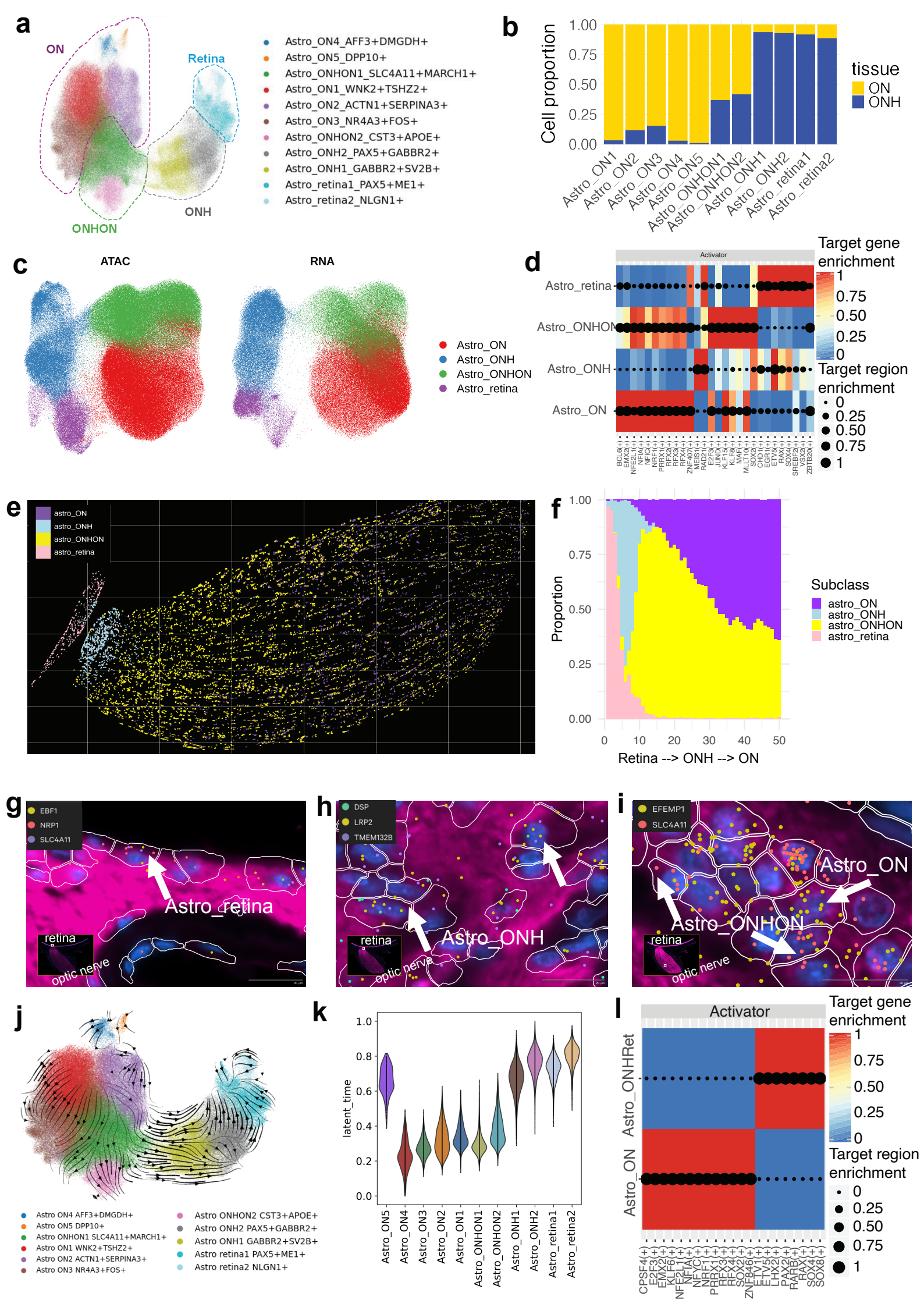
a
ON
Retina
ONH
ONHON
Astro_ON4_AFF3+DMGDH+
Astro_ON5_DPP10+
Astro_ONHON1_SLC4A11+MARCH1+
Astro_ON1_WNK2+TSHZ2+
Astro_ON2_ACTN1+SERPINA3+
Astro_ON3_NR4A3+FOS+
Astro_ONHON2_CST3+APOE+
Astro_ONH2_PAX5+GABBR2+
Astro_ONH1_GABBR2+SV2B+
Astro_retina1_PAX5+ME1+
Astro_retina2_NLGN1+
b
Cell proportion
1.00
0.75
0.50
0.25
0.00
tissue
ON
ONH
Astro_ON1
Astro_ON2
Astro_ON3
Astro_ON4
Astro_ON5
Astro_ONHON1
Astro_ONHON2
Astro_ONH1
Astro_ONH2
Astro_retina1
Astro_retina2
c
ATAC
RNA
Astro_ON
Astro_ONH
Astro_ONHON
Astro_retina
d
Activator
Astro_retina
Astro_ONHON
Astro_ONH
Astro_ON
Target gene enrichment
1
0.75
0.50
0.25
0
Target region enrichment
0
0.25
0.50
0.75
1
e
astro_ON
astro_ONH
astro_ONHON
astro_retina
f
Proportion
1.00
0.75
0.50
0.25
0.00
0
10
20
30
40
50
Retina --> ONH --> ON
Subclass
astro_ON
astro_ONH
astro_ONHON
astro_retina
g
EBF1
NRP1
SLC4A11
Astro_retina
retina
optic nerve
h
DSP
LRP2
TMEM132B
Astro_ONH
retina
optic nerve
i
EFEMP1
SLC4A11
Astro_ON
Astro_ONHON
retina
optic nerve
j
Astro ON4 AFF3+DMGDH+
Astro ON5 DPP10+
Astro ONHON1 SLC4A11+MARCH1+
Astro ON1 WNK2+TSHZ2+
Astro ON2 ACTN1+SERPINA3+
Astro ON3 NR4A3+FOS+
Astro ONHON2 CST3+APOE+
Astro ONH2 PAX5+GABBR2+
Astro ONH1 GABBR2+SV2B+
Astro retina1 PAX5+ME1+
Astro retina2 NLGN1+
k
latent_time
1.0
0.8
0.6
0.4
0.2
0.0
Astro_ON5
Astro_ON4
Astro_ON3
Astro_ON2
Astro_ON1
Astro_ONHON1
Astro_ONHON2
