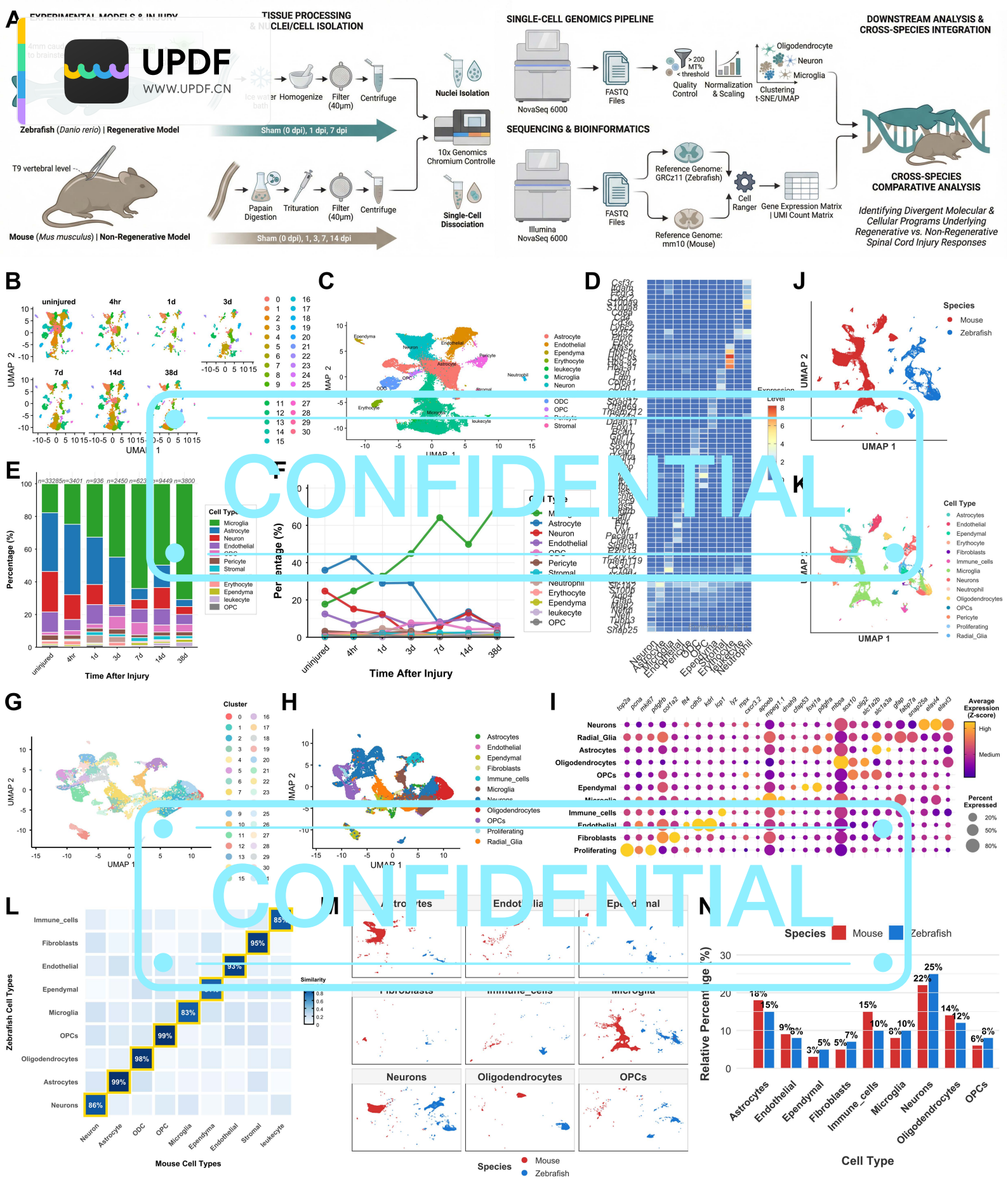
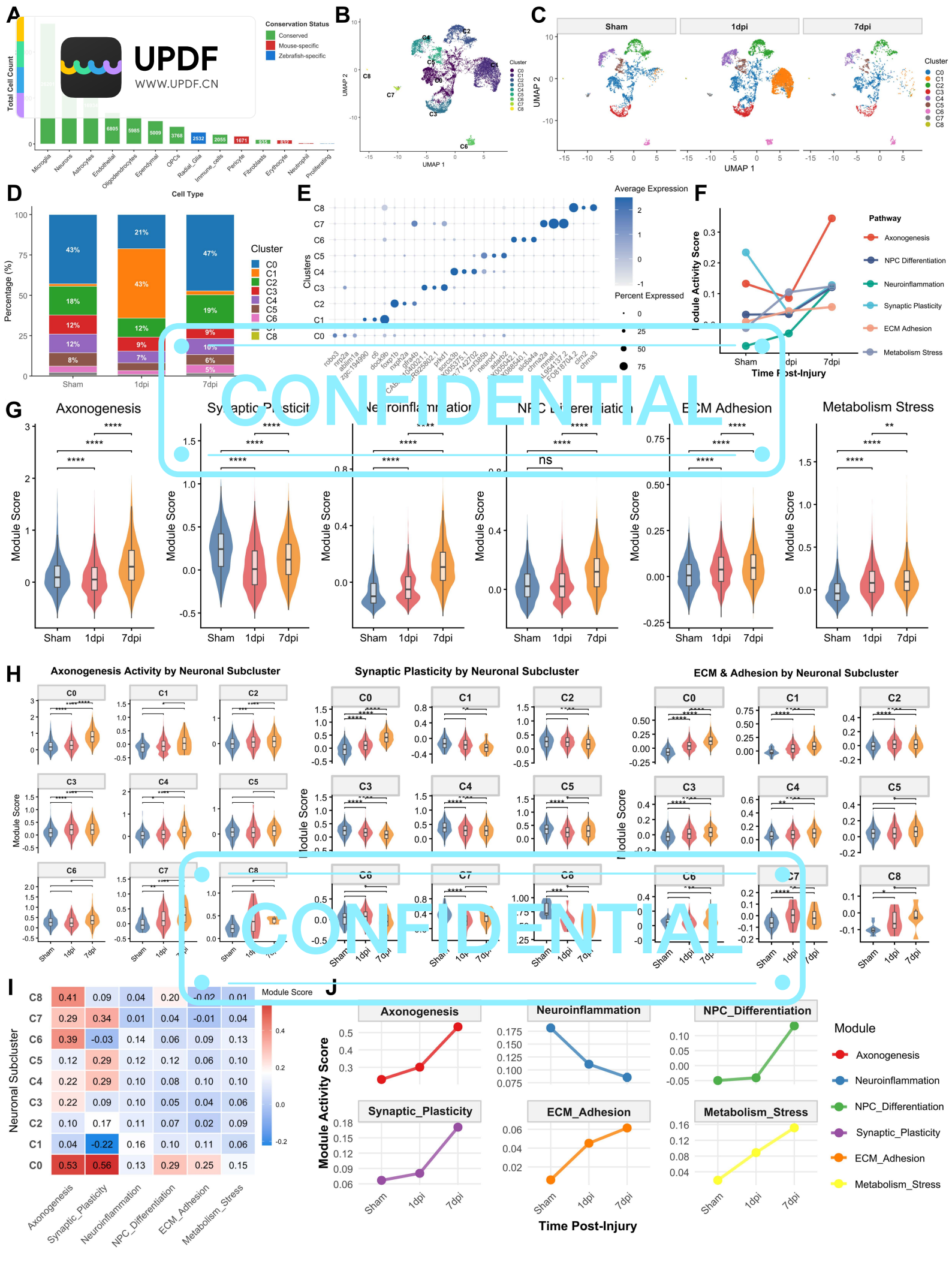
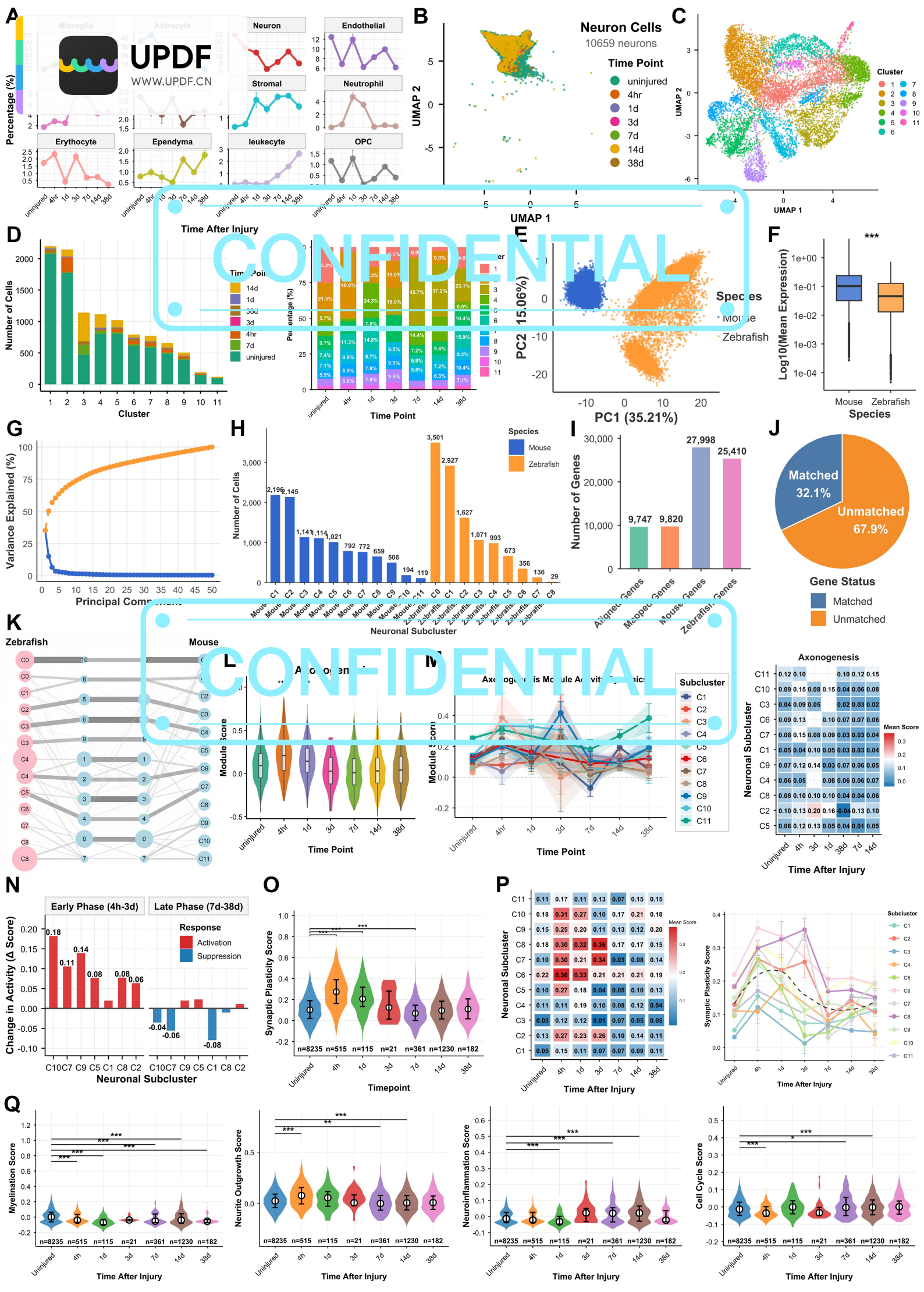


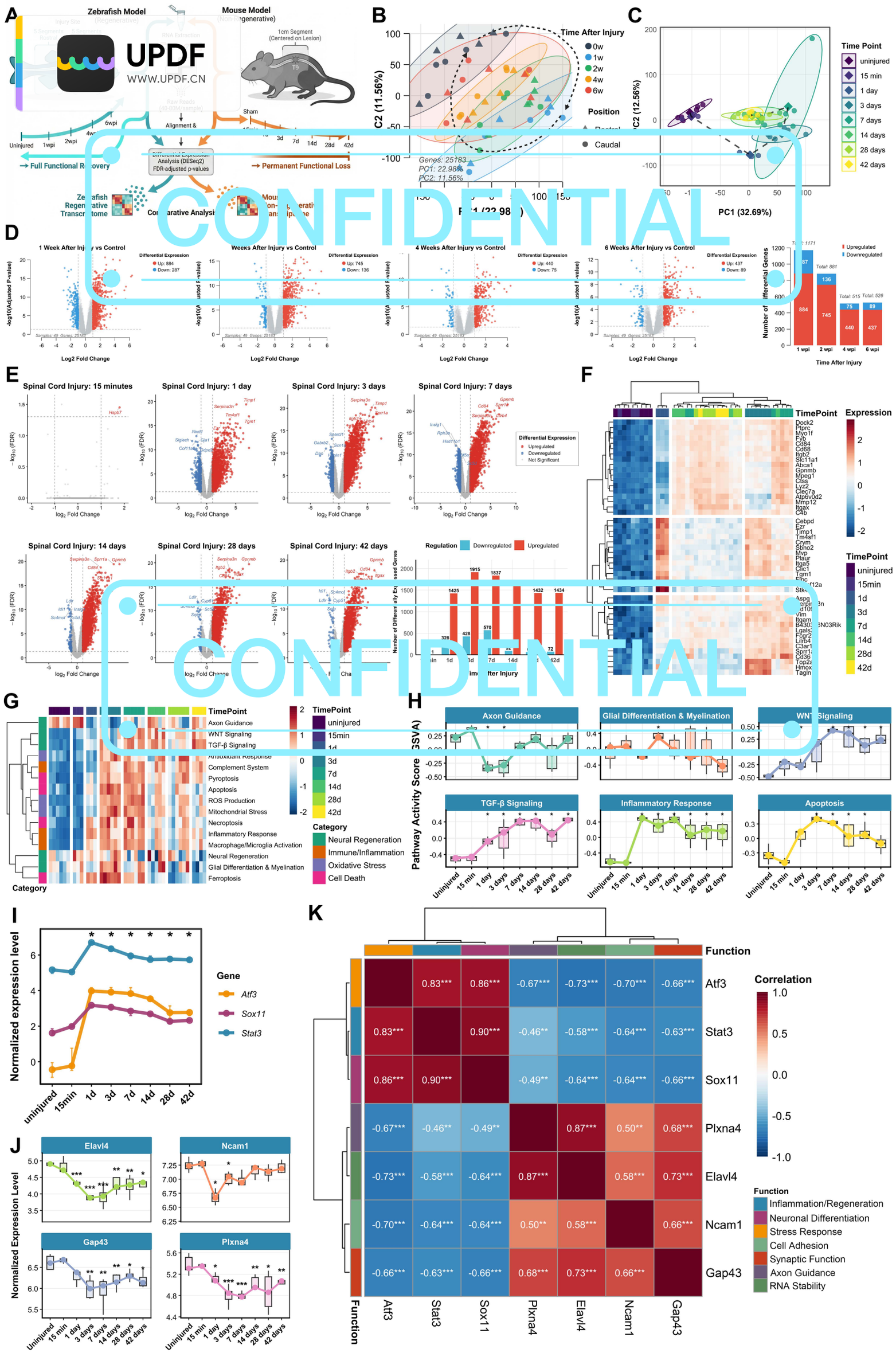
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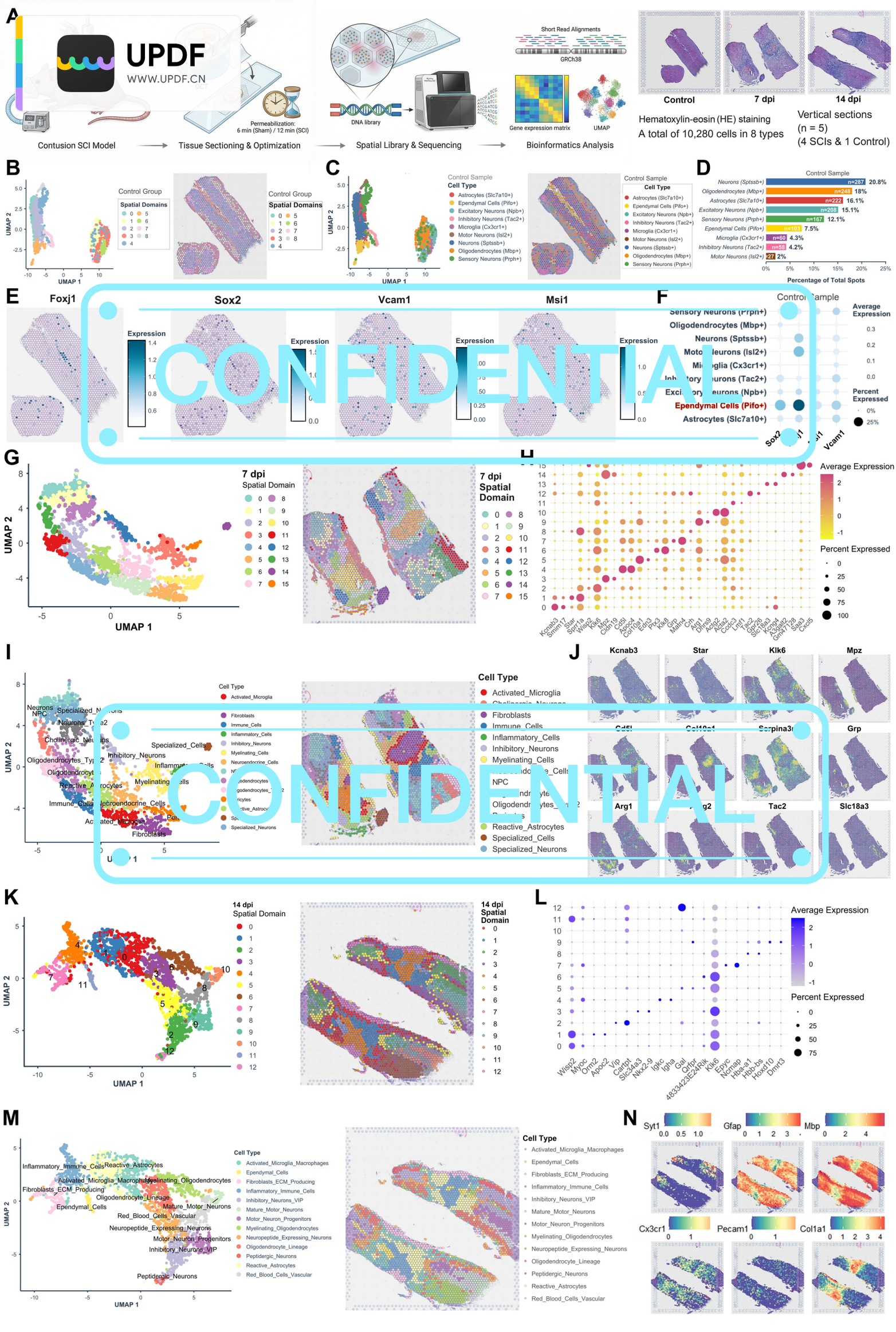


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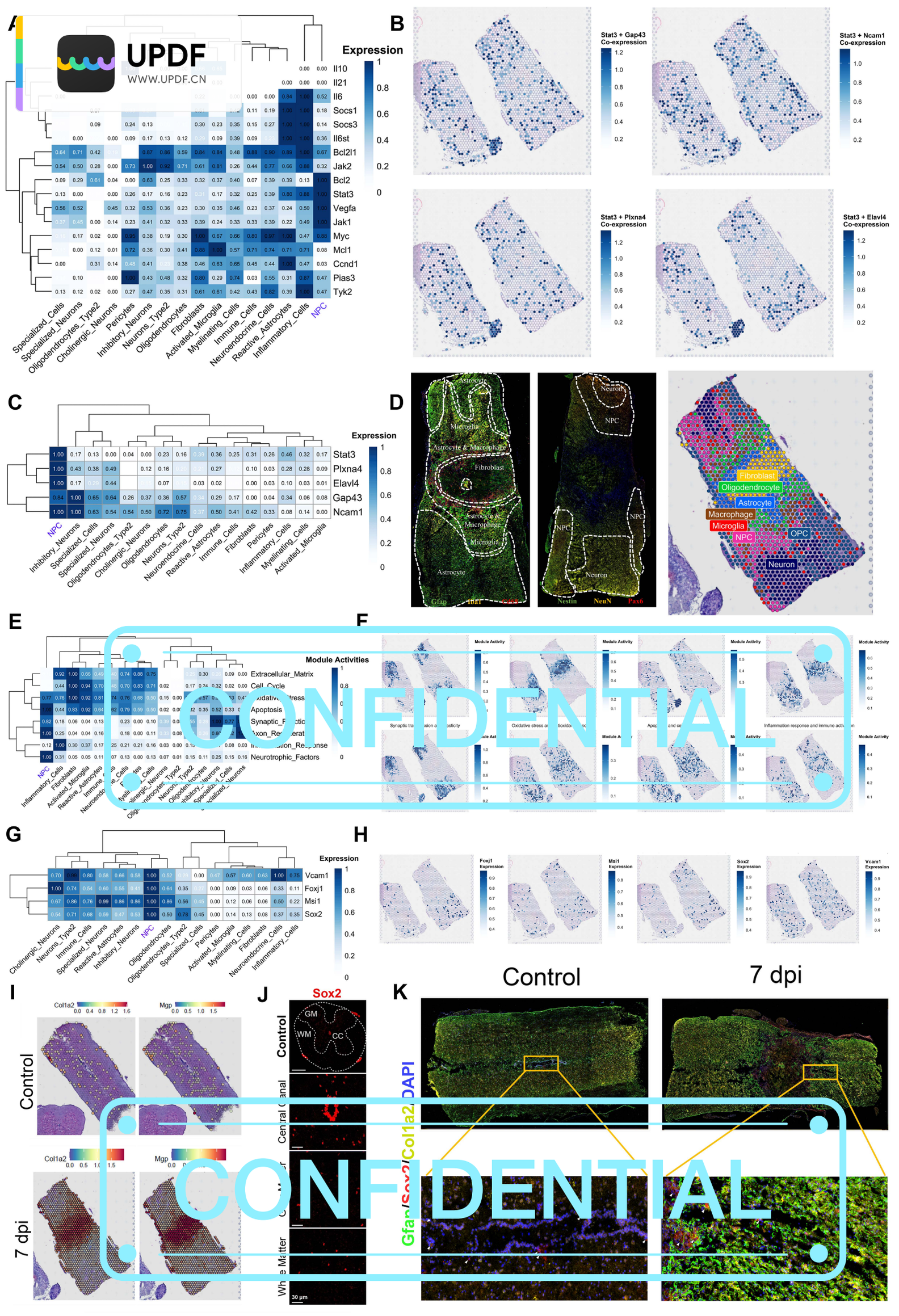


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A
Zebrafish Model
(Regenerative)
Mouse Model
(Non-regenerative)
1cm Segment
(Centered on Lesion)
Sham
Uninjured
1wpi
2wpi
4wpi
6wpi
3d
7d
14d
28d
42d
Alignment &
Differential Expression Analysis (DESeq2)
FDR-adjusted p-values
→ Full Functional Recovery
→ Permanent Functional Loss
