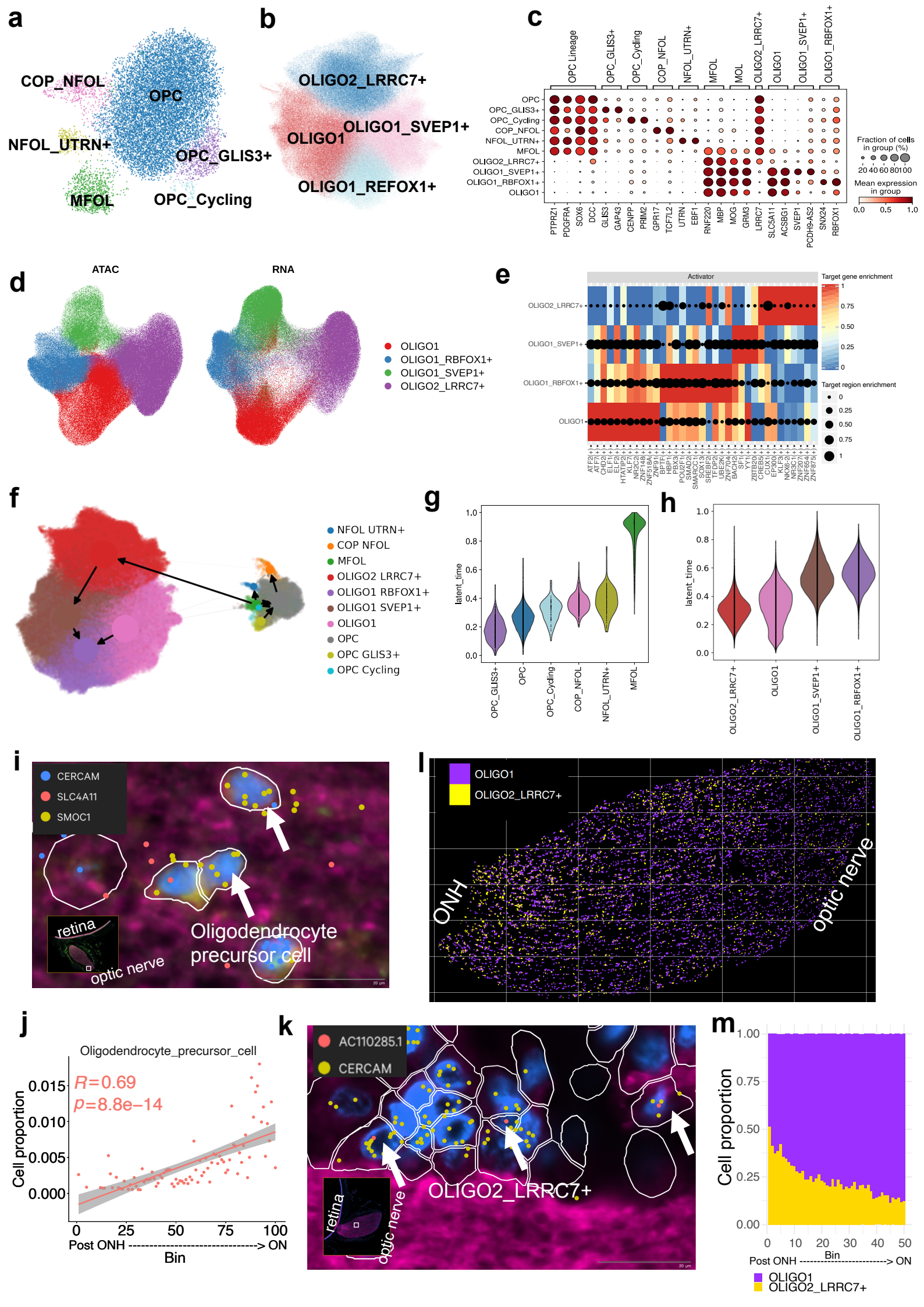
a
COP_NFOL
OPC
NFOL_UTRN+
OPC_GLIS3+
MFOL
OPC_Cycling
b
OLIGO2_LRRC7+
OLIGO1_SVEP1+
OLIGO1
OLIGO1_REFOX1+
c
OPC Lineage
OPC_GLIS3+
OPC_Cycling
COP_NFOL
NFOL_UTRN+
MFOL
MOL
OLIGO2_LRRC7+
OLIGO1
OLIGO1_SVEP1+
OLIGO1_RBFOX1+
OPC
OPC_GLIS3+
OPC_Cycling
COP_NFOL
NFOL_UTRN+
MFOL
OLIGO2_LRRC7+
OLIGO1_SVEP1+
OLIGO1_RBFOX1+
OLIGO1
PTPRZ1
PDGFRA
SOX6
DCC
GLIS3
GAP43
CENPP
PRIM2
GPR17
TCF7L2
UTRN
EBF1
RNF220
MBP
MOG
GRM3
LRRC7
SLC5A11
ACSBG1
SVEP1
PCDH9-AS2
SNX24
RBFOX1
Fraction of cells in group (%)
20 40 60 80 100
Mean expression in group
0.0 0.5 1.0
d
ATAC
RNA
OLIGO1
OLIGO1_RBFOX1+
OLIGO1_SVEP1+
OLIGO2_LRRC7+
e
Activator
Target gene enrichment
1
0.75
0.50
0.25
0
OLIGO2_LRRC7+
OLIGO1_SVEP1+
OLIGO1_RBFOX1+
OLIGO1
Target region enrichment
0
0.25
0.50
0.75
1
f
NFOL UTRN+
COP NFOL
MFOL
OLIGO2 LRRC7+
OLIGO1 RBFOX1+
OLIGO1 SVEP1+
OLIGO1
OPC
OPC GLIS3+
OPC Cycling
g
latent_time
1.0
0.8
0.6
0.4
0.2
0.0
OPC_GLIS3+
OPC
OPC_Cycling
COP_NFOL
NFOL_UTRN+
MFOL
h
latent_time
1.0
0.8
0.6
0.4
0.2
0.0
OLIGO2_LRRC7+
OLIGO1
OLIGO1_SVEP1+
OLIGO1_RBFOX1+
i
CERCAM
SLC4A11
SMOC1
retina
optic nerve
Oligodendrocyte precursor cell
l
OLIGO1
OLIGO2_LRRC7+
ONH
optic nerve
j
Oligodendrocyte_precursor_cell
R=0.69
p=8.8e−14
Cell proportion
0.015
0.010
0.005
0.000
0
25
50
75
100
Post ONH ----------> ON
Bin
k
AC110285.1
CERCAM
retina
optic nerve
OLIGO2_LRRC7+
m
Cell proportion
1.00
0.75
0.50
0.25
0.00
0
10
20
30
40
50
Bin
Post ONH ----------> ON
OLIGO1
OLIGO2_LRRC7+

Figure 3. Identification of oligodendrocytes and their precursors.
