991988	0.99986891	5.69353E-05	no
DUSP5	583.062943	0.000181754	0.11414892	-0.0015923	0.99872957	0.99986891	5.69353E-05	no
FZD6	261.319865	1.23E-05	0.0740424	-0.0001643	0.99989891	0.99986891	5.69353E-05	no
TNNT2	371.302094	2.09E-05	0.10036306	0.00020479	0.9998366	0.99986891	5.69353E-05	no
TNFRSF1B	582.596125	-5.17E-05	0.06748362	0.00121054	0.99903413	0.99986891	5.69353E-05	no
TNFRSF14	756.631404	-0.000169011	0.12058033	0.00140165	0.99888165	0.99986891	5.69353E-05	no
LIFR	240.8318	-0.000595669	0.0942177	0.00632226	0.9949556	0.99986891	5.69353E-05	no
CD2	437.805471	-0.000640976	0.07556696	0.00848223	0.99223224	0.99986891	5.69353E-05	no
CLEC14A	392.540176	-0.000926591	0.0821445	0.01128007	0.99099999	0.99986891	5.69353E-05	no
IL2	289.490414	-0.001521163	0.07571263	0.02009127	0.98397056	0.99592162	0.00177484	no
GLUD1	732.559194	-0.001549148	0.09099606	0.01702434	0.9884172	0.99738847	0.001135957	no
IFNAR2	377.308469	-0.002083748	0.07607695	0.02739001	0.97814867	0.99304433	0.003031362	no
NLRC5	587.303632	-0.002209424	0.06116052	0.038125	0.97118269	0.98977712	0.00444259	no
LDB2	307.546059	-0.002722422	0.08998533	0.03126748	0.9793023	0.99189451	0.003034516	no
OASL	577.31661	-0.003324658	0.15125868	0.02197995	0.98246395	0.99592162	0.00177484	no
MAPK13	608.308894	-0.003434705	0.09140155	0.03757819	0.970024	0.98977712	0.00444259	no
BMP5	299.073696	-0.003751506	0.0728045	0.0515285	0.95890439	0.98450143	0.006783648	no
RB1	359.270517	-0.00387593	0.05817234	0.0666284	0.94687754	0.97922938	0.009115563	no
IL17A	313.884914	-0.004168924	0.07340622	0.05679251	0.95471048	0.98221242	0.00779456	no
IL33	324.978389	-0.00422037	0.08465495	0.06527838	0.94795236	0.97928962	0.009088847	no
IL12RB2	281.700576	-0.004540921	0.07985229	0.05686651	0.95466153	0.98221242	0.00779456	no
ZFP36	988.611548	-0.004643261	0.22352905	0.02077252	0.98342712	0.99592162	0.00177484	no
FGF12	324.495019	-0.005043608	0.07251357	0.06955399	0.94454886	0.97922938	0.009115563	no
IL36G	386.935583	-0.005846758	0.08171066	0.07155441	0.94295652	0.97922938	0.009115563	no
CD300A	401.663487	-0.006123703	0.08555375	0.09341409	0.92557388	0.97503766	0.010978611	no
NCR1	336.849764	-0.006256336	0.09235566	0.08774177	0.9459912	0.97922938	0.009115563	no
RBPJ	692.617517	-0.006896761	0.07743022	0.08907066	0.92902575	0.97503766	0.010978611	no
ACVR2A	450.612967	-0.007430606	0.07609195	0.09765993	0.92220472	0.97503766	0.010978611	no
IL9RA	503.219407	-0.007470542	0.0825799	0.09046442	0.92791817	0.97503766	0.010978611	no
COL9A2	519.808042	-0.007664907	0.0654483	0.11711394	0.90978977	0.96980724	0.013145379	no
CTSG	336.076338	-0.007843501	0.08747278	0.08966791	0.92855112	0.97503766	0.010978611	no
SCGB3A1	398.586933	-0.00796008	0.07206807	0.11045225	0.91205572	0.97191329	0.012372479	no
ADGRL4	212.763108	-0.00819785	0.10087871	0.08126441	0.93523167	0.97712901	0.010048091	no
ETS1	495.125916	-0.008383072	0.10617246	0.07895713	0.93706672	0.97712901	0.010048091	no
ADGRG1	482.988706	-0.008633847	0.0610919	0.14140741	0.8875481	0.95588885	0.019983483	no
BMP7	357.800128	-0.009388143	0.08803612	0.10663968	0.91507484	0.97348387	0.01167124	no
ITGA8	301.277088	-0.009810185	0.06251346	0.15692916	0.87530088	0.94934998	0.022573656	no
TGFB2	369.383091	-0.009872536	0.09615042	0.10267804	0.9182185	0.97364117	0.011601071	no
CALB1	405.512266	-0.009893555	0.05363562	0.18445868	0.85365364	0.93911292	0.027282185	no
ADGRL1	442.467949	-0.010059117	0.08073358	0.12459645	0.90084304	0.96656979	0.014766784	no
IL15	347.679781	-0.010288317	0.08983701	0.14728033	0.88290287	0.95446958	0.020228806	no
ATG10	499.468381	-0.011538669	0.05539428	0.20830072	0.83499417	0.93399795	0.029654076	no
ATM	346.820462	-0.011646045	0.05986475	0.19453926	0.84575386	0.93874816	0.027450903	no
VWA1	558.753379	-0.011815563	0.05184194	0.22787656	0.81974221	0.92521694	0.033756425	no
CXCL13	586.178145	-0.011930157	0.13566135	0.08794073	0.92992379	0.97503766	0.010978611	no
EZH2	339.076418	-0.011977922	0.07131846	0.16794981	0.88662276	0.94309027	0.025485419	no
HDAC11	463.844399	-0.012002194	0.06804668	0.17838177	0.85999403	0.9243942	0.025746557	no
CCL5	590.311238	-0.012597536	0.08047441	0.20831187	0.83498547	0.93399795	0.029654076	no
TOX	383.440354	-0.012664992	0.08156458	0.15527564	0.87690402	0.9467335	0.022398242	no
ACVR1	573.798138	-0.012981863	0.09640808	0.19548622	0.84501233	0.93874816	0.027450903	no
BMP2	438.926447	-0.013324541	0.11100747	0.12003284	0.90445714	0.96836953	0.013958886	no
IFI44L	365.129656	-0.01422227	0.08044654	0.23527509	0.81399523	0.92259007	0.034991224	no
GPNMB	445.088577	-0.014374649	0.07512406	0.19134547	0.84825494	0.93874816	0.027450903	no
IAPP	277.831996	-0.014493441	0.07711063	0.18795646	0.85091078	0.93874816	0.027450903	no
ITGA1	273.852339	-0.014726745	0.08702098	0.16923212	0.86561407	0.94293471	0.025518375	no
TNFSF14	472.852219	-0.014794966	0.08685963	0.1703319	0.86474913	0.94293471	0.025518375	no
TWIST2	451.429826	-0.014871376	0.06519076	0.2281209	0.81955225	0.92521694	0.033756425	no
FZD3	357.372601	-0.015887297	0.06396035	0.24839292	0.80383041	0.91552438	0.038330085	no
LYVE1	334.88977	-0.015977958	0.07156317	0.22327069	0.82332484	0.92692117	0.032957198	no
CYP2U1	386.335176	-0.016160995	0.05173514	0.31295936	0.75431154	0.88608088	0.052526635	no
HBB	432.961653	-0.016339199	0.08765302	0.1864077	0.85212505	0.93874816	0.027450903	no
FGG	228.748665	-0.016790957	0.08356408	0.2009351	0.84074932	0.9383363	0.027641482	no
CDH5	450.850647	-0.017052761	0.08140668	0.27745809	0.78142839	0.90027887	0.045623908	no
LGALS9	1238.56236	-0.017230013	0.15434026	0.11163654	0.9111116	0.97191329	0.012372479	no
SMAD4	360.23742	-0.017503894	0.05988941	0.29236661	0.77008255	0.89743492	0.046997034	no
LGR5	291.195532	-0.01893821	0.08540598	0.22174368	0.82451342	0.92692117	0.032957198	no
PROX1	317.013487	-0.019016021	0.07698066	0.24703336	0.80489014	0.91568844	0.038252267	no
LAMP3	297.731033	-0.019035841	0.0573765	0.32890452	0.74222786	0.88346009	0.055290325	no
BMPR1A	602.580203	-0.019409449	0.08217658	0.23619199	0.81328369	0.92259007	0.034991224	no
CLEC7A	353.808213	-0.019429505	0.05588703	0.3476568	0.72809794	0.87093055	0.060016475	no
HTT	318.98369	-0.019517157	0.06948902	0.28083614	0.77881537	0.90015291	0.045683712	no
VEGFA	602.774632	-0.019782942	0.12037154	0.164349	0.88945641	0.94403519	0.025011816	no
CD19	586.203862	-0.020038572	0.08254694	0.24272944	0.808215	0.9184214	0.036953788	no
CD48	468.705353	-0.02029422	0.07848441	0.26408121	0.79171734	0.90793273	0.041946326	no
IL2RA	361.301607	-0.020295281	0.071331	0.2845226	0.77600902	0.89878378	0.046344773	no
GZMB	352.73942	-0.020326591	0.06992363	0.26065544	0.77131486	0.89743492	0.046997034	no
AREG	374.671861	-0.020546517	0.10758443	0.15098039	0.84854096	0.93874816	0.027450903	no
CD27	734.772682	-0.020592102	0.11969059	0.17646755	0.85992684	0.94243942	0.025746557	no
CLEC12A	341.882151	-0.02069536	0.07740627	0.27084458	0.78650768	0.90339807	0.044120844	no
CXCR2	444.489619	-0.021569281	0.06105933	0.35325117	0.72390015	0.86888985	0.061035277	no
CXCL10	429.21865	-0.021708512	0.07755022	0.27992843	0.7953242	0.90015291	0.045683712	no
SRSF2	1039.33931	-0.022285752	0.18127105	0.1229418	0.90215335	0.96693821	0.014601279	no
FAS	351.800763	-0.022372156	0.07865536	0.28443288	0.77607882	0.89878378	0.046344773	no
IL32	1159.33814	-0.022411409	0.15899623	0.14104431	0.88783494	0.95568885	0.019983483	no
GC	330.186755	-0.022755508	0.07197407	0.31616257	0.75187912	0.88456367	0.053270904	no
STAT5A	513.964642	-0.022791016	0.06491556	0.35108708	0.72552302	0.86888985	0.061035277	no
AHRR1	350.287633	-0.023041925	0.07618716	0.30243842	0.76231787	0.89284388	0.04832177	no
IGF1R	322.656326	-0.023108195	0.06788111	0.34042159	0.73353806	0.87326079	0.058856041	no
SYK	413.559349	-0.023311634	0.09857564	0.33849976	0.73501675	0.87397949	0.058468761	no
IL16	435.567833	-0.024206358	0.11758339	0.20588545	0.83689601	0.9350934	0.029151536	no
TNFRSF11B	360.158147	-0.024210371	0.07388501	0.32767633	0.7431564	0.88051706	0.055262224	no
MS4A1	317.340453	-0.024616028	0.1401191	0.17567932	0.86054588	0.9243942	0.025746557	no
CLEC4A	480.951934	-0.025060598	0.08967395	0.35968391	0.71908353	0.86741077	0.06817519	no
BCL2L1	577.48347	-0.025633723	0.09480254	0.27039067	0.78689572	0.90339807	0.044120844	no
FASLG	356.468805	-0.025805718	0.08496771	0.39723605	0.6911934	0.84936394	0.070906182	no
MS4A6A	510.348106	-0.025817336	0.07157146	0.36072109	0.71830795	0.86741077	0.06817519	no
ITGAX	395.260352	-0.025845918	0.07963389	0.32455926	0.74551466	0.88122301	0.054914172	no
CD34	400.051941	-0.026012401	0.05325671	0.48807685	0.62549541	0.80842624	0.092358526	no
SORBS1	238.792239	-0.026074161	0.08214062	0.31743322	0.7509149	0.88456367	0.053270904	no
TNFRSF19	223.513695	-0.026880754	0.09272293	0.28996406	0.77188864	0.89743492	0.046997034	no
NKG7	467.274729	-0.026886121	0.09303722	0.42651185	0.66973491	0.83404099	0.078812606	no
FFAR4	639.053916	-0.026991393	0.11151384	0.23443533	0.81464703	0.92259007	0.034991224	no
AXL	474.140266	-0.027903005	0.09387224	0.43685653	0.6822154	0.83283275	0.079442207	no
PRF1	433.996719	-0.027904486	0.06784899	0.41127339	0.68087208	0.84266346	0.074345836	no
TGFB1	458.664919	-0.0287019	0.07500288	0.38267732	0.70195904	0.8560476	0.067502084	no