Zebrafish Regenerative Transcriptome
Comparative Analysis
B
Time After Injury
0w
1w
2w
4w
6w
Position
Rostral
Caudal
Genes: 25183
PC1: 22.98%
PC2: 11.56%
C2 (11.56%)
C
Time Point
uninjured
15 min
1 day
3 days
7 days
14 days
28 days
42 days
PC1 (32.69%)
C2 (12.56%)
D
1 Week After Injury vs Control
2 Weeks After Injury vs Control
4 Weeks After Injury vs Control
6 Weeks After Injury vs Control
Differential Expression
Up: 884
Down: 287
Up: 745
Down: 136
Up: 440
Down: 75
Up: 437
Down: 89
-log10(Adjusted P-value)
Log2 Fold Change
Upregulated
Downregulated
Number of Differential Genes
Total: 1171
Total: 881
Total: 515
Total: 526
1 wpi
2 wpi
4 wpi
6 wpi
Time After Injury
E
Spinal Cord Injury: 15 minutes
Spinal Cord Injury: 1 day
Spinal Cord Injury: 3 days
Spinal Cord Injury: 7 days
Spinal Cord Injury: 14 days
Spinal Cord Injury: 28 days
Spinal Cord Injury: 42 days
Differential Expression
Upregulated
Downregulated
Not Significant
−log10 (FDR)
log2 Fold Change
Regulation
Downregulated
Upregulated
Number of Differentially Expressed Genes
F
TimePoint
Expression
uninjured
15min
1d
3d
7d
14d
28d
42d
G
TimePoint
Category
Axon Guidance
WNT Signaling
TGF-β Signaling
Antioxidant Response
Complement System
Pyroptosis
Apoptosis
ROS Production
Mitochondrial Stress
Necroptosis
Inflammatory Response
Macrophage/Microglia Activation
Neural Regeneration
Glial Differentiation & Myelination
Ferroptosis
Neural Regeneration
Immune/Inflammation
