Longitudinal omics in Syrian hamsters integrated with human data unravel cellular effector responses to moderate COVID-19

Supplementary Figures and Tables

Geraldine Nouailles*, Emanuel Wyler*, Peter Pennitz, Dylan Postmus, Daria Vladimirova, Julia Kazmierski, Fabian Pott, Kristina Dietert, Michael Muelleder, Vadim Farztdinov, Benedikt Obermayer, Sandra-Maria Wienhold, Sandro Andreotti, Thomas Hoefler, Birgit Sawitzki, Christian Drosten, Leif E. Sander, Norbert Suttorp, Markus Ralser, Dieter Beule, Achim D. Gruber, Christine Goffinet, Markus Landthaler, Jakob Trimpert* and Martin Witzenrath*

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Supplementary Figure legends

Supplementary Figure 1: Experimental Design

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Supplementary Table 1: Oligonucleotides used in this study

Supplementary Table 2: Specific protein sets referenced in the proteomics results

Supplementary Table 3: Frequencies of cell types positive for the virus or specified genes

Figure S1

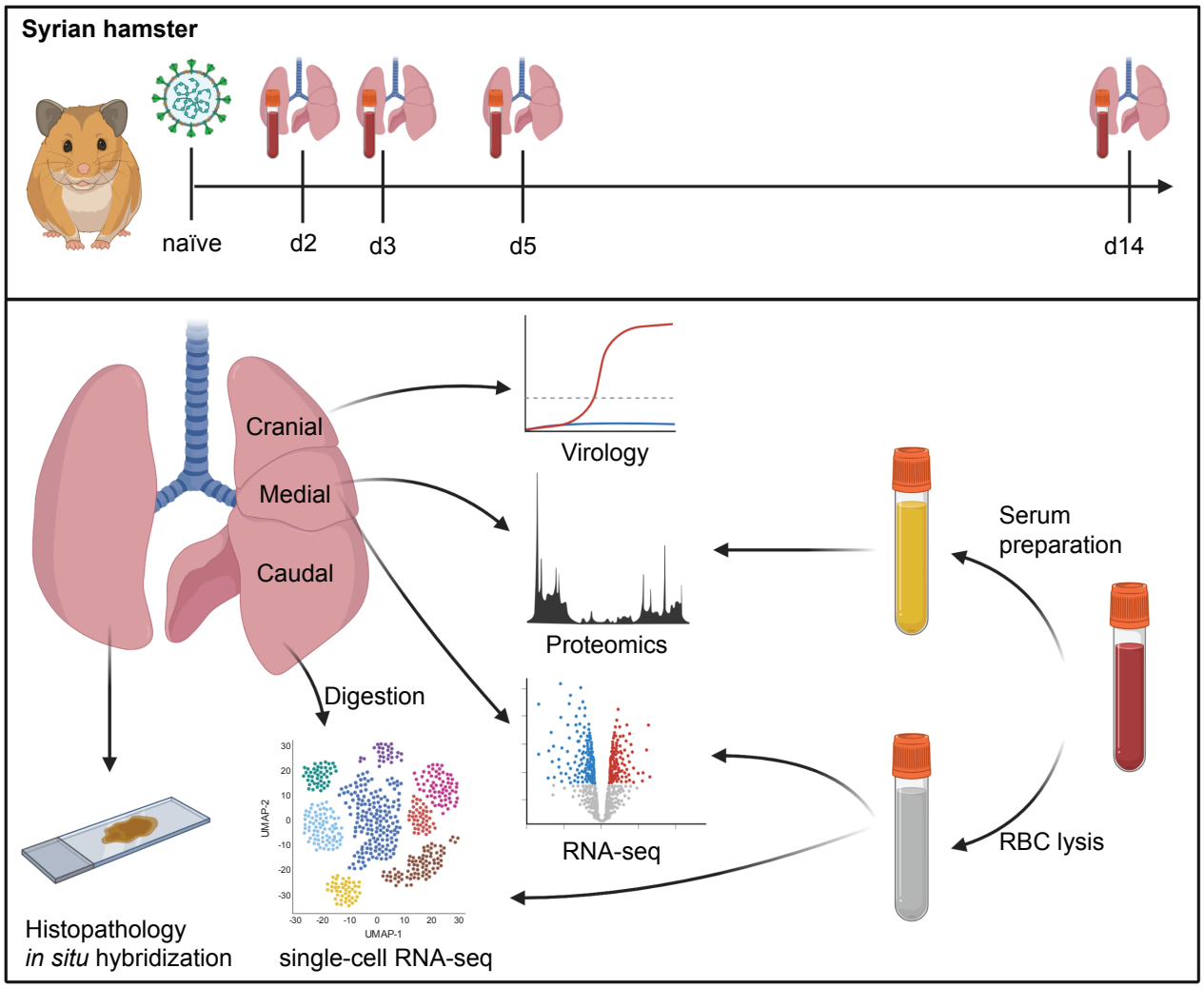

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Figure S2

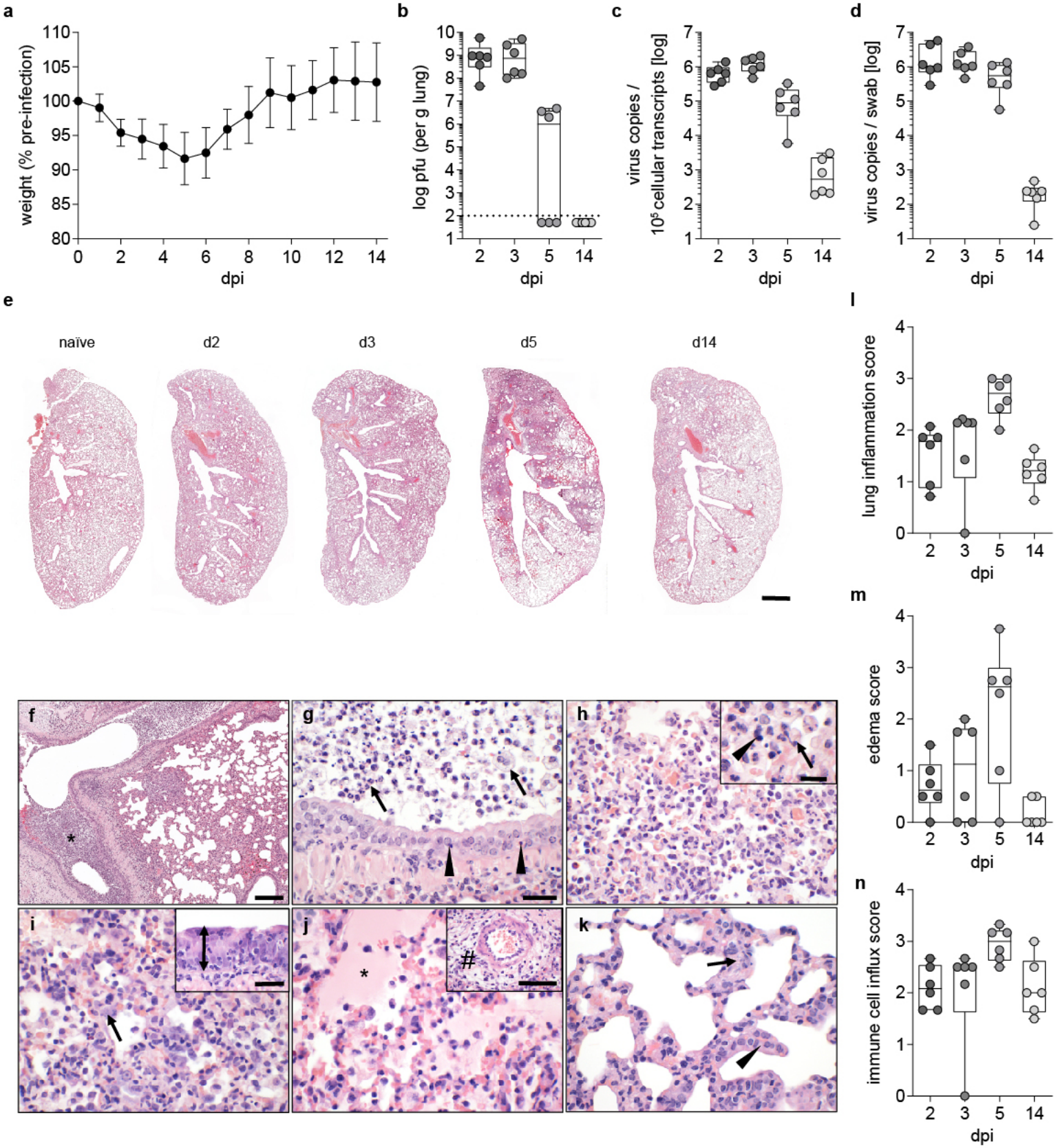

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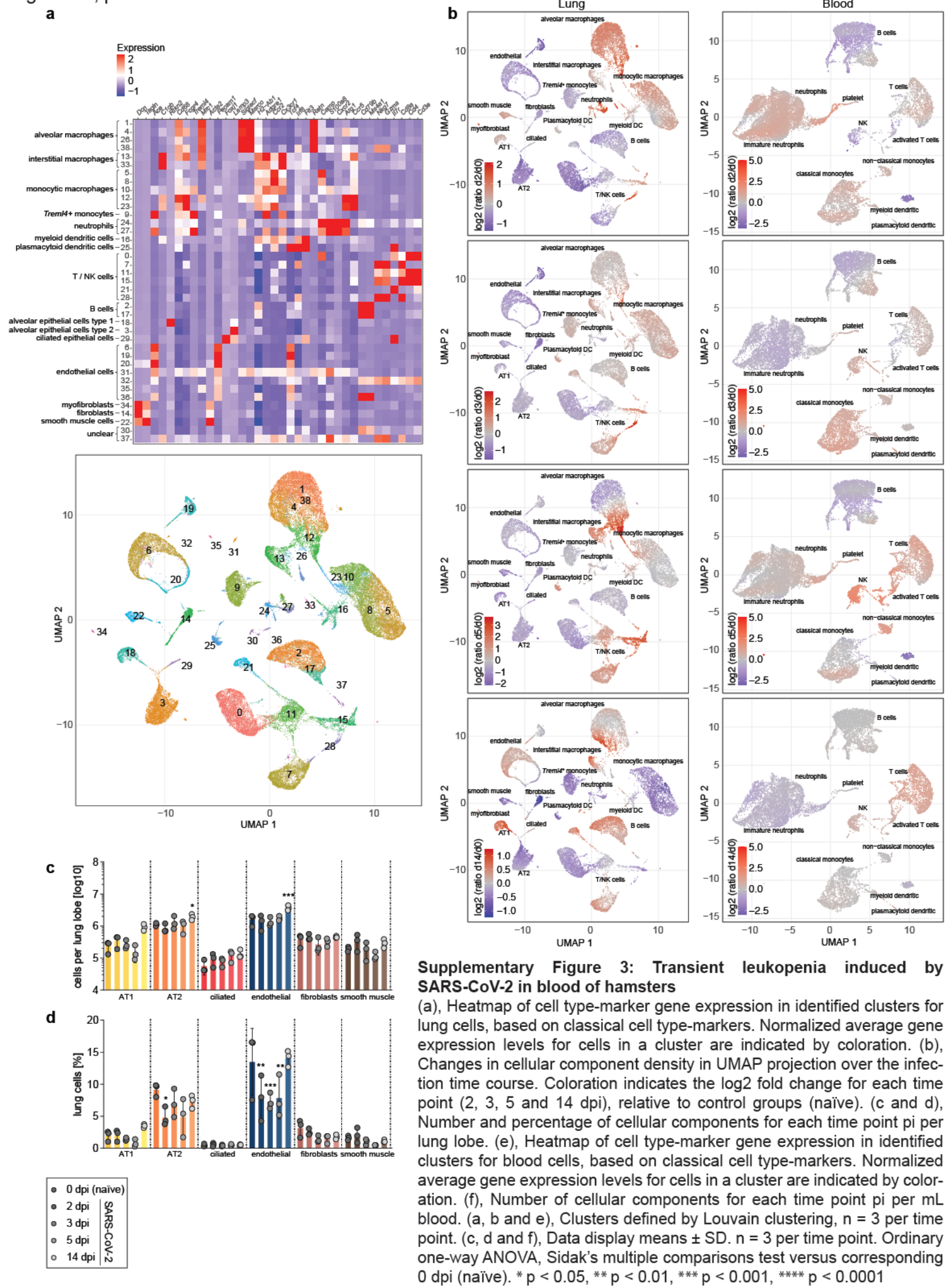
Figure S3, part 1