IL17RE	427.081586	-0.030337057	0.073392	0.41335945	0.67934548	0.84240816	0.07447436	no
HCAR2/3	685.450351	-0.030458528	0.07062387	0.43127807	0.6662862	0.83283275	0.079442207	no
ACKR4	710.072921	-0.030463964	0.06928757	0.45901884	0.64622994	0.825211	0.084488934	no
BRAF	433.24128	-0.03049517	0.06268009	0.48661402	0.62653188	0.80842624	0.092358526	no
STAT5B	339.990086	-0.030780006	0.06191789	0.49711163	0.61911034	0.80508496	0.094158286	no
TGFBR1	416.597342	-0.031682924	0.05361349	0.50656564	0.55455349	0.75871078	0.11922745	no
RARB	417.580918	-0.032006861	0.05885226	0.54385098	0.58654402	0.78414976	0.105600986	no
PXDN	440.134954	-0.032857518	0.06270102	0.52443714	0.59997453	0.79256873	0.100963065	no
SLC40A1	438.210726	-0.033458967	0.08652376	0.38670266	0.69897635	0.85449431	0.068206824	no
FGFR1	267.652004	-0.034756347	0.06872591	0.50572405	0.61305038	0.79824268	0.097865555	no
CAMMK	347.960863	-0.035243218	0.09400788	0.37489942	0.7077375	0.86021985	0.065392056	no
KRT23	316.821703	-0.035438802	0.08978536	0.50782572	0.61157557	0.79824268	0.097865555	no
NLRP3	420.986742	-0.035442107	0.08212977	0.43153788	0.6660732	0.83283275	0.079442207	no
ARIDSB	401.864989	-0.03551443	0.09647457	0.38809122	0.71265522	0.84406633	0.063483077	no
ADGRV1	250.576902	-0.035593345	0.09459115	0.3762862	0.70670414	0.86021985	0.065392056	no
LTF	325.239572	-0.035653055	0.08824328	0.40403139	0.68618964	0.84819485	0.071504367	no
NR3C1	394.148415	-0.035741275	0.06537362	0.54672322	0.5845689	0.78360442	0.105903121	no
STAT4	261.038126	-0.036817468	0.09610647	0.556942	0.57756706	0.77839226	0.108801492	no
IFIT1	358.569974	-0.037154862	0.05545882	0.66995408	0.50288707	0.71129712	0.147948948	no
CCR1	472.765594	-0.03741469	0.0734614	0.5093109	0.61053432	0.79808408	0.097651352	no
FGFR3	443.842215	-0.037855484	0.088385	0.42830215	0.66843115	0.8334553	0.079117685	no
HPGDS	396.933989	-0.037868945	0.07653839	0.4947706	0.63078206	0.8361645	0.093565559	no
IRF3	605.184395	-0.037912073	0.07782197	0.48716411	0.62614204	0.80842624	0.092358526	no
KRT4	278.898191	-0.039181004	0.08277589	0.47333835	0.6359718	0.81681141	0.087984557	no
ICAM2	535.645879	-0.039513955	0.07585472	0.5209162	0.60242515	0.79284936	0.100918889	no
WNT5A	424.282175	-0.039870988	0.07775678	0.51276541	0.60811543	0.79613944	0.099010883	no
BIRC5	470.10375	-0.039878312	0.0554709	0.71890505	0.47219943	0.69237452	0.15965892	no
CMKLR1	449.861299	-0.040743757	0.06916591	0.58907281	0.55581243	0.75871078	0.11922745	no
IKZF3	382.013468	-0.041005143	0.10320284	0.39733574	0.69112727	0.84936394	0.070906182	no
LY75	363.667237	-0.041388211	0.07021532	0.58944706	0.55558141	0.75871078	0.11922745	no
CCL26	354.553984	-0.04184142	0.08019417	0.52181647	0.60179812	0.79284936	0.100918889	no
AHI1	418.396576	-0.041994725	0.08795605	0.47745123	0.63304084	0.81472438	0.088989289	no
PCNA	616.265869	-0.04232623	0.09793335	0.43219425	0.66560024	0.83283275	0.079442207	no
CD83	479.833079	-0.042416774	0.06246413	0.67905808	0.49710106	0.71080055	0.148252244	no
IL1R1	234.572738	-0.042565316	0.07770665	0.54776932	0.58385031	0.78360442	0.105903121	no

LPAR5	582.380889	-0.042763659	0.14051106	0.30434372	0.76086604	0.89198832	0.049640831	no
PDGFRB	541.417811	-0.042790971	0.06198079	0.69030087	0.48994842	0.70496175	0.151834444	no
DNMT3A	491.875515	-0.043148884	0.05963746	0.72352145	0.46935958	0.69125122	0.160364088	no
GNLY	345.164704	-0.043865435	0.05670328	0.77359604	0.43916972	0.66239776	0.178881142	no
GATA3	419.953371	-0.044502468	0.0678776	0.65562814	0.51206341	0.71884301	0.143365945	no
CST7	460.025809	-0.044811458	0.07403766	0.69247734	0.54658545	0.7546781	0.122238251	no
IL1B	393.837624	-0.044833015	0.05595799	0.80119057	0.42392133	0.64880572	0.187885329	no
FES	577.286361	-0.04484309	0.09218591	0.89353949	0.37156833	0.60417615	0.218369422	no
ADGRG6	374.679034	-0.045131168	0.08528197	0.52932364	0.59657687	0.7891284	0.102855386	no
LEP	363.598926	-0.04679801	0.06928698	0.67542285	0.49640715	0.71080055	0.148252244	no
BST1	238.484452	-0.0473107	0.07448809	0.63614462	0.52533417	0.73268364	0.135083509	no
WIF1	404.13693	-0.048108772	0.07006337	0.68664656	0.49230548	0.70733546	0.150374568	no
NPR3	391.043875	-0.04817371	0.07184124	0.67055787	0.50250223	0.71129712	0.147948948	no
CUZD1	454.421664	-0.048768061	0.06941719	0.70253582	0.48234507	0.70142002	0.154021841	no
GPX3	469.446731	-0.048894468	0.07027783	0.695731	0.48659731	0.70366429	0.152449369	no
ACKR3	566.389494	-0.049403495	0.05868389	0.84185794	0.39986748	0.62822228	0.203955551	no
TIGIT	403.817964	-0.049420297	0.07469532	0.66162505	0.50821155	0.71781293	0.143988726	no
PRSS2	668.11963	-0.049644875	0.13252793	0.37459934	0.70795847	0.86021885	0.066390256	no
CD47	299.669603	-0.050458956	0.08470745	0.59568501	0.55138567	0.7573979	0.120679301	no
TCF7	394.928245	-0.05057297	0.07202281	0.72012357	0.47144891	0.69237452	0.15965892	no
CD3D	315.515113	-0.051135458	0.07615698	0.67144804	0.50193515	0.71129712	0.147948948	no
CHI3L2	374.000921	-0.051278237	0.06581	0.77015568	0.43588801	0.65844111	0.181483062	no
SST	414.438767	-0.051532605	0.10053724	0.51257231	0.60625053	0.79613944	0.099010883	no
ETV5	315.25162	-0.051615648	0.05611446	0.91982797	0.35766266	0.58923009	0.229715084	no
CD84	324.889643	-0.052678591	0.0843545	0.62516761	0.53186762	0.7378048	0.132131711	no
ITGA3	464.622419	-0.052689995	0.07776406	0.67756228	0.49804927	0.71080055	0.148252244	no
SIGIRR	702.844476	-0.053269238	0.09989454	0.53393816	0.59382028	0.78755347	0.1037205	no
IL12RB1	496.604837	-0.054786448	0.05995219	0.97916535	0.32749829	0.55903067	0.252564363	no
PDGFB	436.587657	-0.05487563	0.06988295	0.7852506	0.43230665	0.65401914	0.184409541	no
CCL8	398.185573	-0.054982029	0.07807439	0.70422622	0.48129191	0.70142002	0.154021841	no
GPR183	378.616824	-0.055000297	0.09106783	0.60394867	0.54587777	0.7546781	0.122238251	no
CYTOR	1063.36079	-0.05522961	0.11966652	0.46152935	0.64441887	0.82196285	0.085147813	no
CD8A	467.102359	-0.055231559	0.05718367	0.96586242	0.33411303	0.56153451	0.250623552	no
FCGR3A/B	659.254071	-0.055444153	0.08161435	0.6793432	0.49692043	0.71080055	0.148252244	no
RXRA	487.676586	-0.055492599	0.08894792	0.80607171	0.42023298	0.64750945	0.188754561	no
TNFSF8	473.246016	-0.055554674	0.06930245	0.80161486	0.42277578	0.64880572	0.187885329	no
CD274	369.974719	-0.056219924	0.05775752	0.97337848	0.33036523	0.56027198	0.251601094	no
KRT86	501.738475	-0.056380882	0.08971722	0.62842877	0.5297231	0.73674078	0.132676982	no
JUNB	920.547939	-0.056541047	0.24625048	0.22960786	0.81839649	0.92521694	0.033756425	no
IFIH1	365.710467	-0.056813892	0.08176312	0.6948596	0.48714329	0.70366429	0.152449369	no
CCL17	479.591016	-0.05708823	0.05521367	1.13696614	0.25557752	0.4933929	0.306807102	no
GZMH	398.359545	-0.057567138	0.07211872	0.79827339	0.42473854	0.64888415	0.187765909	no
ATG12	481.556349	-0.057642062	0.05901269	0.97677076	0.32868266	0.55903067	0.252564363	no
PLCG1	554.892299	-0.05834102	0.05067664	1.15124062	0.24963326	0.4856782	0.313660674	no
MMP19	297.794435	-0.05834499	0.07414491	0.78690489	0.43133754	0.66354173	0.184726677	no
NLRP3	375.578181	-0.059592679	0.08828896	0.67497321	0.49666079	0.71080055	0.148252244	no
SMAD2	475.754521	-0.05985561	0.0685363	0.87334171	0.38247685	0.61196296	0.213274861	no
IL10	472.740733	-0.0603844	0.05814077	1.03858968	0.29899561	0.53111884	0.27480829	no
FGF1	354.922666	-0.060687872	0.06804924	0.89196998	0.37243909	0.60456621	0.21856044	no
ERBB3	559.112608	-0.060900254	0.13540359	0.4497684	0.65287744	0.82634109	0.082840652	no
FFAR3	512.066599	-0.061059276	0.1174676	0.51979544	0.60320616	0.79264936	0.100918889	no
ADGRF1	350.536868	-0.061074273	0.0769736	0.79344437	0.42751897	0.64888415	0.187765909	no
CLEC10A	293.738225	-0.061252473	0.06562507	0.93337001	0.35062896	0.58051152	0.236189158	no
VSIR	787.835913	-0.061361537	0.09689961	0.63324857	0.5265734	0.73338626	0.13466723	no
RNF43	363.641578	-0.061520225	0.08887889	0.69218042	0.48882403	0.70496175	0.151834444	no
KRAS	394.926067	-0.061540546	0.08557947	0.71910411	0.47207678	0.69237452	0.15965892	no
NGFR	423.592906	-0.061781166	0.07186656	0.85923673	0.39020992	0.61547306	0.21076995	no
RAMP1	573.30886	-0.062341191	0.06587774	0.94631643	0.34398722	0.57236873	0.240324103	no
PHLDA2	665.437356	-0.062593444	0.12375702	0.50577691	0.61301327	0.78924268	0.097865055	no
IL1R2	388.570877	-0.062962504	0.08186098	0.77102316	0.4406932	0.66369458	0.17803728	no
PDGFC	372.155297	-0.062996472	0.0649151	0.97044405	0.3318252	0.56027198	0.251601094	no
MAP3K1	797.3276	-0.063040518	0.06259983	1.00703969	0.3139157	0.54547038	0.263228924	no
FAP	368.517864	-0.063176988	0.06391383	0.98847135	0.32292186	0.55803822	0.254896916	no
CXCL8	422.510087	-0.063182895	0.06081549	1.0389277	0.29883836	0.53111884	0.27480829	no
EPHB6	488.534869	-0.063729614	0.07078973	0.90036832	0.36797854	0.60029125	0.221637894	no
RELA	477.435209	-0.06454214	0.07266193	0.88825245	0.37440497	0.60462937	0.218510758	no
PNOC	575.152701	-0.065120976	0.06838451	0.95227666	0.34095669	0.57111673	0.243275115	no
ADM2	331.793401	-0.065268207	0.08291345	1.03738867	0.29955103	0.53111884	0.27480829	no
CD70	513.534415	-0.065378965	0.07930652	0.82436798	0.40973618	0.63623631	0.196381552	no