Astro_ONH1
Astro_ONH2
Astro_retina1
Astro_retina2
l
Activator
Astro_ONHRet
Astro_ON
Target gene enrichment
1
0.75
0.50
0.25
0
Target region enrichment
0
0.25
0.50
0.75
1

Figure 5. Identification of astrocytes
a, UMAP of astrocytes derived from snRNA-seq data, with cells colored by cell populations. **b,** Bar plot showing distribution of sample collection regions across astrocyte populations. **c**, Co-embedding of cells from snATAC-seq (left) and snRNA-seq (right) datasets for astrocytes, colored by subclass labels. **d,** Heatmap showing the identified regulons associated with region-specific astrocyte subclasses. **e.** Image Dim plot showing distribution of region-specific astrocyte subclasses in situ across optic nerve from Xenium data. **f,** Bar plot displaying cell proportional composition of astrocyte subclasses across optic nerve in situ derived from Xenium data. **g,** Validation of Astro_retina in situ (labeled by colocalization of *EBF1, NRP1, and SLC4A11* transcripts) with Xenium Explorer. **h,** Validation of Astro_ONH in situ (labeled by colocalization of *DSP, LRP2, and TMEM132B* transcripts) from Xenium data visualized with Xenium Explorer. **i,** Validation of Astro_ONHON in situ (dominated by *SLC4A11* transcripts with lowly expressed *EFEMP1* transcripts) and Astro_ON in situ (dominated by *EFEMP1* transcripts) from Xenium data visualized with Xenium Explorer.