Oxidative Stress
Cell Death
H
Axon Guidance
Glial Differentiation & Myelination
WNT Signaling
TGF-β Signaling
Inflammatory Response
Apoptosis
Pathway Activity Score (GSVA)
Uninjured
15 min
1 day
3 days
7 days
14 days
28 days
42 days
I
Normalized expression level
Gene
Atf3
Sox11
Stat3
uninjured
15min
1d
3d
7d
14d
28d
42d
J
Elavl4
Ncam1
Gap43
Plxna4
Normalized Expression Level
K
Function
Atf3
Stat3
Sox11
Plxna4
Elavl4
Ncam1
Gap43
0.83*** 0.86*** -0.67*** -0.73*** -0.70*** -0.66***
0.83*** 0.90*** -0.46** -0.58*** -0.64*** -0.63***
0.86*** 0.90*** -0.49** -0.64*** -0.64*** -0.66***
-0.67*** -0.46** -0.49** 0.87*** 0.50** 0.68***
-0.73*** -0.58*** -0.64*** 0.87*** 0.58*** 0.73***
-0.70*** -0.64*** -0.64*** 0.50** 0.58*** 0.66***
-0.66*** -0.63*** -0.66*** 0.68*** 0.73*** 0.66***
Correlation
1.0
0.5
0.0
-0.5
-1.0
Function
Inflammation/Regeneration
Neuronal Differentiation
Stress Response
Cell Adhesion
Synaptic Function
Axon Guidance
RNA Stability
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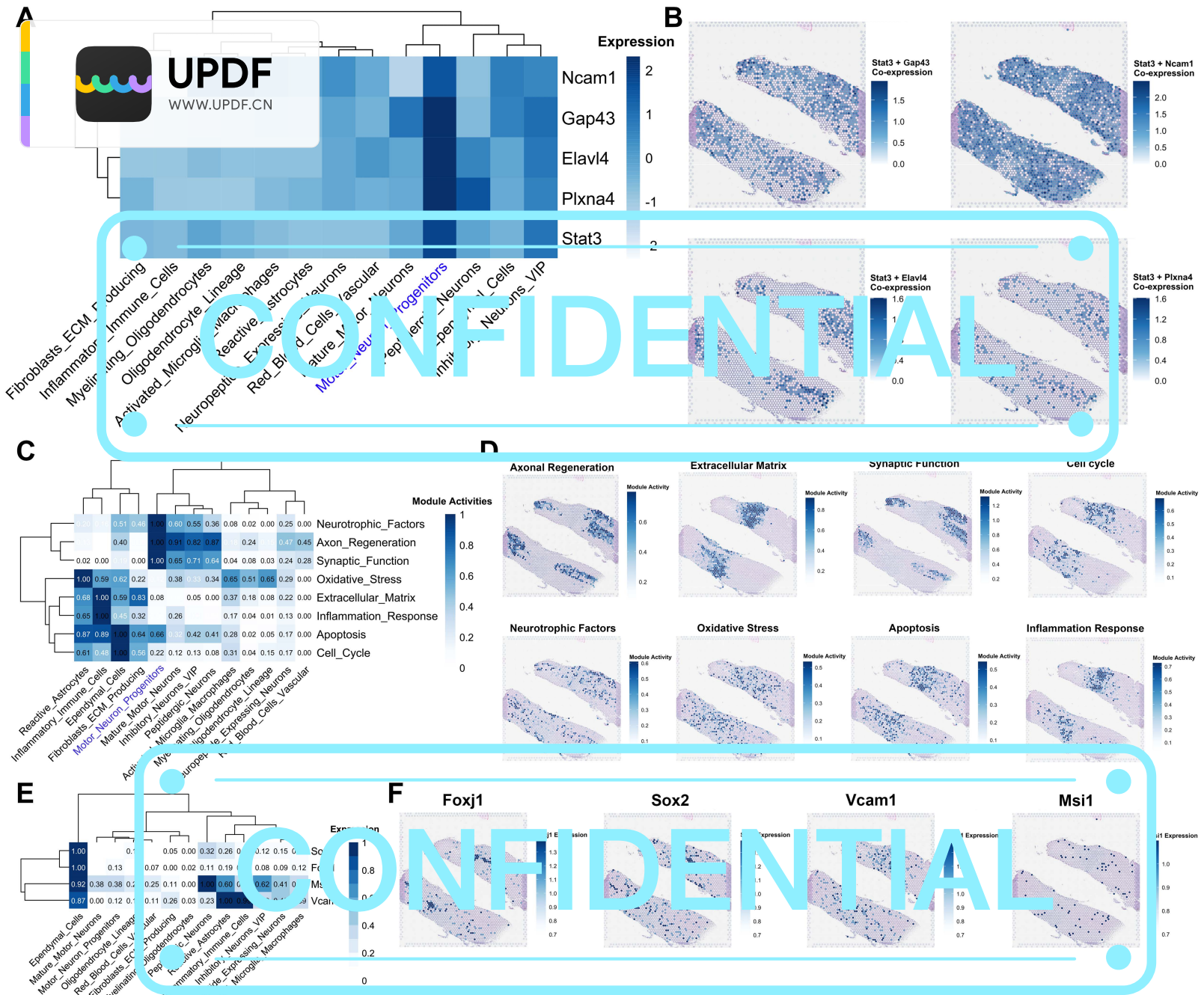

A
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Permeabilization:
6 min (Sham) / 12 min (SCI)
Contusion SCI Model
Tissue Sectioning & Optimization
DNA library
Short Read Alignments
GRCh38
Gene expression matrix
UMAP
Spatial Library & Sequencing
Bioinformatics Analysis
Control
7 dpi
14 dpi
Hematoxylin-eosin (HE) staining
A total of 10,280 cells in 8 types