KRT5	323.92157	-0.065730292	0.09509924	0.69117592	0.48845505	0.70496175	0.15183444	no
IL1RN	377.156009	-0.066130874	0.06354003	1.04077503	0.29797997	0.53111884	0.27480829	no
MYL7	480.3565	-0.066136357	0.08071162	0.81941552	0.41254938	0.63961145	0.194083771	no
KRT34/B/C	811.143172	-0.06868294	0.10667893	0.62547955	0.53165637	0.73768048	0.132131711	no
CD36	415.536031	-0.066969384	0.08997756	0.74428987	0.45670113	0.68225404	0.166053884	no
CHEK1	438.40641	-0.067884006	0.05744433	1.18173548	0.23731068	0.46992213	0.3279741	no
KITLG	442.895005	-0.068068636	0.06406527	1.06248893	0.28801378	0.51988047	0.284096499	no
TSHZ2	357.849959	-0.068825309	0.0925275	0.74383629	0.45697552	0.68225404	0.166053884	no
ALOX5AP	481.130065	-0.069268746	0.08151894	1.12639886	0.26005258	0.49885541	0.301990493	no
NPR1	227.688832	-0.069375754	0.07595144	0.87164845	0.38340019	0.61200436	0.213245487	no
MYC	439.991059	-0.069598237	0.06922902	1.00533325	0.31473641	0.54547038	0.263228924	no
SOSTDC1	374.40305	-0.069737512	0.07565162	0.92182449	0.35662013	0.58949207	0.230266788	no
ADIPOQ	380.225523	-0.070188833	0.06293946	1.11518016	0.26477322	0.50169861	0.2995571	no
CSF3R	377.576019	-0.070704277	0.0589941	1.19849734	0.23072346	0.46015737	0.337093617	no
OSM	469.36194	-0.071225894	0.05639266	1.26325891	0.20649815	0.44241229	0.35417282	no
CD276	640.091749	-0.071489699	0.05914579	1.20870305	0.22677695	0.45892872	0.338254761	no
VWF	538.455486	-0.071753635	0.07277786	0.98592963	0.33416912	0.55803622	0.254896916	no
KRT15	404.888462	-0.072188331	0.07654061	0.94311146	0.34562389	0.57412607	0.240992733	no
HAVCR2	236.5790013	-0.072334997	0.08203992	1.16594269	0.24363762	0.47772082	0.320825834	no
SNAI1	647.571491	-0.072356789	0.07462469	0.96960928	0.33224129	0.56027198	0.251601094	no
CCR7	559.924673	-0.072461625	0.07453825	0.97214013	0.33098084	0.56027198	0.251601094	no
NFKB1	362.869499	-0.072678805	0.0679394	1.06977707	0.28471966	0.51743371	0.28614528	no
IL1R1	334.677183	-0.073276776	0.0675687	1.08447806	0.27815289	0.51131046	0.291315323	no
SNAI2	425.757732	-0.073441398	0.05790787	1.26824561	0.20471025	0.44118589	0.355378384	no
COL14A1	364.05392	-0.073608548	0.08119131	1.20292477	0.22900543	0.45892872	0.338254761	no
MED23	443.964754	-0.073780796	0.0840776	0.87753047	0.38019857	0.60029259	0.215747105	no
ICOS	358.218188	-0.074288596	0.06949878	1.06891943	0.28510597	0.51743371	0.28614528	no
KDR	242.780317	-0.074377177	0.0749804	0.99195468	0.32121949	0.55473233	0.255976677	no
ITGA9	386.278959	-0.074647047	0.04972204	1.50128893	0.13328136	0.35636728	0.448102176	no
TNFSF10	624.119088	-0.075110092	0.13453405	0.55826803	0.57664089	0.77819284	0.108912771	no
COL16A1	378.234939	-0.075354365	0.05884635	1.28625413	0.19835438	0.43061529	0.36591655	no
RXRB	531.641449	-0.075643331	0.05651512	1.33846172	0.18074597	0.41360634	0.383412814	no
KLRF1	267.408864	-0.075795522	0.07300242	1.03826043	0.29914882	0.53111884	0.27480829	no
CXCR1	400.290415	-0.076031522	0.06914331	1.09662225	0.27149675	0.50452292	0.297119101	no
CXCL16	612.530152	-0.076746575	0.06327854	1.21283728	0.22519204	0.45782411	0.339301343	no
CCL20	512.261221	-0.077042293	0.14328103	0.53735057	0.59078379	0.78755347	0.1037205	no
ITGB5	481.646754	-0.077244259	0.06287102	1.22861472	0.21921629	0.45292623	0.343972529	no
WNT5B	427.077338	-0.077698446	0.05442394	1.42765201	0.15339205	0.38348011	0.416257153	no
ITGA2	307.737932	-0.077706417	0.06372737	1.21935697	0.22270873	0.46543708	0.341576162	no
KRT13	285.464923	-0.078319754	0.06727526	1.16416865	0.24435567	0.47819114	0.320398473	no
PDGFD	248.26996	-0.078531796	0.09402036	0.83526372	0.40356924	0.6276349	0.202292917	no
IFNL2/3	673.64295	-0.078751918	0.0401295	0.85767094	0.40221554	0.62748134	0.202399187	no
PTGES2	484.593208	-0.079017703	0.06472432	1.22083475	0.22214859	0.45522283	0.341776254	no
HDAC5	408.228709	-0.079742666	0.07341397	1.08626564	0.27738802	0.5109435	0.291712126	no
ADGRG3	537.519941	-0.080000427	0.04975216	1.60797882	0.10783982	0.31253155	0.505106141	no
TXK	381.0105	-0.081473785	0.07614306	1.07000928	0.28461513	0.51743371	0.28614528	no
RARG	471.45472	-0.082801017	0.07360085	1.12539095	0.2604234	0.49885541	0.301990493	no
EFNA1	668.632355	-0.083782377	0.17857018	0.46914658	0.63893771	0.81712671	0.087710594	no
ACKR1	401.141577	-0.084108971	0.06960951	1.20829707	0.22693301	0.45892872	0.338254761	no
LINC01857	410.225824	-0.084857545	0.08280356	1.0236928	0.3059804	0.53903714	0.268381312	no
CX3CL1	516.713081	-0.085094892	0.06274207	1.36582826	0.17199288	0.40660254	0.39082991	no
INSR	443.340938	-0.085744975	0.08500812	1.00866808	0.31313385	0.54547038	0.263228924	no
CD30	338.472949	-0.085847752	0.06952346	1.23482808	0.21690395	0.45028135	0.346516039	no
PDCD1	455.936481	-0.086666389	0.05724476	1.50348067	0.13271514	0.35580466	0.448788367	no
CD86	302.213316	-0.086388031	0.0640375	1.34824166	0.17758067	0.4125249	0.384548835	no
CASP3	469.663165	-0.086470653	0.05908336	1.46353647	0.14332064	0.37287943	0.428431578	no
NR1H2	632.536635	-0.086670719	0.07290097	1.18741705	0.23506316	0.46639616	0.331245967	no
CSF2	446.503937	-0.088603806	0.07810625	1.11135544	0.26841539	0.50169861	0.2995571	no
MARCO	281.024054	-0.086861669	0.09759007	0.89006666	0.37343009	0.60462937	0.218510758	no
TNFSF15	340.978529	-0.087258363	0.06540472	1.33412948	0.18216143	0.41401104	0.382988081	no
AQP3	709.778456	-0.087548441	0.06010506	1.45658027	0.14522951	0.37527006	0.426560078	no
MECOM	329.717747	-0.088069502	0.0930501	0.94647407	0.34390684	0.57236873	0.240324103	no
KRT7	407.573753	-0.088324621	0.06839226	1.29144175	0.19655954	0.43061529	0.36591655	no
MFAP5	391.854892	-0.088722519	0.08671077	1.0232007	0.30621296	0.53903714	0.268381312	no
RUNX3	533.983786	-0.089248238	0.06402859	1.39388098	0.16333555	0.39201906	0.406692815	no
CSAR2	498.514934	-0.089487004	0.0784574	1.14058084	0.25404439	0.4913818	0.30858593	no
IL24	494.399376	-0.08967914	0.07341397	1.22155413	0.22187628	0.45522253	0.341776254	no
TNFRSF10D	372.334605	-0.089877288	0.07464708	1.20402956	0.22857815	0.45892872	0.338254761	no
ICOSLG	533.784194	-0.089880043	0.08190768	1.45203374	0.14649222	0.33704851	0.423602772	no
ENG	592.288621	-0.090318228	0.08761895	1.33568408	0.18164928	0.41401104	0.382988081	no
CCL3/L1/L3	930.299985	-0.090850949	0.13557527	0.66996029	0.5028931	0.7129712	0.147948948	no
TNFRSF18	609.103008	-0.09109998	0.05767487	1.57954384	0.11421137	0.32446412	0.488833328	no
CD28	396.182597	-0.091248633	0.07017685	1.30026679	0.19350955	0.42791089	0.368646861	no
IFNA1/13	550.598045	-0.091501993	0.06783237	1.34894263	0.17735533	0.4125249	0.384548835	no
CXCR6	609.604252	-0.092037837	0.06347286	1.45003443	0.14704692	0.37704851	0.423602772	no
S100A2	418.493791	-0.093581826	0.08432216	1.10905754	0.26740536	0.50169861	0.2995571	no
FGFR2	547.534696	-0.093649341	0.07999028	1.1719897	0.24120119	0.4748535	0.323484262	no
CACNA1C	350.012717	-0.09380735	0.07032654	1.33388269	0.18224231	0.41401104	0.382988081	no
CXCR3	376.029111	-0.093985275	0.12375911	0.75833925	0.44625333	0.67406512	0.171298148	no
QRFPR	512.046151	-0.093988033	0.0779194	1.20470812	0.228316	0.45892872	0.338254761	no
INHBB	477.883569	-0.094584293	0.08747522	1.40176338	0.16098592	0.39169323	0.407053933	no
CPB1	281.744119	-0.095111786	0.07704796	1.23444908	0.21703561	0.45028135	0.346516039	no
MB	254.912521	-0.095770304	0.09822072	1.11075738	0.2666728	0.50169861	0.2995571	no
SLCO2B1	568.586886	-0.095942897	0.04927787	1.94697745	0.05153744	0.20532844	0.687550892	no
PTGS1	412.070884	-0.096093269	0.08218486	1.54528404	0.12227757	0.34606606	0.467747632	no
TYMS	541.236323	-0.096410578	0.06481912	1.48737863	0.13691484	0.36125287	0.442188691	no
RARRES1	613.819211	-0.096489313	0.1078863	0.8943611	0.37112872	0.60417615	0.218836422	no
CLCF1	521.266586	-0.097024798	0.07417144	1.30811531	0.1908342	0.42422137	0.372407456	no
CXCR5	497.776596	-0.097250476	0.09861746	0.98613853	0.32406514	0.55603622	0.254896916	no
THBS2	395.266577	-0.098123732	0.09395824	1.04433343	0.29633115	0.53111884	0.27480829	no
CSF1	535.234026	-0.098304581	0.09888361	1.40669014	0.15951929	0.39169323	0.407053933	no
ADGRF3	417.802967	-0.098696796	0.07567212	1.30426892	0.19214191	0.42603528	0.370554438	no
VTN	430.496495	-0.099120842	0.05426041	1.82691275	0.06771289	0.23842566	0.62847	no
ADGRF5	420.30869	-0.099189001	0.09025129	1.09903137	0.27175438	0.50452292	0.297119101	no
ICAM3	459.88944	-0.099372672	0.10640555	0.933905	0.3503529	0.58051152	0.236189158	no
NUSAP1	434.121485	-0.099669997	0.07707554	1.40875249	0.15890837	0.39169323	0.407053933	no
ETV4	536.136665	-0.099974191	0.05951989	1.67967702	0.09302017	0.2870993	0.541967866	no
ITGB6	256.468073	-0.100288893	0.09037478	1.10891069	0.26708561	0.50169861	0.2995571	no
NPR2	448.044633	-0.100588205	0.07613373	1.32120423	0.18843328	0.41989476	0.376859541	no
EPHB2	645.188925	-0.10059769	0.06288432	1.59972601	0.10995938	0.31421025	0.502779645	no
IL12A	398.934598	-0.100741833	0.06076595	1.65704835	0.0975097	0.26370392	0.532090261	no
FOXF1	671.286904	-0.101446684	0.0661386	1.53381956	0.12507405	0.34331038	0.464313062	no
SREBF1	481.89339	-0.101945368	0.07928181	1.2858607	0.19849168	0.43061529	0.36591655	no
WNT7A	446.183172	-0.102547653	0.0922506	1.11162047	0.26630137	0.50169861	0.2995571	no
