

Supplemental Table S2. Session info describing fgSEA gene set enrichment analysis using the Hallmark database

```
> sessionInfo()
R version 4.2.2 (2022-10-31)
Platform: x86_64-apple-darwin17.0 (64-bit)
Running under: macOS Monterey 12.3

Matrix products: default
LAPACK: /Library/Frameworks/R.framework/Versions/4.2/Resources/lib/libRlapack.dylib
```

```
locale:
[1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
```

```
attached base packages:
[1] grid      stats4    stats     graphics  grDevices  utils
     datasets  methods  base
```

```
other attached packages:
 [1] factoextra_1.0.7           UCell_2.2.0
biomaRt_2.54.0             Matrix_1.5-3
 [5] hdf5r_1.3.7                SeuratObject_4.1.3
Seurat_4.3.0              VennDiagram_1.7.3
 [9] futile.logger_1.4.3       gdata_2.18.0.1
colorRamps_2.3.1         fgsea_1.24.0
[13] msigdb_7.5.1              forcats_0.5.2
stringr_1.5.0            purrr_0.3.5
[17] readr_2.1.3               tidyr_1.2.1
tidyverse_1.3.2          tibble_3.1.8
[21] RColorBrewer_1.1-3        plots_3.1.3
EnhancedVolcano_1.16.0   ggrepel_0.9.2
[25] ggplot2_3.4.0            dplyr_1.0.10
msImpute_1.8.0          reticulate_1.26
[29] proDA_1.12.0             limma_3.54.0
DEP_1.20.0              SummarizedExperiment_1.28.0
[33] Biobase_2.58.0           GenomicRanges_1.50.1
GenomeInfoDb_1.34.4     IRanges_2.32.0
[37] S4Vectors_0.36.1        BiocGenerics_0.44.0
MatrixGenerics_1.10.0   matrixStats_0.63.0
```

```
loaded via a namespace (and not attached):
 [1] rappdirs_0.3.3           scattermore_0.8
bit64_4.0.5              irlba_2.3.5.1
 [5] DelayedArray_0.24.0     data.table_1.14.6
KEGGREST_1.38.0         RCurl_1.98-1.9
 [9] doParallel_1.0.17       generics_0.1.3
preprocessCore_1.60.0   ScaledMatrix_1.6.0
[13] cowplot_1.1.1          lambda.r_1.2.4
RSQLite_2.2.19         RANN_2.6.1
[17] future_1.29.0          bit_4.0.5
tzdb_0.3.0             spatstat.data_3.0-0
[21] xml2_1.3.3             lubridate_1.9.0
httpuv_1.6.6          assertthat_0.2.1
```

[25] gargle_1.2.1	hms_1.1.2
babelgene_22.9	promises_1.2.0.1
[29] progress_1.2.2	fansi_1.0.3
caTools_1.18.2	dbplyr_2.2.1
[33] readxl_1.4.1	igraph_1.3.5
DBI_1.1.3	htmlwidgets_1.5.4
[37] spatstat.geom_3.0-3	googledrive_2.0.0
ellipsis_0.3.2	ggpubr_0.5.0
[41] backports_1.4.1	deldir_1.0-6
sparseMatrixStats_1.10.0	vctrs_0.5.1
[45] SingleCellExperiment_1.20.0	imputeLCMD_2.1
ROCR_1.0-11	abind_1.4-5
[49] cachem_1.0.6	withr_2.5.0
progressr_0.11.0	sctransform_0.3.5
[53] prettyunits_1.1.1	scraper_1.26.0
goftest_1.2-3	softImpute_1.4-1
[57] cluster_2.1.4	lazyeval_0.2.2
crayon_1.5.2	spatstat.explore_3.0-5
[61] edgeR_3.40.0	pkgconfig_2.0.3
labeling_0.4.2	nlme_3.1-160
[65] ProtGenerics_1.30.0	rlang_1.0.6
globals_0.16.2	lifecycle_1.0.3
[69] miniUI_0.1.1.1	sandwich_3.0-2
filelock_1.0.2	affyio_1.68.0
[73] BiocFileCache_2.6.0	modelr_0.1.10
rsvd_1.0.5	polyclip_1.10-4
[77] cellranger_1.1.0	lmtest_0.9-40
carData_3.0-5	zoo_1.8-11
[81] reprex_2.0.2	ggribbles_0.5.4
GlobalOptions_0.1.2	googlesheets4_1.0.1
[85] viridisLite_0.4.1	png_0.1-8
rjson_0.2.21	mzR_2.32.0
[89] bitops_1.0-7	shinydashboard_0.7.2
KernSmooth_2.23-20	Biostrings_2.66.0
[93] blob_1.2.3	DelayedMatrixStats_1.20.0
shape_1.4.6	spatstat.random_3.0-1
[97] parallelly_1.32.1	rstatix_0.7.1
ggsignif_0.6.4	tmvtnorm_1.5
[101] beachmat_2.14.0	scales_1.2.1
memoise_2.0.1	magrittr_2.0.3
[105] plyr_1.8.8	ica_1.0-3
zlibbioc_1.44.0	compiler_4.2.2
[109] dqrng_0.3.0	pcaMethods_1.90.0
clue_0.3-63	fitdistrplus_1.1-8
[113] cli_3.4.1	affy_1.76.0
XVector_0.38.0	listenv_0.8.0
[117] pbapply_1.6-0	patchwork_1.1.2
formatR_1.12	MASS_7.3-58.1
[121] tidyselect_1.2.0	vsn_3.66.0
stringi_1.7.8	BiocSingular_1.14.0
[125] locfit_1.5-9.6	norm_1.0-10.0
MALDIquant_1.22	fastmatch_1.1-3
[129] tools_4.2.2	timechange_0.1.1
future.apply_1.10.0	parallel_4.2.2

[133] circlize_0.4.15	rstudioapi_0.14
MsCoreUtils_1.10.0	bluster_1.8.0
[137] foreach_1.5.2	gridExtra_2.3
metapod_1.6.0	farver_2.1.1
[141] mzID_1.36.0	Rtsne_0.16
digest_0.6.30	BiocManager_1.30.19
[145] FNN_1.1.3.1	shiny_1.7.3
Rcpp_1.0.9	car_3.1-1
[149] broom_1.0.1	scuttle_1.8.1
later_1.3.0	RcppAnnoy_0.0.20
[153] ncd4_1.2.0	AnnotationDbi_1.60.0
httr_1.4.4	MSnbase_2.24.0
[157] ComplexHeatmap_2.14.0	colorspace_2.0-3
tensor_1.5	rvest_1.0.3
[161] XML_3.99-0.13	fs_1.5.2
splines_4.2.2	uwot_0.1.14
[165] statmod_1.4.37	spatstat.utils_3.0-1
sp_1.5-1	gmm_1.7
[169] plotly_4.10.1	xtable_1.8-4
jsonlite_1.8.4	futile.options_1.0.1
[173] R6_2.5.1	pillar_1.8.1
htmltools_0.5.4	mime_0.12
[177] glue_1.6.2	fastmap_1.1.0
DT_0.26	BiocParallel_1.32.4
[181] BiocNeighbors_1.16.0	codetools_0.2-18
mvtnorm_1.1-3	utf8_1.2.2
[185] spatstat.sparse_3.0-0	lattice_0.20-45
curl_4.3.3	leiden_0.4.3
[189] gtools_3.9.4	survival_3.4-0
munsell_0.5.0	GetoptLong_1.0.5
[193] GenomeInfoDbData_1.2.9	iterators_1.0.14
impute_1.72.1	reshape2_1.4.4
[197] haven_2.5.1	gtable_0.3.1