Vertical sections
(n = 5)
(4 SCIs & 1 Control)
B
Control Group
Spatial Domains
C
Control Sample
Cell Type
Astrocytes (Slc7a10+)
Ependymal Cells (Pifo+)
Excitatory Neurons (Npb+)
Inhibitory Neurons (Tac2+)
Microglia (Cx3cr1+)
Motor Neurons (Isl2+)
Neurons (Sptssb+)
Oligodendrocytes (Mbp+)
Sensory Neurons (Prph+)
D
Control Sample
Neurons (Sptssb+) n=287 20.8%
Oligodendrocytes (Mbp+) n=248 18%
Astrocytes (Slc7a10+) n=222 16.1%
Excitatory Neurons (Npb+) n=208 15.1%
Sensory Neurons (Prph+) n=167 12.1%
Ependymal Cells (Pifo+) n=103 7.5%
Microglia (Cx3cr1+) n=60 4.3%
Inhibitory Neurons (Tac2+) n=58 4.2%
Motor Neurons (Isl2+) 27 2%
Percentage of Total Spots
E
Foxj1
Sox2
Vcam1
Msi1
Expression
F
Control Sample
Sensory Neurons (Prph+)
Oligodendrocytes (Mbp+)
Neurons (Sptssb+)
Motor Neurons (Isl2+)
Microglia (Cx3cr1+)
Inhibitory Neurons (Tac2+)
Excitatory Neurons (Npb+)
Ependymal Cells (Pifo+)
Astrocytes (Slc7a10+)
Average Expression
Percent Expressed
Sox2
Vcam1
G
7 dpi
Spatial Domain
UMAP 1
UMAP 2
H
Average Expression
Percent Expressed
I
Cell Type
Activated_Microglia
Fibroblasts
Immune_Cells
Inflammatory_Cells
Inhibitory_Neurons
Myelinating_Cells
NPC
Reactive_Astrocytes
Specialized_Cells
Specialized_Neurons
J
Kcnab3
Star
Klk6
Mpz
Grp
Arg1
Tac2
Slc18a3
K
14 dpi
Spatial Domain
L
Average Expression
Percent Expressed
M
Cell Type
Activated_Microglia_Macrophages
Ependymal_Cells
Fibroblasts_ECM_Producing