INSIG1	641.634458	-0.103065853	0.12249807	0.84136719	0.40014226	0.62522228	0.203965551	no
FABP4	342.408169	-0.103100299	0.07404592	1.39240071	0.16379504	0.39201906	0.406692815	no
PTTG1	541.447051	-0.103288521	0.08031391	1.28603533	0.19843073	0.43061529	0.36591655	no
ZBTB16	488.075277	-0.104864683	0.07551372	1.38868379	0.16492892	0.39362512	0.404917197	no
KRT1	308.131795	-0.104978251	0.07290876	1.43686764	0.14690759	0.38047613	0.419672588	no
NR0N3	425.040529	-0.105778152	0.08141213	1.29929231	0.19384363	0.42791089	0.368646861	no
CD86	539.557699	-0.106466482	0.07369488	1.44469307	0.14854412	0.37893907	0.421430611	no
CAMP	476.012339	-0.106546384	0.05998601	1.77608929	0.07757672	0.2500302	0.60200754	no
EGFR	436.471985	-0.106716485	0.09885605	1.0795139	0.2803587	0.51272232	0.290117779	no
CSPG4	571.30182	-0.107652536	0.05911321	1.82083217	0.06863237	0.23913719	0.621352881	no
TACSTD2	358.010449	-0.108396611	0.08840589	1.22612435	0.22015188	0.45384603	0.343091459	no
TLR3	445.268128	-0.10840598	0.07044366	1.53893035	0.12382789	0.3425208	0.465313045	no
ISG15	627.539168	-0.108609522	0.07777567	1.39644596	0.16258024	0.39201906	0.406692815	no
ERBB2	625.342231	-0.108808985	0.10645158	1.02214531	0.30671213	0.53903714	0.268381312	no
MT1X	685.816806	-0.110002696	0.15034971	0.73164555	0.49438494	0.6854487	0.164025041	no
NELL2	309.558375	-0.110103852	0.07281642	1.51207451	0.13051491	0.352743	0.452541598	no
HDAC3	609.136658	-0.110159727	0.05529652	1.9921637	0.0463531	0.19533324	0.709223839	no
BBLN	633.997557	-0.111812884	0.07177105	1.55791066	0.11925443	0.33783124	0.47130019	no
MAPK14	538.61278	-0.112764413	0.05589731	2.02458344	0.04290913	0.18919793	0.72538515	no
IL34	524.254936	-0.114135017	0.06902724	1.65347803	0.09823361	0.2946498	0.530693846	no
FZD4	529.882874	-0.114169495	0.06985589	1.67063319	0.0909466	0.22296545	0.651762425	no
ATG5	602.878437	-0.114315057	0.08149439	1.40273537	0.16069577	0.39169323	0.407053933	no
CASR	336.482999	-0.114733422	0.04924442	2.32987662	0.01981267	0.11321528	0.946094973	no
APOA1	492.617926	-0.11550004	0.08821451	1.69318868	0.09041958	0.28344889	0.547528304	no
CD14	687.504479	-0.115934193	0.10366055	1.11840225	0.26339523	0.50169861	0.2995571	no
NOSIP	542.637347	-0.11603162	0.10741514	1.08021665	0.28004572	0.51272232	0.290117779	no
TNF	359.036885	-0.116348995	0.09192627	1.2947637	0.20595905	0.44241229	0.35417282	no
CSF2RA	453.737355	-0.116402606	0.07227782	1.61048865	0.10729122	0.31189308	0.505994257	no
TNFRSF19B	405.084415	-0.116644208	0.07226951	1.61953227	0.11148894	0.3185424	0.496832752	no
MERTK	321.930083	-0.117057421	0.05913277	1.97956937	0.04775194	0.19732206	0.704824365	no
NPPC	674.224088	-0.11709366	0.09651173	1.76049643	0.07832367	0.25512597	0.593245337	no
CDKN3	439.847287	-0.117677846	0.05614811	2.09940901	0.03578086	0.17031574	0.76874521	no
TFEB	357.719721	-0.118053084	0.05431751	2.17338925	0.02975103	0.14950268	0.825351028	no
BMP1	474.342377	-0.118118187	0.08067077	1.46420055	0.14313916	0.37287943	0.428431578	no

CTSW	436.288594	-0.118218355	0.08927347	1.70654593	0.08790648	0.27931699	0.553902645	no
PSCA	434.542041	-0.119153491	0.07371288	1.61645405	0.10599618	0.30993035	0.508735892	no
PTK2	421.853386	-0.119461357	0.0844165	1.65451495	0.09366552	0.22819184	0.641699888	no
IL15RA	497.587247	-0.11951926	0.04799475	2.49025674	0.01276508	0.0895716	1.047829682	no
PTEN	347.539217	-0.119668277	0.07351573	1.62779156	0.10356909	0.30385974	0.517326841	no
ARG1	265.310997	-0.120472212	0.07263665	1.65849108	0.09721839	0.29370392	0.532006261	no
PPARD	546.56147	-0.12136605	0.07113551	1.70612477	0.08798485	0.27931699	0.553902645	no
TNXA/B	674.694393	-0.121682617	0.09866204	1.4041051	0.16028755	0.39169323	0.407053933	no
CCL22	390.304299	-0.122258938	0.0739787	1.65259839	0.09841303	0.2946498	0.530693846	no
MAML2	390.606883	-0.123502854	0.09442659	1.30792344	0.19089962	0.42422137	0.372407456	no
IGFBP6	432.757594	-0.123669441	0.0558762	2.09541906	0.03888337	0.17832627	0.748784669	no
RORA	358.52842	-0.124220586	0.06914532	1.79651464	0.07241271	0.24714234	0.607052839	no
ICA1	398.749745	-0.12464491	0.07549456	1.65104495	0.0987294	0.29471462	0.53059832	no
ATR	446.050464	-0.124653214	0.06230264	2.00076942	0.04541724	0.19244595	0.715691222	no
CELSR1	474.542093	-0.125014535	0.05256562	2.37825668	0.01739471	0.10738682	0.969040606	no
PLAC9	644.897342	-0.12567198	0.07387538	1.70113488	0.08891786	0.28138501	0.550699047	no
IL1A	424.659543	-0.125852776	0.05785805	2.17519902	0.02961521	0.14850268	0.825351028	no
EFNA5	419.18943	-0.126020334	0.07147455	1.76314974	0.07787524	0.25449424	0.594322043	no
COL9A1	235.952046	-0.126509402	0.07239716	1.74122034	0.08164496	0.26287386	0.582252597	no
TLR1	356.606267	-0.126303664	0.05749888	2.1966282	0.02804701	0.14607818	0.835414648	no
KLK3	431.078888	-0.126474755	0.08502293	1.48753705	0.13687303	0.36125287	0.442188691	no
CD69	366.588982	-0.126534071	0.07530408	1.68030828	0.09269735	0.2870993	0.541967866	no
RYK	538.005916	-0.126226078	0.06724943	1.9067236	0.05555839	0.21422103	0.669137894	no
NDUFA4L2	470.24504	-0.128654108	0.05517488	2.33175145	0.01971377	0.11321528	0.946094973	no
NLRC4	387.581086	-0.12695009	0.05894212	2.18774065	0.02868848	0.14787879	0.830094117	no
CD3E	355.073158	-0.129510247	0.09646363	1.34258105	0.17940767	0.4129255	0.384128301	no
IGF2	416.911515	-0.129761144	0.08166383	1.58896717	0.11206781	0.3192815	0.495828249	no
BAX	749.870095	-0.131120148	0.08766233	1.49539982	0.13481013	0.35853757	0.445465328	no
TNFRSF14	865.057728	-0.132328501	0.1070033	1.23667685	0.21620708	0.45028135	0.346516039	no
TNFRSF4	509.140427	-0.132362346	0.0894783	1.90508846	0.05978657	0.21422103	0.669137894	no
DPP4	365.755752	-0.132448498	0.06701265	1.97647	0.04810157	0.19794885	0.703447016	no
TNFRSF12A	679.331241	-0.132547554	0.09900126	1.33884714	0.18062044	0.41360634	0.383412814	no
IL18	314.736229	-0.132727662	0.09737535	1.36305193	0.17298615	0.40738958	0.389990083	no
APOC1	670.981892	-0.132872246	0.0854496	1.55497796	0.11995132	0.33877692	0.470086189	no
EPHB2	331.172376	-0.132950129	0.09370573	1.41859122	0.15601823	0.3897288	0.409969038	no
TNFSF12	546.50125	-0.133148273	0.08612888	1.54591803	0.12212415	0.34060606	0.467747632	no
RGS13	217.790962	-0.134793218	0.09632932	1.39925591	0.16172427	0.39201906	0.406692815	no
PDGFA	581.500693	-0.134945658	0.10304301	1.30986512	0.19032946	0.42422137	0.372407456	no
TLR4	381.503969	-0.138981085	0.07471017	1.86026984	0.06284736	0.22688577	0.644192741	no
DDC	594.737167	-0.139239534	0.08364774	1.66459408	0.09599377	0.29099372	0.53611638	no
PTGIS	535.555071	-0.139586436	0.05692621	2.48853409	0.01282818	0.0895716	1.047829682	no
WNT3	565.171979	-0.13978525	0.06787238	2.0595308	0.03944432	0.178477	0.748417735	no
FABP5	1650.64138	-0.139702955	0.07856208	1.77939488	0.07517505	0.2500302	0.60200754	no
INHA	566.395154	-0.140760433	0.08058111	2.32427086	0.02011098	0.11426694	0.942079403	no
COL9A3	445.873721	-0.140927537	0.07934956	1.77603427	0.07572727	0.2500302	0.60200754	no
FPR1	483.24927	-0.14099689	0.10401056	1.34397239	0.17895731	0.4129255	0.384128301	no
RAMP2	412.874473	-0.141195673	0.07043967	2.00450371	0.04501613	0.19179581	0.717160886	no
ITGAE	489.857028	-0.141861664	0.06209647	2.25297154	0.02426094	0.13354484	0.874372904	no
NR1H3	527.515078	-0.142358723	0.07097671	2.0057104	0.04488715	0.19179581	0.717160886	no
IL11RA	475.601481	-0.143604569	0.07359572	1.95126248	0.05102583	0.20442491	0.689466176	no
CCND1	621.742408	-0.144487744	0.07263793	1.98915003	0.04668465	0.19533324	0.709223839	no
AATK	476.836558	-0.145494075	0.05589272	2.59683919	0.00932675	0.07810493	1.107321556	no
CSHL1	606.512556	-0.146131809	0.0758959	1.92542423	0.05417631	0.21245611	0.672730783	no
ABL2	402.34333	-0.147609038	0.08323997	1.77594087	0.07579915	0.2500302	0.60200754	no
MXRA8	547.552005	-0.148583497	0.06188796	2.40084672	0.01635719	0.10287539	0.987688515	no
DHRS2	621.039459	-0.149300242	0.0574203	2.60013008	0.00931884	0.07810493	1.107321556	no
DUSP2	579.670942	-0.149310651	0.0615836	2.42455889	0.015327	0.09762419	1.010442577	no
MST1R	473.250707	-0.149510488	0.08142458	1.83616374	0.06633049	0.23438335	0.630073251	no
BMP4	486.693834	-0.151212411	0.06837204	2.21161169	0.02699351	0.14435031	0.840582292	no
TGFB3	473.427717	-0.1515237	0.05357604	2.82819975	0.00468107	0.05445155	1.263989714	no
FFAR2	586.805781	-0.151701729	0.07314831	2.07388257	0.03808929	0.17715948	0.751635594	no
XCL10	731.548133	-0.152212272	0.0909733	1.6751517	0.09429715	0.28613368	0.540459078	no
NTRK2	219.904287	-0.152328633	0.08533652	1.78503453	0.07425572	0.25001925	0.60202656	no
IL11	477.373307	-0.153689615	0.0698277	2.19238087	0.0283513	0.1468979	0.832984405	no
IL1RL1	266.215351	-0.153882603	0.07739026	1.99064354	0.04652009	0.19533324	0.709223839	no
IL17RB	374.016677	-0.153958255	0.08586862	1.75295132	0.07298071	0.2482337	0.605139254	no
TNFSF4	370.814541	-0.153993152	0.06895513	2.23323713	0.02553331	0.1380179	0.860064592	no
WNT10B	382.940728	-0.154335976	0.04951196	3.1714525	0.00182612	0.03043526	1.516622042	no
RGS1	399.391885	-0.154740399	0.08545239	1.81083749	0.07016601	0.24131391	0.617417638	no
MYL4	467.72358	-0.155704418	0.06405542	2.40077665	0.0159885	0.09698432	1.013298497	no
ABL1	483.808516	-0.155928839	0.06252364	2.49391814	0.01263417	0.0895716	1.047829682	no
