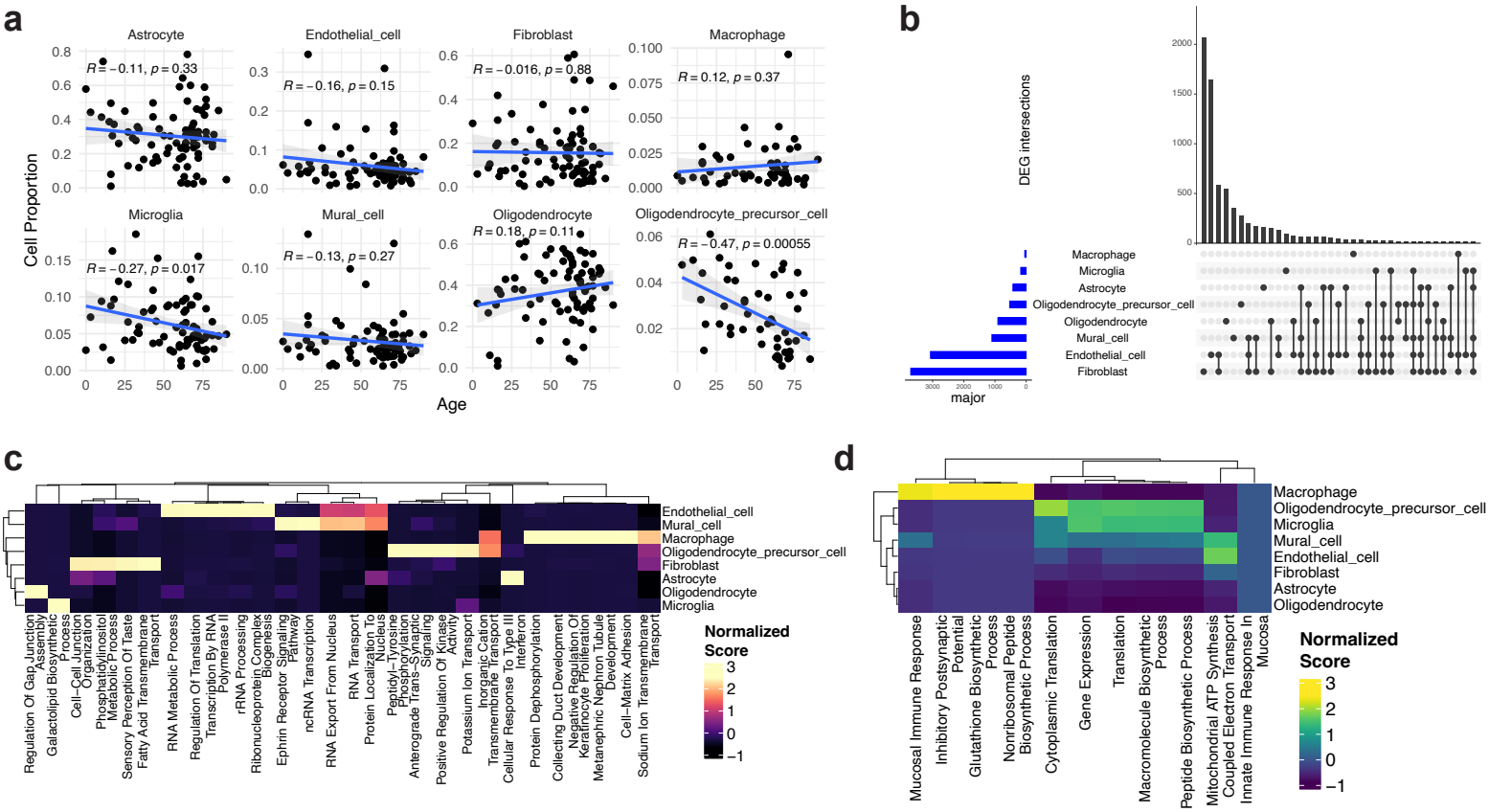
a
Astrocyte
Endothelial_cell
Fibroblast
Macrophage
Microglia
Mural_cell
Oligodendrocyte
Oligodendrocyte_precursor_cell
R = −0.11, p = 0.33
R = −0.16, p = 0.15
R = −0.016, p = 0.88
R = 0.12, p = 0.37
R = −0.27, p = 0.017
R = −0.13, p = 0.27
R = 0.18, p = 0.11
R = −0.47, p = 0.00055
Cell Proportion
Age
b
DEG intersections
major
Macrophage
Microglia
Astrocyte
Oligodendrocyte_precursor_cell
Oligodendrocyte
Mural_cell
Endothelial_cell
Fibroblast

c
Endothelial_cell
Mural_cell
Macrophage
Oligodendrocyte_precursor_cell
Fibroblast
Astrocyte
Oligodendrocyte
Microglia
Normalized Score
3
2
1
0
−1
Regulation Of Gap Junction Assembly
Galactolipid Biosynthetic Process
Cell–Cell Junction Organization
Phosphatidylinositol Metabolic Process
Sensory Perception Of Taste
Fatty Acid Transmembrane Transport
RNA Metabolic Process
Regulation Of Translation
Transcription By RNA Polymerase II
rRNA Processing
Ribonucleoprotein Complex Biogenesis
Ephrin Receptor Signaling Pathway
ncRNA Transcription
RNA Export From Nucleus
RNA Transport
Protein Localization To Nucleus
Peptidyl–Tyrosine Phosphorylation
Anterograde Trans–Synaptic Signaling
Positive Regulation Of Kinase Activity
Potassium Ion Transport
Inorganic Cation Transmembrane Transport
Cellular Response To Type III Interferon
Protein Dephosphorylation
Collecting Duct Development
Negative Regulation Of Keratinocyte Proliferation
Metanephric Nephron Tubule Development
Cell–Matrix Adhesion
Sodium Ion Transmembrane Transport

d
Macrophage
Oligodendrocyte_precursor_cell
Microglia
Mural_cell
Endothelial_cell
Fibroblast
Astrocyte
Oligodendrocyte
Normalized Score
3
2
1
0
−1
Mucosal Immune Response
Inhibitory Postsynaptic Potential
Glutathione Biosynthetic Process
Nonribosomal Peptide Biosynthetic Process
Cytoplasmic Translation
Gene Expression
Translation
Macromolecule Biosynthetic Process
Peptide Biosynthetic Process
Mitochondrial ATP Synthesis Coupled Electron Transport
Innate Immune Response In Mucosa

Extended Data Figure 8. Age-related cell proportion and gene expression change
a, Scatter plot showing cell proportion (Y axis) versus age (X axis). Each dot is a donor sample. Pearson correlation coefficients and P-values were indicated in the plots. **b**, UpSet plot showing the numbers of age-related differentially expressed genes across major cell classes. **c,** Heatmap showing the pathways enriched in genes up-regulated during aging. **d,** Heatmap showing pathways enriched in genes down-regulated during aging.