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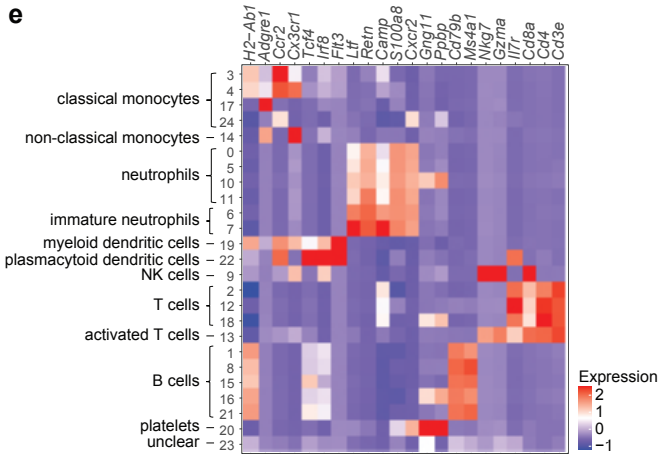
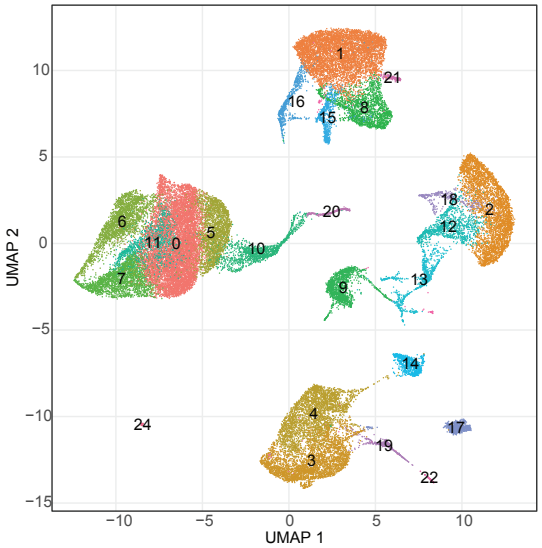




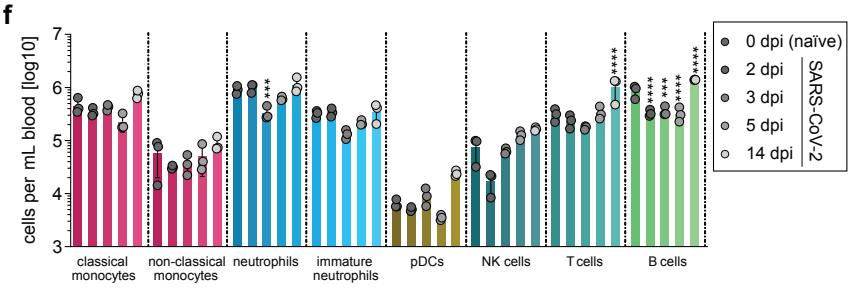
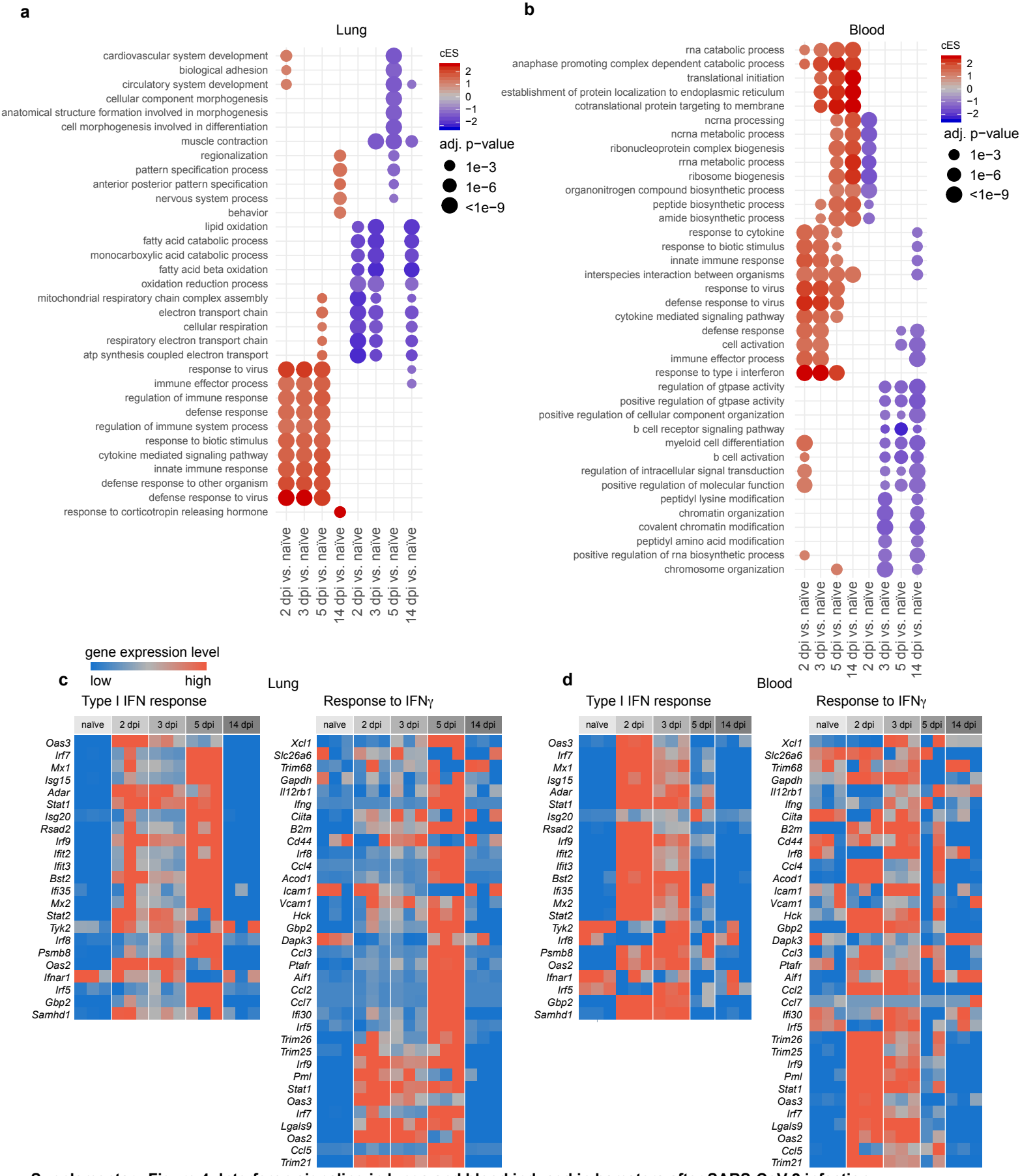