EPHB4	434.061336	-0.156390278	0.07075655	2.25265772	0.02428074	0.13354484	0.874372904	no
FLT3LG	494.607778	-0.1598813	0.07709154	2.07521211	0.03796688	0.17715948	0.751635594	no
KRT10	246.213481	-0.160096624	0.07988926	2.00398175	0.04507202	0.19179581	0.717160886	no
SPRY2	493.447629	-0.160537758	0.08612261	1.8640606	0.06231319	0.22577244	0.646329069	no
FZD5	714.471084	-0.162180622	0.12982134	1.24926014	0.21156994	0.44655009	0.350324377	no
EPHA2	698.493966	-0.162200381	0.09146478	1.77336435	0.07616835	0.25028536	0.601564557	no
CELSR2	447.027915	-0.162951734	0.0631326	2.67476455	0.01003112	0.0863374	1.066082253	no
IL17B	567.048522	-0.163113177	0.06543134	2.49268068	0.01267079	0.0895716	1.047829682	no
LEFTY1	737.521281	-0.16483258	0.14592557	1.1295661	0.2586591	0.49837977	0.302439593	no
HEY1	593.671072	-0.165114813	0.09265593	1.77626991	0.07568844	0.2500302	0.60200754	no
JAG1	562.772415	-0.165153838	0.09269482	1.78169431	0.0747991	0.2500302	0.60200754	no
APOD	372.290994	-0.165863463	0.09762931	1.69891046	0.08933606	0.28181721	0.550032488	no
ACE	368.919399	-0.165867199	0.0622767	2.66339115	0.00773574	0.07366371	1.132746432	no
ELANE	606.274186	-0.16687212	0.06403426	2.60598197	0.00916113	0.07810493	1.107321556	no
PRTN3	520.539979	-0.16693216	0.07590291	2.19994421	0.02781085	0.14580656	0.836819053	no
CIDEA	296.976017	-0.167985402	0.09284101	1.80938797	0.07039075	0.24131391	0.617417638	no
PGF	578.986323	-0.168411945	0.06932635	2.42926299	0.01512655	0.09698432	1.013298487	no
SPRY4	443.620843	-0.16850008	0.08144229	2.0690015	0.03854595	0.17796237	0.74991593	no
FZD8	585.388843	-0.169613966	0.08745895	2.51432864	0.01192592	0.08826098	1.054231262	no
ITGB8	443.596957	-0.16971378	0.05627946	3.01554714	0.00256516	0.03817518	1.418218936	no
IL17D	601.798322	-0.169844543	0.05765457	2.94588881	0.00322018	0.04312418	1.365279188	no
IL27RA	518.086722	-0.170796421	0.06945006	2.5702974	0.01016112	0.08064384	1.09342879	no
IL20	415.008354	-0.17111827	0.05292137	3.23344399	0.00122307	0.02496068	1.602743639	no
CX3CR1	456.865038	-0.172181017	0.06615131	2.60263803	0.00924562	0.07810493	1.107321556	no
SOX2	307.679885	-0.17268421	0.065837	2.62290516	0.00871835	0.07784244	1.108783535	no
PFAV1	618.673556	-0.174987224	0.0615852	2.83648981	0.00458124	0.05445155	1.263989714	no
BRCA1	251.886703	-0.17483191	0.0669761	2.61036279	0.00904462	0.07810493	1.107321556	no
CD37	537.035013	-0.176811797	0.12700236	1.39219298	0.16386397	0.39201906	0.406692815	no
LINC02446	482.209921	-0.177802261	0.0775969	2.29138745	0.02194101	0.12326413	0.909163292	no
ANGPT1	252.128936	-0.177881801	0.06984484	2.54681391	0.01087114	0.08493077	1.070934924	no
FZD1	541.303537	-0.177959411	0.06335152	2.8090788	0.00496835	0.05475986	1.261537672	no
CXCL17	467.047111	-0.182167055	0.07193074	2.5325343	0.01132413	0.0863902	1.06353553	no
ADIRF	867.745519	-0.183068116	0.12451139	1.47029216	0.14148264	0.37232275	0.429080432	no
EPOR	494.207973	-0.184140876	0.07370167	2.49846262	0.01247333	0.0895716	1.047829682	no
PPARG	399.589281	-0.184354788	0.13208267	1.39575305	0.16278887	0.39201906	0.406692815	no
KRT14	576.873086	-0.184477549	0.12330187	1.49614562	0.13461571	0.35853757	0.445465328	no
MSMB	360.781929	-0.184817379	0.07762654	2.37821529	0.01739667	0.10738682	0.969040606	no
INS	360.454357	-0.184853394	0.07180519	2.5743737	0.01004217	0.0803374	1.095082253	no
POU5F1	1710.60481	-0.185484672	0.09353331	1.98308683	0.04735773	0.1966354	0.706338304	no
GADD45B	746.180736	-0.186031573	0.07810716	2.42015671	0.01551382	0.09818873	1.007938351	no
MRC2	596.948236	-0.189402221	0.05891002	3.21541604	0.00130256	0.02604472	1.584280293	no
ADGRA2	639.946587	-0.189712985	0.0810998	2.33924591	0.01932271	0.11178324	0.951623152	no
NOTCH1	658.905113	-0.190262404	0.08981458	2.12311802	0.03374389	0.16380528	0.785672104	no
AZU1	508.272567	-0.193478262	0.07668709	2.52295755	0.01163724	0.08749808	1.058001475	no
ESAM	594.027368	-0.194112605	0.09503729	2.04246005	0.0411286	0.18187105	0.742236435	no
WNT11	262.477787	-0.194743341	0.07733081	2.51831495	0.01179178	0.08799838	1.055525335	no
PTGES	664.528934	-0.194883841	0.07334505	2.65706244	0.00788202	0.07366371	1.132746432	no
CCRL2	413.232734	-0.199332413	0.08434501	2.36328814	0.01811309	0.10945093	0.960769536	no
TNNC1	551.103566	-0.199416354	0.0662088	3.01193146	0.00259591	0.03817518	1.418218936	no
TCAP	529.641894	-0.199929944	0.07208445	2.77355154	0.00554481	0.05998612	1.221949224	no
DUSP4	543.695068	-0.200096358	0.0557813	3.58723376	0.0003342	0.01635021	1.786476558	no
HDAC4	596.486181	-0.200553701	0.06325746	3.17043537	0.00152211	0.02718048	1.565742877	no
FGF9	524.791722	-0.202379596	0.06926532	3.03864446	0.00178326	0.0221691	1.674297881	no
TNFSF9	525.682914	-0.203192964	0.07385527	2.75123173	0.00593716	0.06249645	1.204144654	no
ANGPTL1	413.786933	-0.203314209	0.06236591	3.2600217	0.00111404	0.02421819	1.615858253	no
GPER1	677.606624	-0.203456178	0.05022097	4.05121838	5.10E-05	0.00636893	2.195933796	no
GDF15	528.526708	-0.207404427	0.10633925	1.95058672	0.05110623	0.20442491	0.689466176	no
CSF3	410.52934	-0.208124373	0.09316841	2.29475428	0.00098508	0.02345423	1.626778778	no
TPSAB1/B2	763.780553	-0.209938643	0.12028931	1.74528093	0.08093598	0.26241055	0.581018706	no
PSD3	357.627488	-0.211397189	0.07344569	2.87827899	0.00399851	0.050551	1.29627022	no
HSD17B2	418.39461	-0.211631273	0.10916085	1.93871039	0.05253661	0.20883706	0.684319445	no
SCG5	441.939807	-0.214243797	0.05964326	3.7823351	0.00015536	0.01195108	1.92259292	no
ADGRA3	376.473254	-0.21747683	0.08095231	2.68848096	0.00722091	0.07026314	1.153272452	no
HBA1/2	1034.75889	-0.218538035	0.07602109	2.87470275	0.00404408	0.050551	1.29627022	no
FZD7	536.025881	-0.218558976	0.06991374	3.26627965	0.00108971	0.02421819	1.615858253	no
EMP3	963.62551	-0.218972227	0.14128492	1.54986268	0.12117448	0.33942431	0.469257054	no
EPHB3	433.147743	-0.220211252	0.08895043	2.48656474	0.01289831	0.0895716	1.047829682	no
LIF	540.481899	-0.22136396	0.05883566	3.894802	9.83E-05	0.01026004	1.988851011	no
CCL13	404.085456	-0.222073115	0.0850038	3.41628225	0.00063482	0.0199931	1.70049454	no
KRT17	1141.74965	-0.224350709	0.10485841	2.13955854	0.03239046	0.15877676	0.799213051	no
LTBR	456.058939	-0.225669687	0.11768584	1.91756023	0.0551668	0.21336929	0.670868085	no
VEGFB	664.346876	-0.226857128	0.10818853	2.09723834	0.03597248	0.17031574	0.76874521	no
CCR10	674.947919	-0.22693822	0.07707076	2.94454365	0.00323431	0.04312418	1.365279188	no
CNTFR	440.212014	-0.227634013	0.06484138	3.51062851	0.00044705	0.01719418	1.764618539	no
BCL2	775.749474	-0.228579133	0.12322719	1.85189462	0.06406969	0.22882031	0.640505427	no
IL6R	582.080752	-0.229239286	0.06099686	3.75821457	0.00017113	0.01222358	1.912801626	no
CPD	520.99773	-0.232956592	0.09315555	2.4968516	0.01253014	0.0895716	1.047829682	no
PPARA	528.130346	-0.235008259	0.08010772	2.93365315	0.00334998	0.04403935	1.356159053	no
VPREB3	589.672896	-0.237380833	0.10064909	2.35849954	0.01834868	0.10945093	0.960769536	no
PTK6	849.779887	-0.238725153	0.11042881	2.16074473	0.0307506	0.1528126	0.815944636	no
ACVR1B	565.466347	-0.239469093	0.09886436	2.47740252	0.0005063	0.01757597	1.755080715	no
LAG3	453.671372	-0.242572655	0.08564464	2.83231575	0.00462122	0.05445155	1.263989714	no
KLRK1	333.925056	-0.242805908	0.07546422	3.20978844	0.00132828	0.02604472	1.584280293	no
TNFRSF11A	362.866135	-0.24348431	0.0826306	2.94668036	0.00321226	0.04312418	1.365279188	no
UPK3A	523.58908	-0.245428719	0.08304411	2.9554018	0.00312262	0.04312418	1.365279188	no
DPT	392.138422	-0.247397659	0.08748895	2.82773888	0.00468751	0.05445155	1.263989714	no
NR2F2	655.161684	-0.256035117	0.08256811	3.10089594	0.00192936	0.03162887	1.499161386	no
IL20RA	283.354474	-0.259923535	0.07012139	3.70676524	0.00020992	0.0127351	1.894997764	no
GPBAR1	613.746592	-0.263707525	0.09903849	2.66267722	0.00775217	0.07366371	1.132746432	no
BEST1	464.381631	-0.265067439	0.07410806	3.57676915	0.00034787	0.01635021	1.786476558	no
DLL1	677.822559	-0.265545008	0.07246276	3.68457186	0.00024775	0.01303861	1.884735252	no
DLL4	463.127933	-0.267139544	0.07649821	3.49210177	0.00047924	0.01757597	1.755080715	no
EFNA4	622.377359	-0.2674658	0.07520813	3.55634168	0.00037605	0.01635021	1.786476558	no
HLFDA	544.51843	-0.280162894	0.06604806	4.24180332	2.22E-05	0.00369552	2.432324904	no
THSD4	367.950119	-0.286633701	0.06671727	4.29624473	1.74E-05	0.00369552	2.432324904	no
JUN	871.881082	-0.288619034	0.16581598	1.7409997	0.08175377	0.26287386	0.582252597	no
SOX9	440.902097	-0.30535532	0.08283137	3.68588584	0.00022793	0.0127351	1.894997764	no
CYP1B1	470.319191	-0.311271099	0.08117811	3.83442154	0.00012586	0.01048834	1.979293037	no
TIE1	479.235651	-0.31585909	0.07748742	4.07624996	4.58E-05	0.00636893	2.195933796	no
RPS4Y1	522.799576	-0.351762368	0.40733458	0.86361349	0.38780025	0.61518749	0.210992505	no
KRT16	1220.06216	-0.450449155	0.25822201	1.74442585	0.08108486	0.26241055	0.581018706	no
PTGDR2	481.990208	-0.450570879	0.08803503	5.11808821	3.09E-07	0.00030665	3.510631584	yes

Supplementary Table 5. Pseudobulk DE gene analysis of CosMx data comparing colon biopsies in UC PRE versus HC.
Significance was set as log2fc >0.4 or <-0.4, p-adj < 0.1 and baseMean >400.