a, UMAP of oligodendrocyte precursor cells derived from snRNA-seq data, with cells colored by distinct cell populations. **b,** UMAP of oligodendrocytes derived from snRNA-seq data, with cells colored by distinct cell populations. **c**, Dot plot showing expression of marker genes across precursors and mature oligodendrocytes derived from snRNA-seq. MOL: myelinating oligodendrocyte. **d**, Co-embedding of cells from snATAC-seq (left) and snRNA-seq (right) datasets for oligodendrocytes, colored by cell type labels. **e,** Heatmap showing the identified regulons associated with oligodendrocyte cell types. **f,** PAGA graph with velocity-directed edges showing the lineage progression from precursor cells to mature oligodendrocytes. **g,** Violin plot showing latent times of the precursor populations inferred from transcriptional velocity. **h,** Violin plot showing latent times of the oligodendrocytes inferred from transcriptional velocity. **i,** Validation of oligodendrocyte precursor cells (labeled by *SMOC1* transcripts) with Xenium Explorer. **j,** Scatter plot showing the decline in oligodendrocyte precursor cell proportion along the longitudinal axis of the optic nerve. **k,** In situ validation of OLIGO2_LRRC7+ cells (labeled by co-localization of *AC110285.1* and *CERCAM* transcripts) in Xenium spatial transcriptomic data visualized with Xenium Explore. **l.** Dim plot showing distribution of OLIGO2_LRRC7+ cells and other oligodendrocytes in situ across the optic nerve. **m**. Bar plot displaying cell proportional composition of OLIGO2_LRRC7+ cells and other oligodendrocytes across optic nerve in situ derived from Xenium spatial transcriptomic data.