Figure S4 part 1



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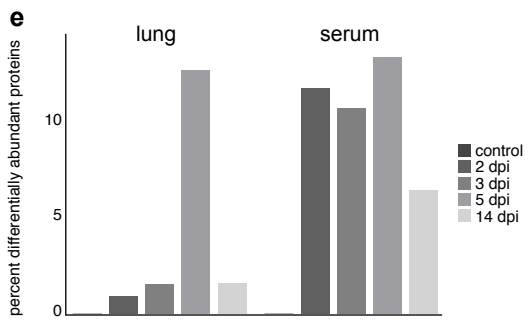
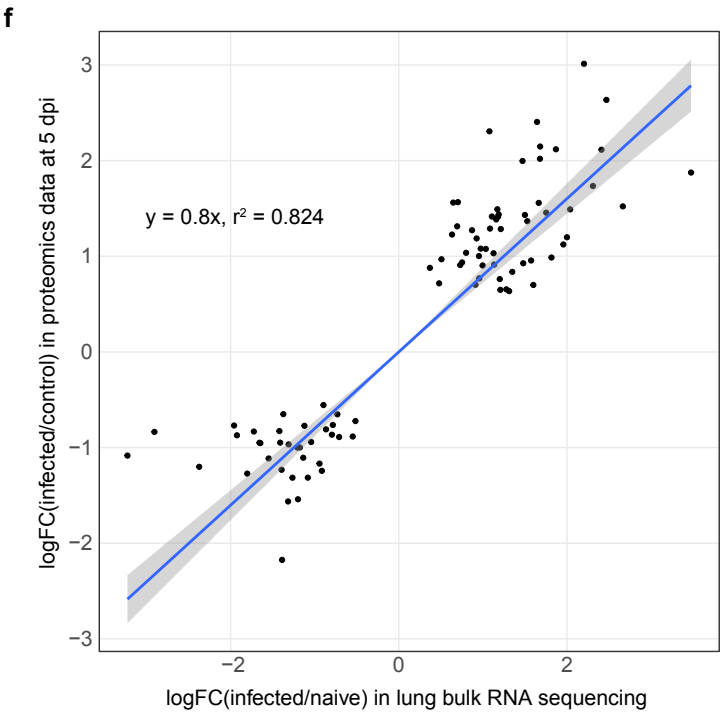