	baseMean	log2FoldChange	lfcSE	stat	pvalue	padj	-log$_{10}$(q-value)	Significance
MMP1	4356.24289	3.41523231	0.97080174	3.51795035	0.00043489	0.01709684	1.76708418	yes
MMP3	1673.18929	2.7423359	1.04598916	2.6217632	0.00874762	0.06264113	1.20314041	yes
MS4A1	5393.16287	2.57076258	0.95200461	2.70036778	0.00692629	0.05783023	1.23784507	yes
BANK1	4178.99064	2.22221574	0.74315608	2.99024095	0.00278757	0.03562572	1.4482364	yes
CD19	3401.9927	2.08618451	0.74763838	2.79036573	0.00526485	0.05089358	1.29333699	yes
CCR7	1745.05622	2.05465648	0.81784489	2.51228136	0.01199534	0.076209	1.11799376	yes
CXCR5	1502.46352	2.00830911	0.81341173	2.46899454	0.01354933	0.07918847	1.10133805	yes
FCER2	1164.9854	1.96605834	0.74627599	2.63449228	0.00842632	0.06264113	1.20314041	yes
SELL	2560.14415	1.81666133	0.73396255	2.47514171	0.01331833	0.07918847	1.10133805	yes
ZBTB16	709.078541	1.7551234	0.53162473	3.30143296	0.00096192	0.02363953	1.62636116	yes
CD1C	870.394762	1.73887084	0.64302203	2.7042166	0.00684656	0.05783023	1.23784507	yes
IL1R2	177.225688	1.73802411	0.68142389	2.55057703	0.01075448	0.07088177	1.14946544	no
IGHD	555.955821	1.63342091	0.96545353	1.69186902	0.09067095	0.26282945	0.58032597	no
OSM	540.695673	1.51049856	0.80321953	1.88055507	0.06003247	0.19343795	0.71345831	no
CCR6	1063.59855	1.43849137	0.52601261	2.73470892	0.00624355	0.05658214	1.24732067	yes
LTB	1866.54329	1.43458494	0.70964458	2.02155414	0.04322243	0.15657365	0.80528132	no
LTA	791.260317	1.43269229	0.74761231	1.91635728	0.05531963	0.18025499	0.7441127	no
CD69	1516.25796	1.43060727	0.4711908	3.03615282	0.00239618	0.03474459	1.45911277	yes
TREM1	1611.896	1.39068068	0.85440512	1.62765957	0.10359709	0.27861496	0.55499557	no
DUSP1	7987.84709	1.35970994	0.74104759	1.83484835	0.06652816	0.20308597	0.69232008	no
S1PR1	1096.07189	1.31159152	0.51232586	2.56007283	0.01046502	0.07057806	1.15133027	yes
PTGDS	7751.66235	1.30609567	0.84667142	1.54262402	0.12292203	0.2921917	0.53433212	no
FOLR3	190.086772	1.2929175	0.86339402	1.49748258	0.13426774	0.3018422	0.52022005	no
S100A12	414.708353	1.26764323	0.87080574	1.45571299	0.14547198	0.32128204	0.49311355	no
CLU	5555.10391	1.25462836	0.64012069	1.95998721	0.04999729	0.17201781	0.7644266	no
ALOX5AP	1967.02909	1.25363105	0.42166159	2.97307384	0.00294834	0.03562572	1.4482364	yes
C3	8969.74854	1.24566561	0.76643811	1.62526574	0.10410595	0.27861496	0.55499557	no
S1PR5	221.729939	1.19289581	0.8343949	1.42965377	0.15281642	0.33300625	0.47754761	no
S100A8	1912.86507	1.18893337	1.01388688	1.17264894	0.24093662	0.41344153	0.3835859	no
TRDV2	198.094352	1.15827169	0.70533365	1.64216139	0.10055656	0.27510757	0.56049745	no
IL3RA	870.508282	1.15489548	0.35083364	3.2918607	0.00099527	0.02363953	1.62636116	yes
ICOS	712.357049	1.14549785	0.43328483	2.64375248	0.00819926	0.06257329	1.203611	yes
CXCR1	657.025771	1.11373192	0.89532389	1.24394305	0.21352052	0.40050485	0.39739222	no
CTLA4	1716.01121	1.10990554	0.54576565	2.03366689	0.04198519	0.15657365	0.80528132	no
CD28	1851.17888	1.10502101	0.53587772	2.0620768	0.03920042	0.1525121	0.8166957	no
FLT3	867.918626	1.08780692	0.51245277	2.12274569	0.03377517	0.13773601	0.86095251	no
IL10	695.611225	1.06027296	0.66311524	1.59892715	0.10983679	0.27861496	0.55499557	no
CD7	46.6169971	1.05645492	0.45127521	2.34104353	0.01922993	0.09962906	1.00161399	no
HAND2	636.828897	1.04846807	0.49761037	2.10700608	0.03511705	0.1395061	0.85540681	no
TNF	1069.46083	1.03661032	0.55798183	1.85778509	0.06319954	0.19713568	0.70523476	no
ITGAX	3566.65599	1.03480904	0.34736542	2.97902146	0.00289171	0.03562572	1.4482364	yes
TNFSF9	233.517645	1.03395086	0.64472639	1.60370489	0.10877912	0.27861496	0.55499557	no
GZMK	1222.45935	1.00616956	0.64451838	1.56111849	0.1184958	0.28636484	0.54308031	no
ABCC9	636.055213	0.99795395	0.42726247	2.33569301	0.01950725	0.09962906	1.00161399	yes
CD80	589.995259	0.99615144	0.45187814	2.20446922	0.02749136	0.12457024	0.90458571	no
IL7R	6618.94046	0.99241457	0.51755142	1.9175188	0.05517206	0.18025499	0.7441127	no
KLF2	1876.11788	0.97479619	0.39898545	2.44318732	0.01455818	0.0827818	1.08206513	yes
GATA3	338.898803	0.96338933	0.50006999	1.92650897	0.05404085	0.18025499	0.7441127	no
IL18R1	1253.08496	0.95463137	0.29733514	3.21062405	0.00132447	0.02400603	1.61967957	yes
PTPRC	13970.3792	0.94880185	0.51384207	1.84648536	0.06482176	0.19998204	0.69900901	no
CD8B	1926.92698	0.93983684	0.64191522	1.46411364	0.1431629	0.31936339	0.49571487	no
TNFRSF13B	1217.16313	0.93819237	0.56730659	1.65376602	0.09817506	0.27510757	0.56049745	no
ACKR1	1261.60761	0.92205745	0.49366497	1.86777978	0.06179277	0.19692202	0.70570571	no
JAK3	4521.55009	0.9179017	0.57851788	1.58664362	0.11259338	0.27907762	0.554275	no
TREM2	853.424568	0.89808523	0.75314965	1.19243929	0.23308904	0.41144595	0.38568721	no
IL1B	1957.75188	0.8847266	0.82825214	1.06818511	0.28543702	0.45987076	0.33736421	no
TRAC	6948.11473	0.87758204	0.62512999	1.4038393	0.16036671	0.3384902	0.4704539	no
TNFSF15	451.778802	0.87166786	0.50703726	1.71913967	0.08558894	0.25071509	0.60081953	no
CCL4	2162.1315	0.85204854	0.53312085	1.59822775	0.1099923	0.27861496	0.55499557	no
TIGIT	2064.10891	0.84057996	0.52106889	1.61318394	0.10670455	0.27861496	0.55499557	no
IFNG	487.783311	0.83190631	0.54705245	1.52070665	0.12833347	0.29773365	0.52617208	no
ADGRB3	556.980907	0.83071509	0.54559302	1.5225911	0.12786104	0.29773365	0.52617208	no
FCN1	684.105916	0.81193855	0.64093968	1.26679401	0.20522895	0.40050485	0.39739222	no
MMRN1	1987.36669	0.80819908	0.50039553	1.61512049	0.10628461	0.27861496	0.55499557	no
TRAV1-2	415.503525	0.80491034	0.66661089	1.20746653	0.22725253	0.41144595	0.38568721	no
KCNJ8	882.613362	0.78018257	0.60164458	1.29674995	0.19471724	0.38915281	0.40987983	no
SERPINF1	6266.924	0.76678158	0.35341939	2.16960813	0.03003655	0.12810694	0.89242734	no
NOTCH4	739.349007	0.76655003	0.46664964	1.64266713	0.10045182	0.27510757	0.56049745	no
CCDC80	3139.17565	0.76099121	0.64354512	1.1824986	0.23700792	0.41144595	0.38568721	no
SOX8	492.621655	0.75053481	0.63652724	1.1791087	0.23835489	0.41144595	0.38568721	no
CLEC9A	681.956717	0.74862995	0.57308031	1.30632642	0.19144157	0.38554206	0.41392824	no
RTKN2	1858.83013	0.73032349	0.46440622	1.57259627	0.11581233	0.28462353	0.5457292	no
LYVE1	1537.22231	0.70698892	0.56229526	1.25732683	0.20863531	0.40050485	0.39739222	no
CD3E	3772.72142	0.7020892	0.49637746	1.41442604	0.15723685	0.33528446	0.47458658	no
STAT4	1540.00042	0.69899308	0.33006453	2.11774669	0.03419653	0.13773601	0.86095251	no
PYY	288.419992	0.68242214	0.61560274	1.10854304	0.26762736	0.4460456	0.35062074	no
NTRK2	1115.41481	0.68076118	0.63520649	1.07171636	0.28384745	0.45986458	0.33737004	no
BASP1	4239.58352	0.67774494	0.40166368	1.68734437	0.09153715	0.26282945	0.58032597	no
CSPG4	2330.574	0.66435397	0.604946	1.09820376	0.27211553	0.4509343	0.34588673	no
CD40	2964.34461	0.6577479	0.43156979	1.52408234	0.12748814	0.29773365	0.52617208	no
FYB1	3987.67501	0.65261179	0.53160444	1.22762668	0.21958714	0.40050485	0.39739222	no
MT1G	237.253781	0.63545611	0.80697033	0.78745907	0.43101318	0.61765959	0.20925081	no
TIMP1	4973.32528	0.62874391	0.77036966	0.81615871	0.41440937	0.60089358	0.22120243	no
IRF8	4519.44282	0.61888905	0.34025876	1.81887763	0.0689301	0.20822635	0.68146431	no
CDH5	2144.0873	0.60618286	0.37617423	1.61144178	0.10708347	0.27861496	0.55499557	no
XCR1	582.639676	0.5999356	0.50622852	1.18510826	0.23597465	0.41144595	0.38568721	no
CD3D	2876.52694	0.59369513	0.50158145	1.18364651	0.23655302	0.41144595	0.38568721	no
TRGC1	907.388359	0.5845915	0.53969721	1.08318422	0.27872666	0.45410523	0.34284349	no
CD86	2135.88046	0.58200204	0.42572694	1.36707823	0.17160079	0.35045231	0.45537107	no
SH2D6	207.044499	0.56380102	0.70582219	0.7987862	0.42441439	0.61233917	0.21300796	no
NEUROD1	791.465371	0.56028891	0.62252389	0.90002796	0.36810537	0.56184504	0.25038345	no
FXYD5	5369.07009	0.55419012	0.31682914	1.74917659	0.0802605	0.23750556	0.62432622	no
S100A9	3473.14706	0.53585536	0.96858096	0.55323756	0.58010075	0.75007895	0.12489302	no
NOTCH3	2021.86666	0.52916021	0.37108326	1.42598783	0.15387185	0.33300625	0.47754761	no
KLRF1	670.003887	0.52592936	0.41736479	1.26011913	0.20762639	0.40050485	0.39739222	no
CLDN5	889.083778	0.52139784	0.67144331	0.77653293	0.43743439	0.61880962	0.20844294	no
CSF3R	1189.80923	0.51914081	0.78815178	0.65868126	0.51010047	0.69125764	0.16036005	no
LEF1	3583.37577	0.48364171	0.34012302	1.42196113	0.15503754	0.3330436	0.47749891	no

CACNA1A	960.236156	0.48163638	0.65663091	0.73349636	0.46325575	0.64279505	0.19192747	no
IGHE	97.0412267	0.47857994	1.06351777	0.44999713	0.65271251	0.80206198	0.09579207	no
TRGV9	716.779404	0.45828269	0.58639262	0.78152875	0.43449158	0.61765959	0.20925081	no
TNFSF13B	1863.35862	0.4570269	0.39421808	1.15932508	0.2463237	0.41774195	0.37909191	no
MRC1	3356.91078	0.45282759	0.50084353	0.90412987	0.36592654	0.56147459	0.25066989	no
ZFP36L1	12275.9423	0.43886158	0.59282452	0.74028917	0.45912455	0.64012557	0.19373482	no
CRYAB	2098.64151	0.43353543	0.41901327	1.034658	0.30082866	0.48199067	0.31696137	no
TRGC2	1582.5655	0.42894772	0.39474646	1.0866411	0.27719545	0.45410523	0.34284349	no
IL1R1	6092.98725	0.40521105	0.43358735	0.93455458	0.3500179	0.5428085	0.26535336	no
OSMR	2661.85795	0.39047101	0.3266134	1.19551433	0.23188614	0.41144595	0.38568721	no
CCSER1	2486.56767	0.37726307	0.42810619	0.88123713	0.37818948	0.5712237	0.24319378	no
VWF	2640.62439	0.36738076	0.4452452	0.82512008	0.40930342	0.59647232	0.2244097	no
FOXP3	506.931456	0.36732149	0.63264665	0.58061082	0.56150278	0.73622147	0.13299152	no
CCL23	584.543271	0.36214927	0.50250257	0.72069139	0.47109941	0.6474826	0.1887719	no
CYTH1	4619.9569	0.35658088	0.42331242	0.84235866	0.39958722	0.58525401	0.2326556	no