Inflammatory_Immune_Cells
Inhibitory_Neurons_VIP
Mature_Motor_Neurons
Motor_Neuron_Progenitors
Myelinating_Oligodendrocytes
Neuropeptide_Expressing_Neurons
Oligodendrocyte_Lineage
Peptidergic_Neurons
Reactive_Astrocytes
Red_Blood_Cells_Vascular
N
Syt1
Gfap
Mbp
Cx3cr1
Pecam1
Col1a1
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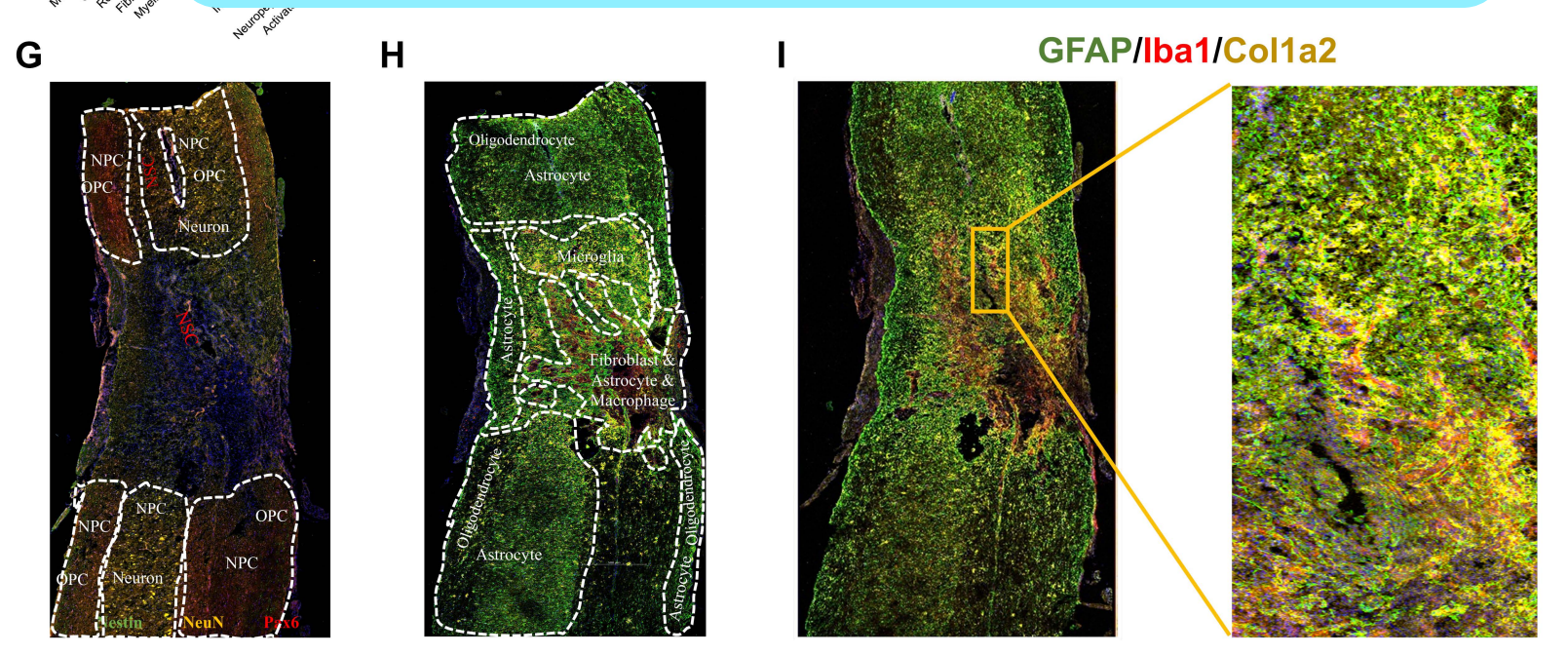
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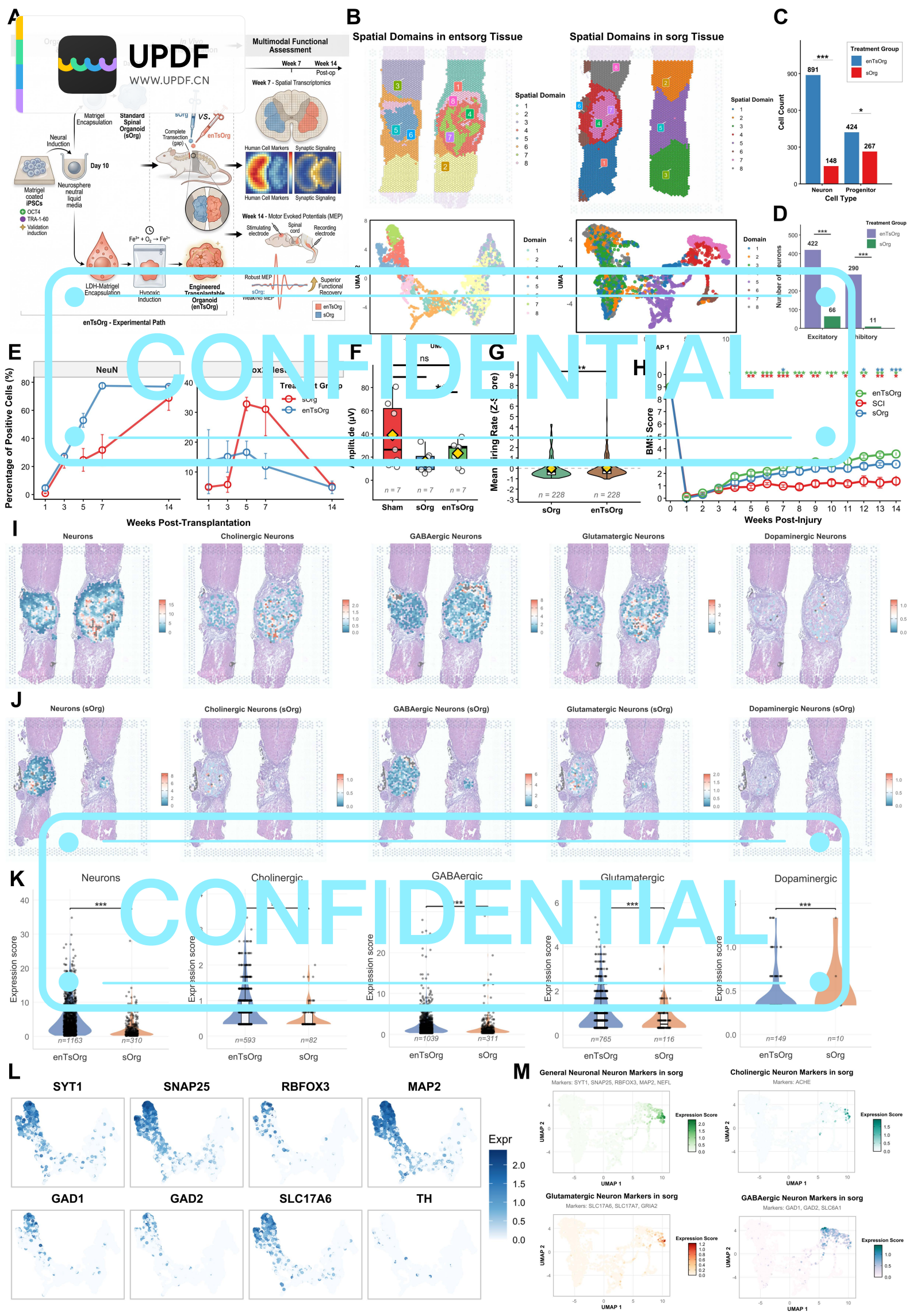


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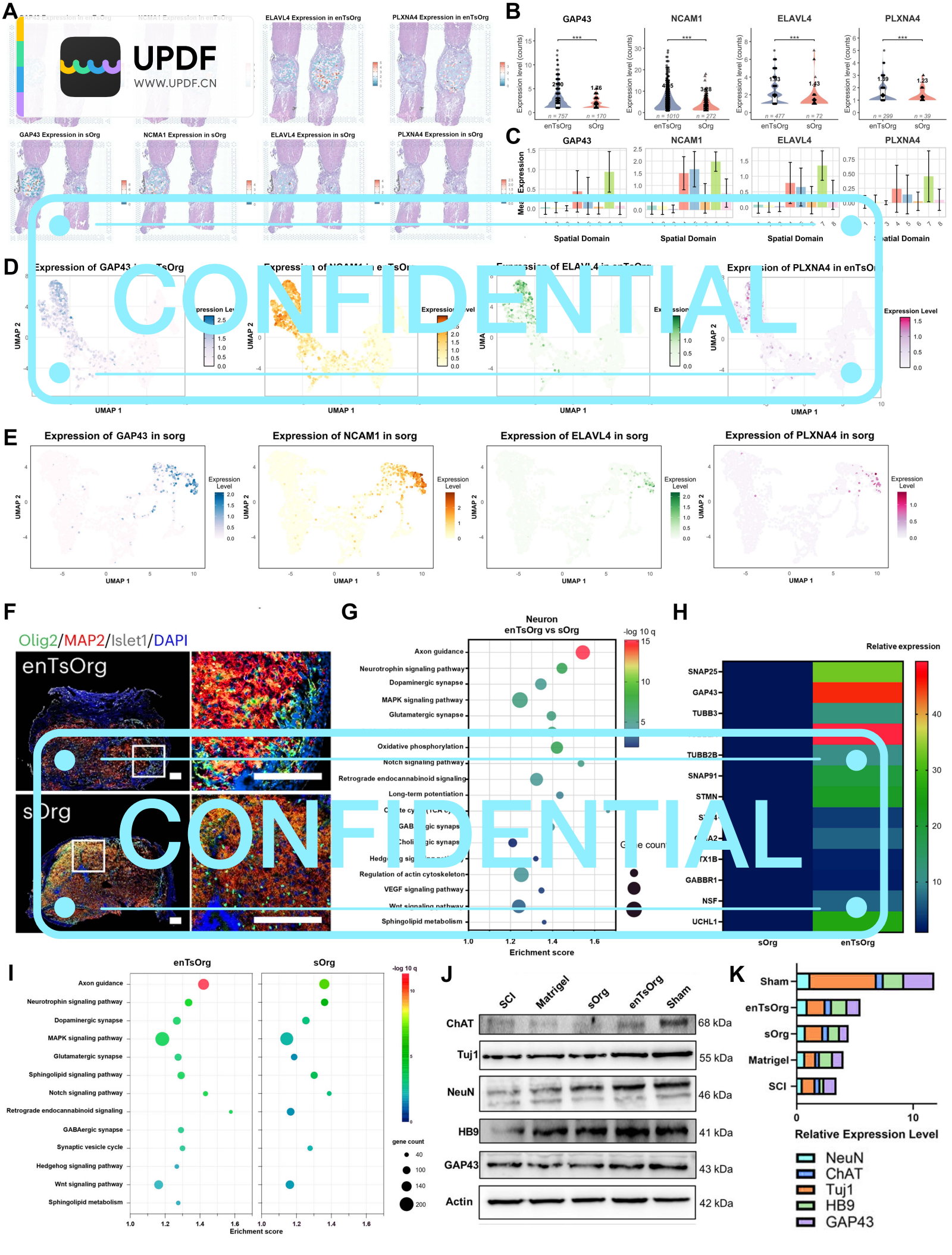
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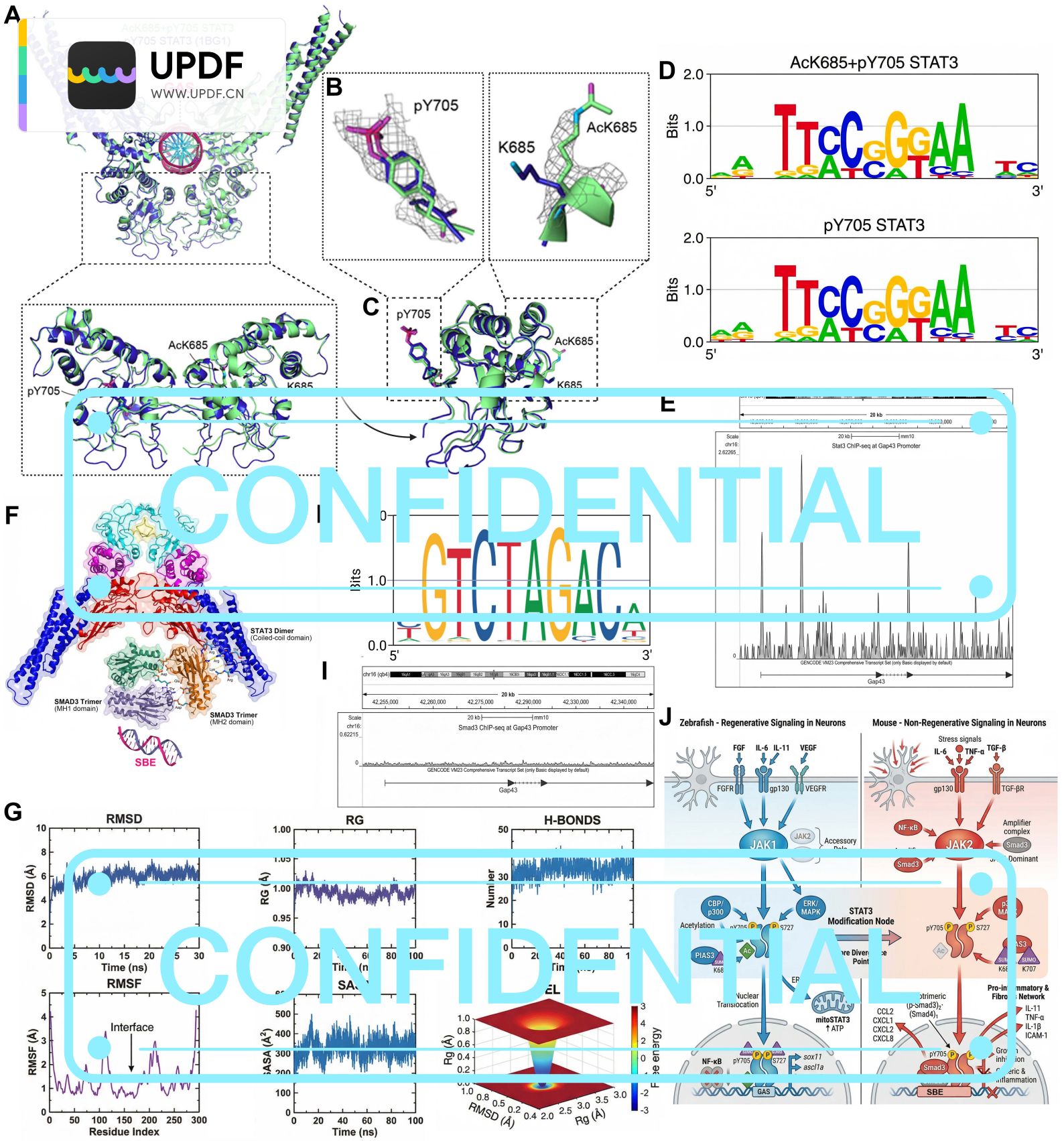




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