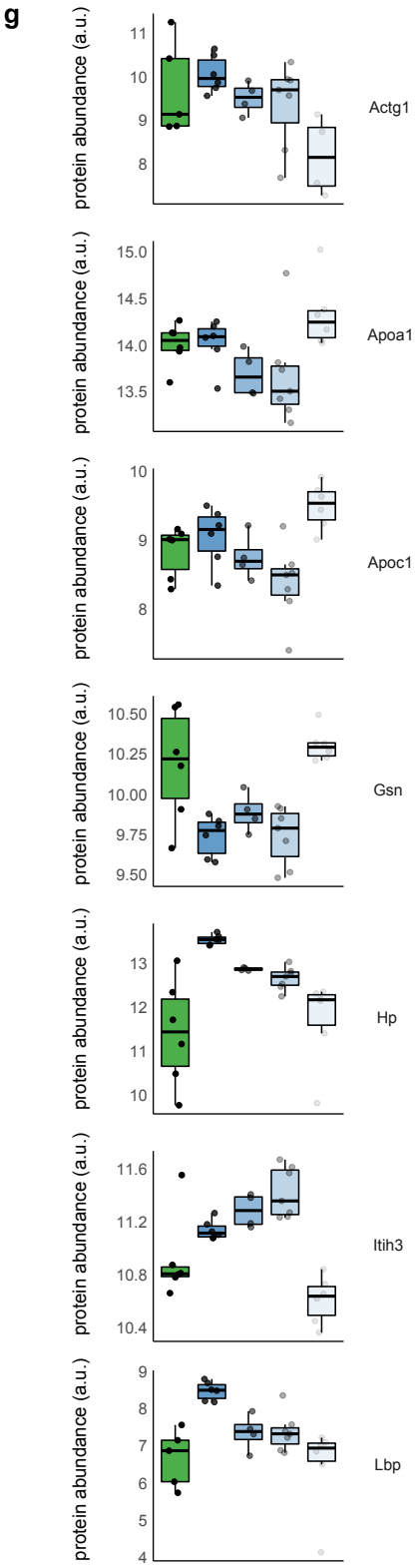
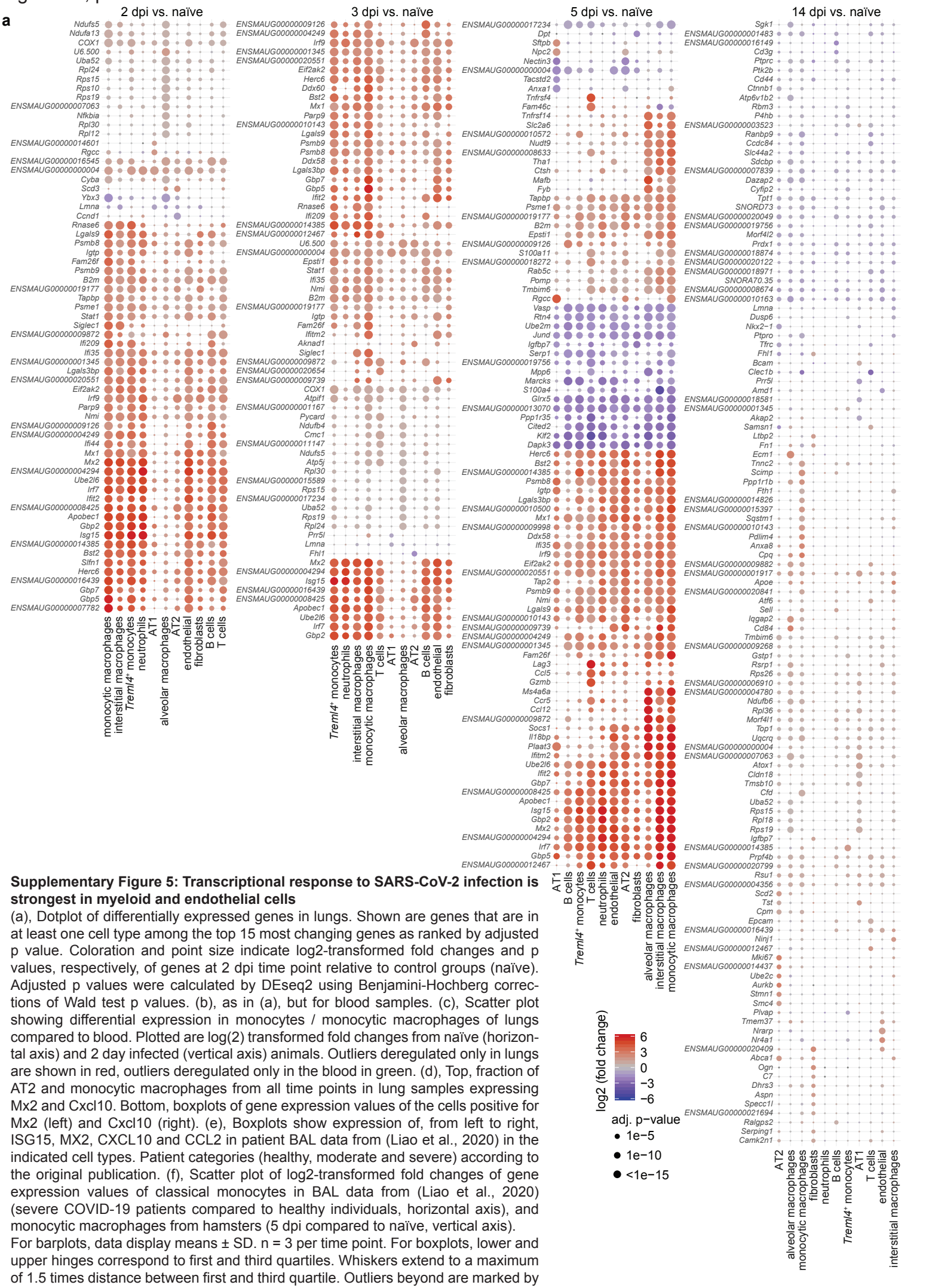