IL1RL1	1153.38695	0.34880068	0.38443592	0.90730512	0.36424547	0.56147459	0.25066989	no
VCAN	4267.30924	0.33719796	0.53011325	0.63608665	0.52471994	0.70776178	0.15011289	no
TGFBR2	7579.67825	0.33570305	0.44261746	0.75844965	0.44818185	0.63093561	0.20001496	no
ALOX5	3354.62151	0.33357323	0.4450963	0.74944058	0.4535917	0.63546663	0.19690725	no
TNFAIP3	7131.71415	0.32997486	0.37882781	0.87104181	0.38373132	0.57659111	0.23913206	no
CD8A	1127.59325	0.32053351	0.51971139	0.61675291	0.53739772	0.71818128	0.14376592	no
FCGR3B	2307.78612	0.29779736	0.66919248	0.44501002	0.65631251	0.8025054	0.09555204	no
NFKBIA	6678.05303	0.28819199	0.50063273	0.57565551	0.56484805	0.73622147	0.13299152	no
CD1D	1611.36803	0.26645507	0.26290255	1.01351267	0.31081535	0.49525522	0.30517094	no
TRDC	982.418259	0.2577235	0.46832779	0.5503058	0.58210965	0.75007895	0.12489302	no
CD79A	6817.54988	0.24730059	0.76989811	0.3212121	0.74804966	0.86428049	0.06334529	no
HPGDS	935.045685	0.24320181	0.45826619	0.53069989	0.59562676	0.7561008	0.1214203	no
KLRB1	1985.69773	0.24102815	0.45473205	0.53004435	0.59608118	0.7561008	0.1214203	no
TNFRSF1B	5545.37429	0.23719667	0.35329017	0.67139335	0.50196998	0.68343331	0.16530386	no
MCAM	3740.74407	0.2158931	0.41229661	0.5236354	0.60053215	0.7561008	0.1214203	no
CD4	3278.25061	0.21539046	0.37351612	0.57665641	0.56417159	0.73622147	0.13299152	no
COL1A2	24033.8077	0.21354201	0.60721746	0.35167303	0.72508349	0.84447474	0.07341333	no
GLIS3	1096.79648	0.20364274	0.48740297	0.41781186	0.67608468	0.8113261	0.09080455	no
BATF	409.524264	0.20095653	0.32287329	0.62240061	0.53367848	0.71651278	0.14477606	no
GATA2	2043.52493	0.1980654	0.48013069	0.41252393	0.67995544	0.81146946	0.09072782	no
MEF2C	3166.64943	0.19467715	0.3740221	0.52049639	0.60271764	0.7561008	0.1214203	no
C7	2206.58324	0.18843596	0.74359751	0.25341123	0.79995045	0.88760144	0.051782	no
S100B	1431.59288	0.18807367	0.35793906	0.5254349	0.5992809	0.7561008	0.1214203	no
COL1A1	27985.0535	0.18546701	0.61483639	0.30165263	0.76291689	0.86763097	0.06166495	no
FCER1G	6285.04915	0.17552422	0.5462375	0.32133316	0.74795793	0.86428049	0.06334529	no
SPARC	16800.0697	0.17186035	0.66376984	0.25891557	0.79570038	0.88760144	0.051782	no
IL10RA	5656.27472	0.16564736	0.4637217	0.35721287	0.72093245	0.84447474	0.07341333	no
LILRA4	1838.12172	0.15420247	0.33349447	0.46238389	0.64380605	0.79448406	0.09991481	no
GZMB	859.258529	0.15061619	0.59322533	0.25389373	0.79957766	0.88760144	0.051782	no
CTSL	5683.08235	0.13764451	0.44727845	0.30773786	0.75828181	0.86763097	0.06166495	no
COL6A2	9314.92282	0.13700599	0.66664261	0.20551639	0.83716869	0.90252387	0.0445413	no
LAMP3	3485.7638	0.13614552	0.30942409	0.43999651	0.65993963	0.8025054	0.09555204	no
COL3A1	35487.2811	0.13468081	0.62056665	0.21702876	0.82818593	0.90252387	0.0445413	no
TNFRSF11B	1906.35102	0.13279169	0.77956772	0.17034015	0.86474264	0.91523856	0.03846569	no
SPARCL1	10113.9213	0.12963438	0.56263457	0.23040601	0.8177763	0.90044036	0.04554505	no
APOE	2353.41664	0.12448485	0.54618643	0.22791641	0.81971122	0.90044036	0.04554505	no
OGN	1294.86949	0.1142031	0.69220798	0.1649838	0.86895674	0.91538724	0.03839515	no
FCGR3A	1237.2805	0.10894855	0.52753492	0.20652387	0.83638172	0.90252387	0.0445413	no
NKG7	583.099906	0.10144009	0.56068765	0.18092086	0.85642969	0.90976048	0.04107293	no
MAF	9653.17113	0.09874499	0.39358458	0.25088633	0.80190199	0.88760144	0.051782	no
CCL8	795.427419	0.09578607	0.59076391	0.16213934	0.87119613	0.91538724	0.03839515	no
HMGB2	7935.80976	0.09423443	0.45260241	0.20820577	0.8350683	0.90252387	0.0445413	no
TGFBR1	4446.99339	0.08257963	0.28164549	0.29320415	0.76936611	0.87154755	0.05970892	no
TYROBP	1596.51563	0.06204919	0.49520551	0.12529988	0.90028615	0.93243922	0.03037947	no
IRF7	100.856079	0.05514205	0.52970716	0.10409912	0.91709069	0.94310745	0.02543883	no
TCF4	2331.13703	0.04918573	0.44556827	0.11038877	0.91210106	0.94131426	0.02626536	no
CLEC10A	1867.66406	0.04373027	0.48071185	0.09096982	0.92751657	0.95045868	0.02206676	no
ASPN	1211.93258	0.00630214	0.48591406	0.01296965	0.98965201	0.99706356	0.00127716	no
HMGN2	32112.0311	-0.0016114	0.29878793	-0.0053931	0.99569694	0.99706356	0.00127716	no
KLRC2	1351.28228	-0.001848	0.50213533	-0.0036803	0.99706356	0.99706356	0.00127716	no
TYK2	5738.73775	-0.0037923	0.32210166	-0.0117737	0.99060615	0.99706356	0.00127716	no
LST1	515.700859	-0.0069104	0.40282372	-0.017155	0.98631298	0.99706356	0.00127716	no
TRPM5	803.841932	-0.0183568	0.70743955	-0.0259483	0.97929859	0.99647927	0.00153173	no
PLP1	686.667113	-0.026776	0.53483156	-0.0500643	0.96007117	0.98035436	0.00861691	no
RGCC	1611.68025	-0.0466933	0.34133816	-0.1367948	0.89119301	0.92889968	0.03203118	no
PDGFRA	6603.12943	-0.0586203	0.43855306	-0.1336674	0.89366556	0.92889968	0.03203118	no
TLE4	3245.07062	-0.0782954	0.29311465	-0.2671154	0.78938028	0.88760144	0.051782	no
TPSB2	1488.32088	-0.0801921	0.54909061	-0.1460453	0.88388559	0.92536759	0.03368572	no
NCAM1	1040.62283	-0.083402	0.43981902	-0.189628	0.84960061	0.9061102	0.04281898	no
JAK2	5120.8998	-0.0853257	0.32079826	-0.2659794	0.79025505	0.88760144	0.051782	no
GZMA	1227.09625	-0.0934198	0.49353847	-0.1892857	0.84986888	0.9061102	0.04281898	no
HLA-DRA	16413.3057	-0.1051219	0.54481295	-0.1929505	0.84699772	0.9061102	0.04281898	no
PECAM1	9946.17504	-0.1106539	0.49996844	-0.2213219	0.82484183	0.90252387	0.0445413	no
TOP2A	3752.54684	-0.1131834	0.37517189	-0.3016841	0.7628929	0.86763097	0.06166495	no
IFITM2	2616.48229	-0.1324943	0.37363635	-0.3546076	0.72288358	0.84447474	0.07341333	no
S100A4	1685.74879	-0.1386095	0.36706203	-0.3776186	0.70571394	0.83533487	0.07813939	no
MS4A7	5283.47913	-0.1636338	0.34295521	-0.4771287	0.63327051	0.78482242	0.1052286	no
TUBB	8071.50028	-0.1658269	0.28901687	-0.5737619	0.56612893	0.73622147	0.13299152	no
CPA3	3586.24516	-0.177941	0.35609713	-0.499698	0.61728773	0.76829803	0.11447028	no
JAK1	11059.4691	-0.1796985	0.43143981	-0.4165089	0.67703764	0.8113261	0.09080455	no
CCL5	3433.52566	-0.1812969	0.50719924	-0.3574471	0.72075711	0.84447474	0.07341333	no
CD14	5297.90012	-0.1987213	0.45767114	-0.4342011	0.6641424	0.8025054	0.09555204	no
MS4A2	1147.41002	-0.2076834	0.40140225	-0.5173947	0.60488064	0.7561008	0.1214203	no
IL13RA2	854.347269	-0.2370598	0.76736994	-0.308925	0.75737855	0.86763097	0.06166495	no
PLVAP	5503.58908	-0.2435467	0.44543707	-0.546759	0.58454429	0.75007895	0.12489302	no
CD44	22491.6211	-0.255122	0.43907643	-0.5810424	0.56121191	0.73622147	0.13299152	no
PHLDA2	358.524149	-0.2586657	0.59073371	-0.4378719	0.66147912	0.8025054	0.09555204	no
TGFB1	20332.6947	-0.266264	0.67572625	-0.3940412	0.69355064	0.82430199	0.08391365	no
QDPR	2915.60647	-0.2706092	0.31640799	-0.855254	0.39241056	0.58406564	0.23353834	no
TPH1	2162.42886	-0.3166271	0.53314998	-0.5938799	0.55259241	0.7351	0.13365358	no
CPE	2511.08592	-0.3550456	0.41644344	-0.8525661	0.39389996	0.58406564	0.23353834	no
NPC2	5980.98134	-0.4386594	0.28939611	-1.5157749	0.12957628	0.29823112	0.52544703	no
CAV1	3118.44421	-0.443147	0.46202055	-0.9591501	0.33748315	0.52902765	0.27652163	no
UBE2C	1475.25515	-0.4443065	0.35905932	-1.2374181	0.21593189	0.40050485	0.39739222	no

INSM1	994.016817	-0.4670687	0.55342088	-0.8439665	0.39868813	0.58525401	0.2326556	no
KIT	2108.29862	-0.4674724	0.38820587	-1.2041869	0.22851733	0.41144595	0.38568721	no
RORC	2441.77639	-0.4745409	0.4373544	-1.0850261	0.2779101	0.45410523	0.34284349	no
SOX6	1718.78727	-0.475219	0.38243505	-1.2426137	0.21401024	0.40050485	0.39739222	no
WNT5A	3349.41961	-0.4762339	0.60852428	-0.7826045	0.43385938	0.61765959	0.20925081	no
PROX1	1646.78975	-0.4777906	0.4259989	-1.1215772	0.26204226	0.43926159	0.35727677	no
POSTN	6799.184	-0.4916098	0.57765857	-0.8510388	0.39474781	0.58406564	0.23353834	no
CD209	3280.26477	-0.4918763	0.35589109	-1.3820978	0.16694168	0.3482956	0.45805201	no
RGS5	5353.96751	-0.4959407	0.49747498	-0.9969158	0.31880538	0.50246501	0.29889418	no
STMN1	7112.84912	-0.5074335	0.44907573	-1.1299508	0.25849698	0.43583793	0.36067498	no
FABP5	12212.1062	-0.5161133	0.40971007	-1.2597038	0.20777625	0.40050485	0.39739222	no
MKI67	7800.26954	-0.5165899	0.41812996	-1.2354769	0.21665308	0.40050485	0.39739222	no
TPSAB1	676.972831	-0.5360763	0.74382342	-0.7207037	0.47109183	0.6474826	0.1887719	no
ACTG1	105448.403	-0.5449691	0.41089417	-1.3263003	0.18474025	0.37464806	0.42637651	no
CALD1	12046.6369	-0.5498026	0.58381599	-0.9417395	0.34632603	0.53997068	0.26762982	no
BEST4	551.312459	-0.5546551	0.80119155	-0.6922877	0.48875666	0.66858222	0.17484518	no
HLA-DRB1	9531.98169	-0.592694	0.66348814	-0.8933	0.37169654	0.564356	0.24844685	no
A2M	18885.8881	-0.618585	0.61342017	-1.0084197	0.313253	0.49641187	0.30415785	no
APP	28138.247	-0.6676403	0.53447921	-1.2491418	0.21161323	0.40050485	0.39739222	no
IGHA2	769.55433	-0.6717744	0.54433867	-1.2341112	0.21716148	0.40050485	0.39739222	no
CD59	17776.8393	-0.6730311	0.53961026	-1.247254	0.21230437	0.40050485	0.39739222	no
CCL20	1862.03197	-0.7007523	0.51243115	-1.3675052	0.17146701	0.35045231	0.45537107	no
TNFRSF1A	6989.81671	-0.7081066	0.45589296	-1.55323	0.12036819	0.28848575	0.53987564	no
DUSP23	915.194974	-0.7205409	0.38787857	-1.8576455	0.06321937	0.19713568	0.70523476	no
TM4SF1	4506.98939	-0.7409377	0.63388519	-1.1688831	0.24245074	0.41359244	0.38342741	no
S100A11	10790.127	-0.7597886	0.50691505	-1.4988481	0.13391305	0.3018422	0.52022005	no
TUBA1B	57892.8789	-0.7720671	0.4602516	-1.6774892	0.09344686	0.26568225	0.57563746	no
FCER1A	1467.9427	-0.7747403	0.59905614	-1.2932682	0.19591831	0.38915281	0.40987983	no
MZB1	15536.3626	-0.7918994	0.64361794	-1.2303874	0.21855209	0.40050485	0.39739222	no
F3	7352.51271	-0.798783	0.67128762	-1.1899265	0.23407527	0.41144595	0.38568721	no
C1QA	3218.33667	-0.8074313	0.5083546	-1.5883231	0.1122133	0.27907762	0.554275	no
SEC61B	2324.72837	-0.8806766	0.56268317	-1.5651376	0.11755066	0.28636484	0.54308031	no
PLAC8	26890.5595	-0.8917227	0.61373416	-1.4529461	0.14623872	0.32128204	0.49311355	no
ASCL2	1023.18462	-0.8928285	0.63706736	-1.4014664	0.16107465	0.3384902	0.4704539	no
IL32	5750.57097	-0.9293315	0.46063413	-2.0175047	0.04364287	0.15657365	0.80528132	no
NUPR1	5388.12845	-0.9567296	0.40986472	-2.3342571	0.01958226	0.09962906	1.00161399	yes
GSN	26004.6796	-0.9808445	0.49027272	-2.0006099	0.04543444	0.15874684	0.7992949	no
TMEM176A	12356.3759	-0.9871753	0.40027204	-2.4662609	0.01365318	0.07918847	1.10133805	yes
LTBR	4714.62655	-1.0182869	0.4645796	-2.191846	0.02839063	0.12520921	0.90236374	no
ANXA2	51690.1993	-1.0272292	0.5093755	-2.0166444	0.04373264	0.15657365	0.80528132	no
JUN	13975.4846	-1.0465046	0.54545081	-1.9186049	0.05503435	0.18025499	0.7441127	no
C1QB	2214.65925	-1.047101	0.58023684	-1.8046097	0.07113579	0.212674	0.6722856	no
TINAGL1	3562.7049	-1.0591709	0.5142761	-2.0595374	0.03944278	0.1525121	0.8166957	no
CST3	10473.5316	-1.0633765	0.36108145	-2.9449768	0.00322979	0.03624763	1.44072037	yes
MGLL	6414.94017	-1.0875673	0.50196453	-2.1666218	0.0302637	0.12810694	0.89242734	no
LYZ	27013.2345	-1.0986711	0.54005673	-2.0343623	0.04191508	0.15657365	0.80528132	no
LGR5	1818.8912	-1.1389743	0.76046295	-1.497738	0.13420133	0.3018422	0.52022005	no
TMEM176B	19200.2275	-1.1672661	0.4409675	-2.647057	0.00811957	0.06257329	1.203611	yes
SSR4	10887.252	-1.2241086	0.61043132	-2.0053175	0.04492911	0.15874684	0.7992949	no
C1QC	4069.13535	-1.2400276	0.55975488	-2.2153046	0.02673916	0.12457024	0.90458571	no
SELENOP	34314.8266	-1.2435086	0.51776171	-2.4017006	0.01631906	0.09101013	1.04091027	yes
INAVA	4294.78486	-1.2559343	0.59033848	-2.1274817	0.03338008	0.13773601	0.86095251	no
REG4	15966.2714	-1.3432509	0.97524079	-1.3773531	0.1684031	0.348835	0.45737994	no
TNFRSF17	2792.8458	-1.3586279	0.61541533	-2.2076601	0.02726798	0.12457024	0.90458571	no
MS4A8	1287.98924	-1.3637374	0.63025459	-2.1637881	0.03048062	0.12810694	0.89242734	no
TNFRSF11A	7263.14539	-1.4018091	0.60910519	-2.3014236	0.0213677	0.10502768	0.97869622	no
OLFM4	25435.528	-1.4177527	0.88830737	-1.5960159	0.11048524	0.27861496	0.55499557	no
NOS2	4415.26132	-1.4378824	0.6009771	-2.3925744	0.01673064	0.091545	1.03836537	yes
CA7	1298.27157	-1.4865783	0.75985711	-1.9563918	0.05041901	0.17201781	0.7644266	no
SOX9	4574.56688	-1.5105352	0.66764838	-2.2624711	0.02366831	0.11252149	0.94876452	no
MYH11	20743.4326	-1.5204588	0.75223562	-2.0212534	0.04325355	0.15657365	0.80528132	no
OTOP2	738.768648	-1.528389	0.92993831	-1.6435381	0.10027165	0.27510757	0.56049745	no
CXCL14	8732.76611	-1.5309708	0.66100733	-2.3161177	0.02055184	0.10275922	0.98817918	no
CEACAM1	21259.322	-1.6170256	0.70494001	-2.2938485	0.0217992	0.10536281	0.97731265	no
CEACAM6	23845.8847	-1.6680934	0.70067926	-2.3806804	0.0172807	0.09280374	1.03243453	yes
MUC1	8206.29814	-1.7108829	0.52490528	-3.2594127	0.00111643	0.02363953	1.62636116	yes
KRT8	97907.0904	-1.7241713	0.58818072	-2.9313632	0.00337478	0.03624763	1.44072037	yes
S100A16	8527.96765	-1.7641203	0.63524246	-2.7770818	0.00548494	0.0513107	1.28979208	yes
ITM2C	59915.0621	-1.8161916	0.56167577	-3.2335231	0.00122273	0.02363953	1.62636116	yes
S100P	5597.95965	-1.8902844	0.86298947	-2.1903911	0.02849589	0.12520921	0.90236374	no
DDC	5190.05703	-1.894338	0.6678015	-2.8366783	0.00455855	0.04558552	1.34117306	yes
ADAMDEC1	10264.2272	-1.9346004	0.57903053	-3.3411025	0.00083446	0.02363953	1.62636116	yes
FABP2	5896.1976	-2.0219118	0.80813417	-2.5019507	0.01235111	0.076209	1.11799376	yes
TFF3	10832.0483	-2.022793	0.70427139	-2.8721783	0.00407653	0.0422212	1.37446948	yes
PIGR	117128.085	-2.0292558	0.75601726	-2.6841395	0.00727168	0.05857739	1.23226999	yes
AGR2	47284.3389	-2.0361977	0.81159554	-2.5088823	0.01211138	0.076209	1.11799376	yes
EPCAM	57971.1687	-2.1039525	0.70352997	-2.9905655	0.00278461	0.03562572	1.4482364	yes
SPINK1	10616.1579	-2.1851581	0.61445418	-3.5562588	0.00037617	0.01709684	1.76708418	yes
LEFTY1	3988.95609	-2.2570835	0.86228618	-2.6175574	0.00885616	0.06264113	1.20314041	yes
C15orf48	26739.1836	-2.4489055	0.67213804	-3.6434563	0.000269	0.01709684	1.76708418	yes
MUC2	12916.4213	-2.4902386	0.92305577	-2.6978203	0.00697951	0.05783023	1.23784507	yes
WFDC2	1460.19394	-2.4986149	0.85141237	-2.9346706	0.00333902	0.03624763	1.44072037	yes
SPINK4	10731.9425	-2.6137551	1.01448594	-2.5764331	0.00998255	0.06892715	1.16160966	yes
LYPD8	8786.16714	-2.6434257	0.86153923	-3.0682593	0.0021531	0.03286306	1.48329199	yes
SLC26A2	20711.8808	-2.6730985	0.82422152	-3.2431797	0.00118204	0.02363953	1.62636116	yes
GPR15	3900.81575	-2.6848083	0.75945183	-3.5351923	0.00040748	0.01709684	1.76708418	yes
ITLN1	13676.6227	-2.8477454	0.90704111	-3.139599	0.00169179	0.02725666	1.56452743	yes
LGALS4	94777.0134	-2.9341603	0.83920226	-3.4963685	0.00047164	0.01709684	1.76708418	yes
PHGR1	74019.8639	-3.0317675	0.81278179	-3.7301125	0.00019139	0.01709684	1.76708418	yes
GUCA2A	1260.16858	-3.1077626	0.93260398	-3.3323498	0.00086116	0.02363953	1.62636116	yes
FABP1	63313.6438	-3.3477142	0.90835847	-3.6854549	0.00022829	0.01709684	1.76708418	yes
CA4	10499.4036	-3.5330824	0.93494966	-3.7789012	0.00015752	0.01709684	1.76708418	yes
AQP8	10362.8134	-3.6448886	1.15982052	-3.1426316	0.00167436	0.02725666	1.56452743	yes

Supplementary Table 6. Pseudobulk DE gene analysis of Xenium data comparing colon biopsies in UC PRE Non-Responders versus UC PRE Responders. Significance was set as log2fc >0.4 or <-0.4, p-adj < 0.1 and baseMean >500.

Gene Signature	Gene list	Numeric ID
Xenium_HC	*AQP8*	7994252
	GUCA2A	7915404
	SLC26A2	8109194
	BEST4	7915598
	OTOP2	8009705
	DDC	8139640
	MT1G	8001531
	CA7	7996331
	TRPM5	7945742
	FABP1	8053654
	JUN	7916609
	FABP2	8102523
	CLDN5	8074473
	LGALS4	8036591
	PIGR	7923929
	TREM2	8126279
	DUSP1	8115831
	C15ORF48	7983478
	MS4A8	7940323
	EPCAM	8041853
	IL32	7992828
	C7	8105084
	KRT8	7963567
	PHLDA2	7945781
	NTRK2	8156134
	CACNA1A	8034643
	PLP1	8169061
	GATA2	8090469
	TRGV9	8139107
	CEACAM1	8037205
	HPGDS	8101780
	CD8B	8044154
	RORC	7920082
	NCAM1	7943892
	CCL23	8014361
	MGLL	8090433
	CLEC9A	7953924
	IL10	7923907
	FCER1A	7906443
	TINAGL1	7899627
	TPH1	7946946
	INAVA	7908639
	CCL8	8006453
	CSPG4	7990545
	TNFSF9	8025053
	ADGRB3	8120468
	FABP5	7948420
	GLIS3	8159900
	CCSER1	8096425
	TRGC1	8180366
	SOX6	7946757
	KLRC2	7961182
	NUPR1	8000574
	LILRA4	8039246
	CST3	8065403
	TRGC2	8180366
	MS4A2	7940226
	IL1RL1	8044021
	HMGN2	7899187
	S100B	8071036
Xenium_UC_PRE	*S100A12*	7920238
	LTB	8124950
	SELL	7896687
	PTGDS	8159521
	JAK3	8035351
	MZB1	8114511
	BANK1	8096617
	CD19	7994487
	C3	8033257
	CD79A	8029136
	TIMP1	8167185
	S100A9	7905571
	MS4A1	7940287
	S100A8	7920244
	NOS2	8013536
	PTPRC	7908553
	SSR4	8170775
	CLU	8149927
	PECAM1	8017599
	COL1A1	8016646
	BASP1	8104601
	IL7R	8104901
	MRC1	7926410

	ALOX5	7927215
	TCF4	8023415
	SERPINF1	8003667
	CD1D	7906330
	VWF	7960464
	CD44	7939341
	OSMR	8105040
	MEF2C	7896727
CosMx_UC_PRE	*REG1A*	8042986
	OLFM4	7969288
	KRT20	8015124
	LCN2	8158167
	S100A6	7920258
	MALAT1	7941272
	AGR2	8138381
	B2M	7983360
	CEACAM6	8029098
	S100A10	7920123
	ANXA2	7989335
	COL3A1	8046922
	TIMP1	8167185
	PLAC8	8101429
	COL1A1	8016646
	XBP1	8075182
	LGALS3	7974461
	DMBT1	7931108
	SOD2	8130556
	MZB1	8114511
	CD63	7963911
	SH3BGRL3	7899153
	PFN1	8011759
	SELENOP	8111915
	EZR	8130505
	MYL12A	8019924
	HSP90B1	7958130
	ENO1	7912198
	CSTB	8070701
	LYZ	7957023
	SOD1	8068168
	SERPINA1	7981068
	TPT1	7971373
	FAU	7893603
	IGFBP7	8100541
	ANXA4	8042468
	VIM	7926368
	COL1A2	8134263
	ARF1	7892830
	PSAP	7934196
	PGK1	8168500
	CALM3	8029831
	GSTP1	7941936
	CALM1	8052010
	CTNNB1	8079021
	COL6A3	8059905
	ITM2B	7969003
	SRGN	7927964
	RACK1	8116520
	ATP5F1E	8067288
	RBM47	8099967
	IRF4	8116559
Xenium UC PRE R	*AQP8*	7994252
	CA4	8008900
	FABP1	8053654
	GUCA2A	7915404
	LGALS4	8036591
	ITLN1	7921690
	GPR15	8081214
	SLC26A2	8109194
	SPINK4	8154779
	WFDC2	8063000
	MUC2	7937560
	C15orf48	7983478
	LEFTY1	7924663
	SPINK1	8114964
	EPCAM	8041853
	AGR2	8138381
	PIGR	7923929
	TFF3	8070567
	FABP2	8102523
	ADAMDEC1	8145317
	DDC	8139640
	ITM2C	8048995
	S100A16	7920291
	KRT8	7963567

	MUC1	7920642
	CEACAM6	8029098
	NOS2	8013536
	SELENOP	8111915
	TMEM176B	8143790
	CST3	8065403
	TMEM176A	8137264
	NUPR1	8000574
Xenium UC PRE NR	*CD1C*	7906348
	ZBTB16	7943984
	SELL	7896687
	FCER2	8033420
	CXCR5	7944335
	CCR7	8015031
	CD19	7994487
	BANK1	8096617
	MS4A1	7940287
	MMP3	7951284
	MMP1	7951271
	CCR6	8123364
	CD69	7896693
	S1PR1	7903393
	ALOX5AP	7968344
	ICOS	8047702
	IL3RA	8165752
	CD7	8019478
	ITGAX	7995128
	ABCC9	7961710
	KLF2	8026564
	IL18R1	8044035
Xenium GALT B DC S4_fibroblast	*CD19*	7994487
	MS4A1	7940287
	BANK1	8096617
	SELL	7896687
	CD79A	8029136
	CCR7	8015031
	LTB	8124950
	C3	8033257
	TNFSF13B	7969986
	IRF8	7997712
	PTGDS	8159521
	CD1C	7906348
	HLA-DRA	8118548
	CD86	7896700
	ITGAX	7995128
	FCER1A	7906443
	CLEC10A	8012013
	CD1D	7906330
	CLEC9A	7953924
	XCR1	8086595
	FLT3	7970737
	HLA-DRB1	8125445
	CD40	8063156
	CD209	8033445
	LAMP3	7893231
Xenium IAF-Monocyte-Neutrophil	*IL1R1*	8043995
	TIMP1	8167185
	CD44	7939341
	IL13RA2	8174598
	MMP1	7951271
	MMP3	7951284
	OSMR	8105040
	NFKBIA	7978644
	TNFAIP3	8122265
	TNFRSF11B	8152512
	S100A8	7920244
	S100A9	7905571
	FCGR3B	7921873
	CSF3R	7914950
	BASP1	8104601
	OSM	8075316
	VCAN	8106743
	LYZ	7957023
	FCN1	8165011
	CST3	8065403
	CD14	8114612
	HLA-DRA	8118548
	HLA-DRB1	8125445
	TREM1	8126303

Supplementary Table 7. iSCST gene signatures used for Gene Set Enrichment Analysis (GSEA). Numeric ID, Affymetrix numeric probe identifier corresponding to each gene.