Figure S5, part 1



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b

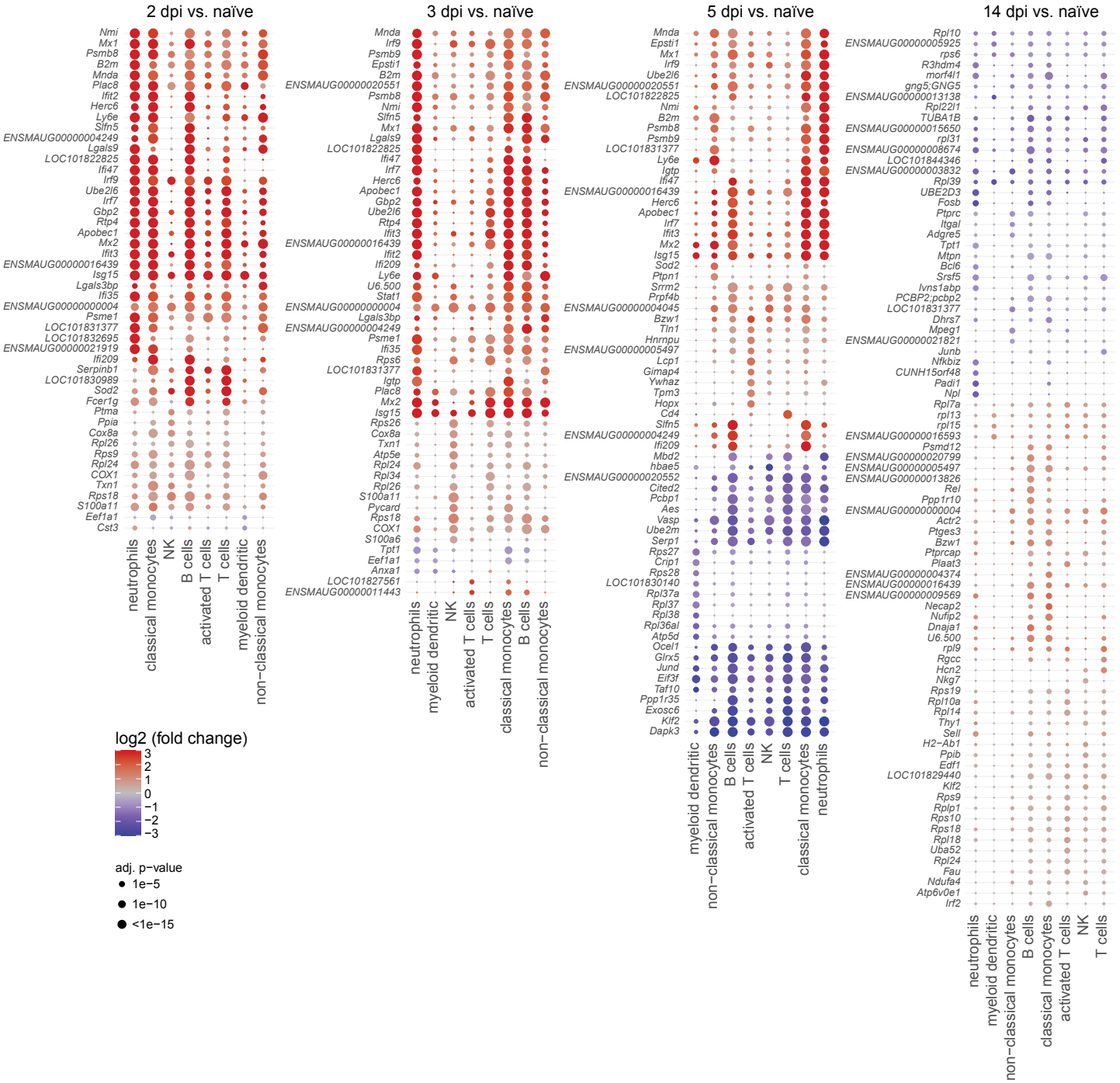
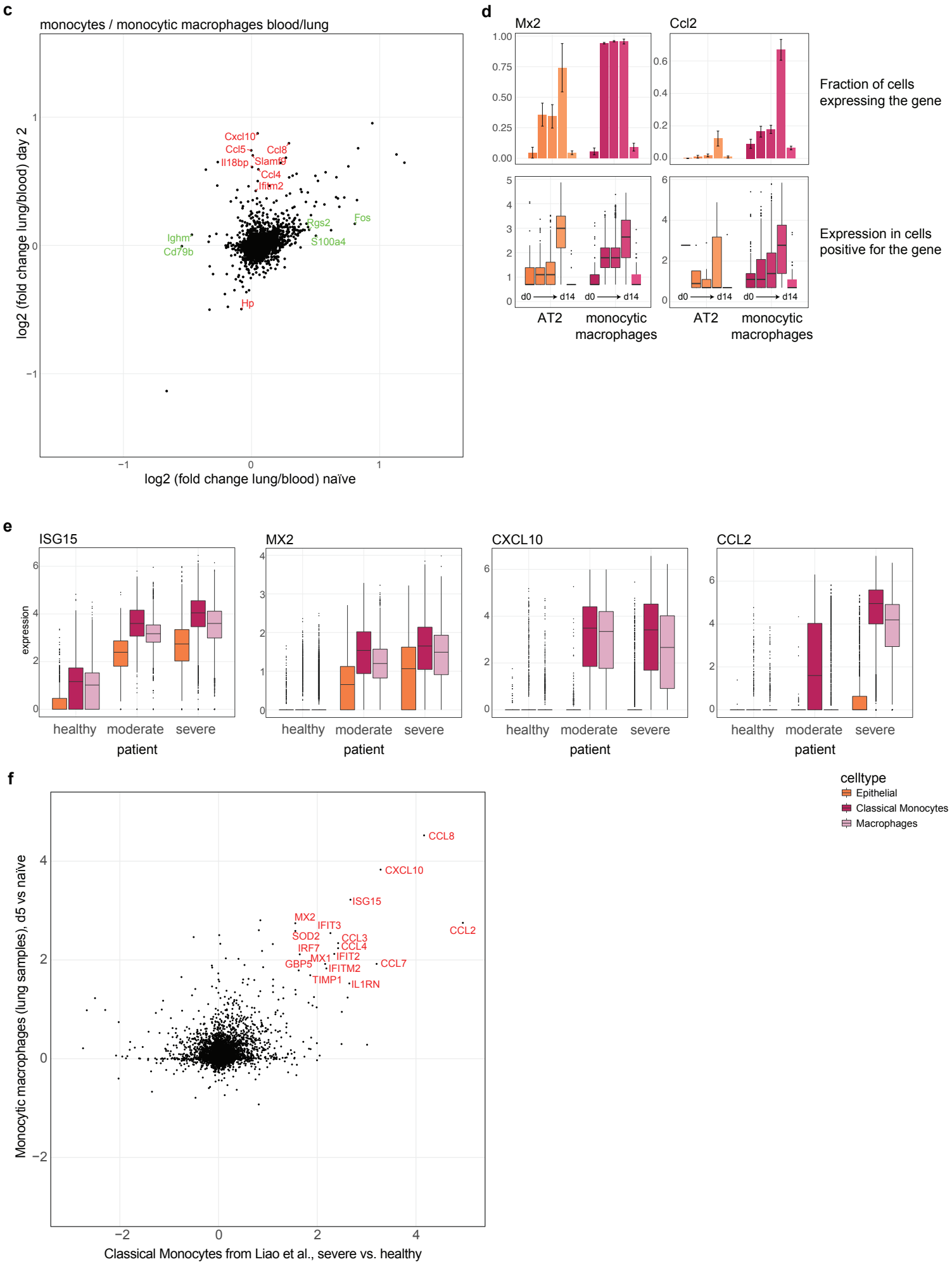


Figure S5, part 3



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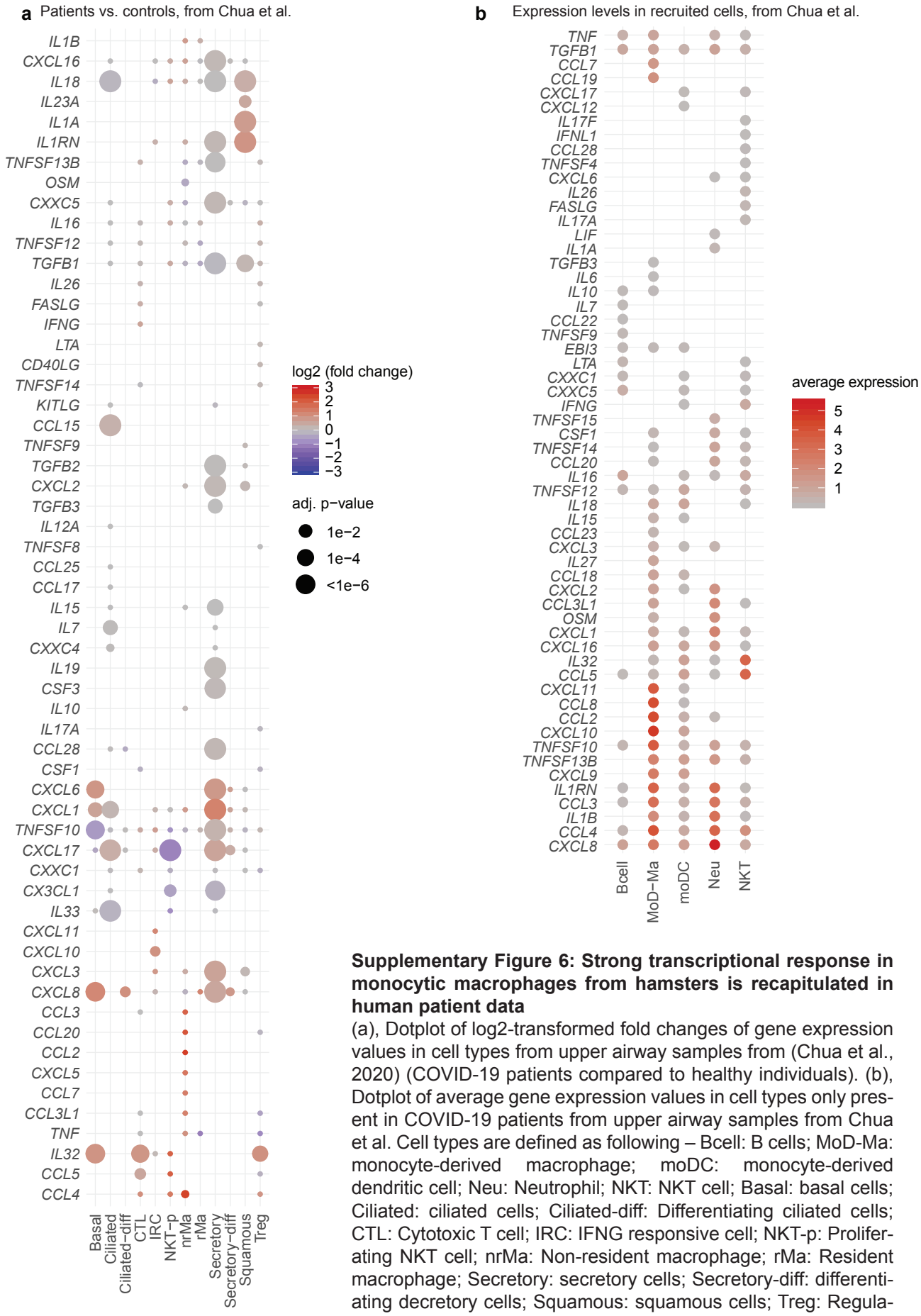

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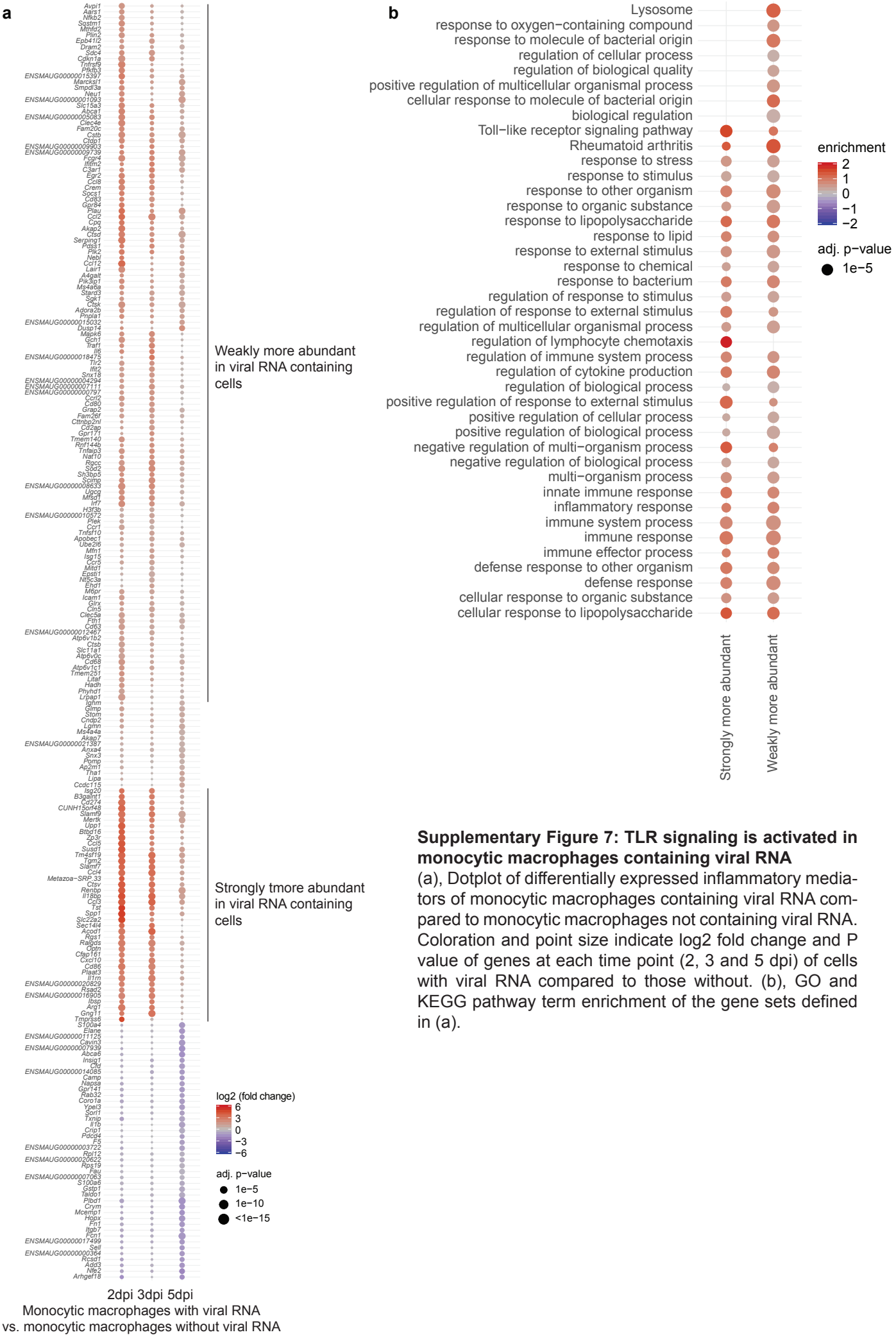

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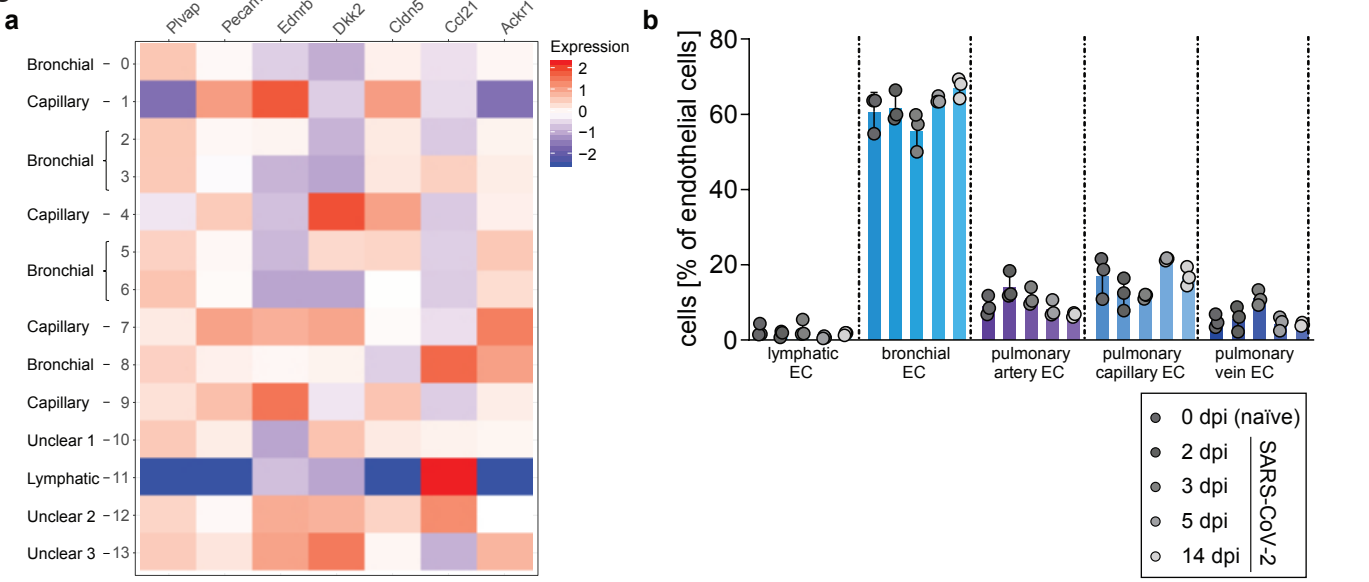

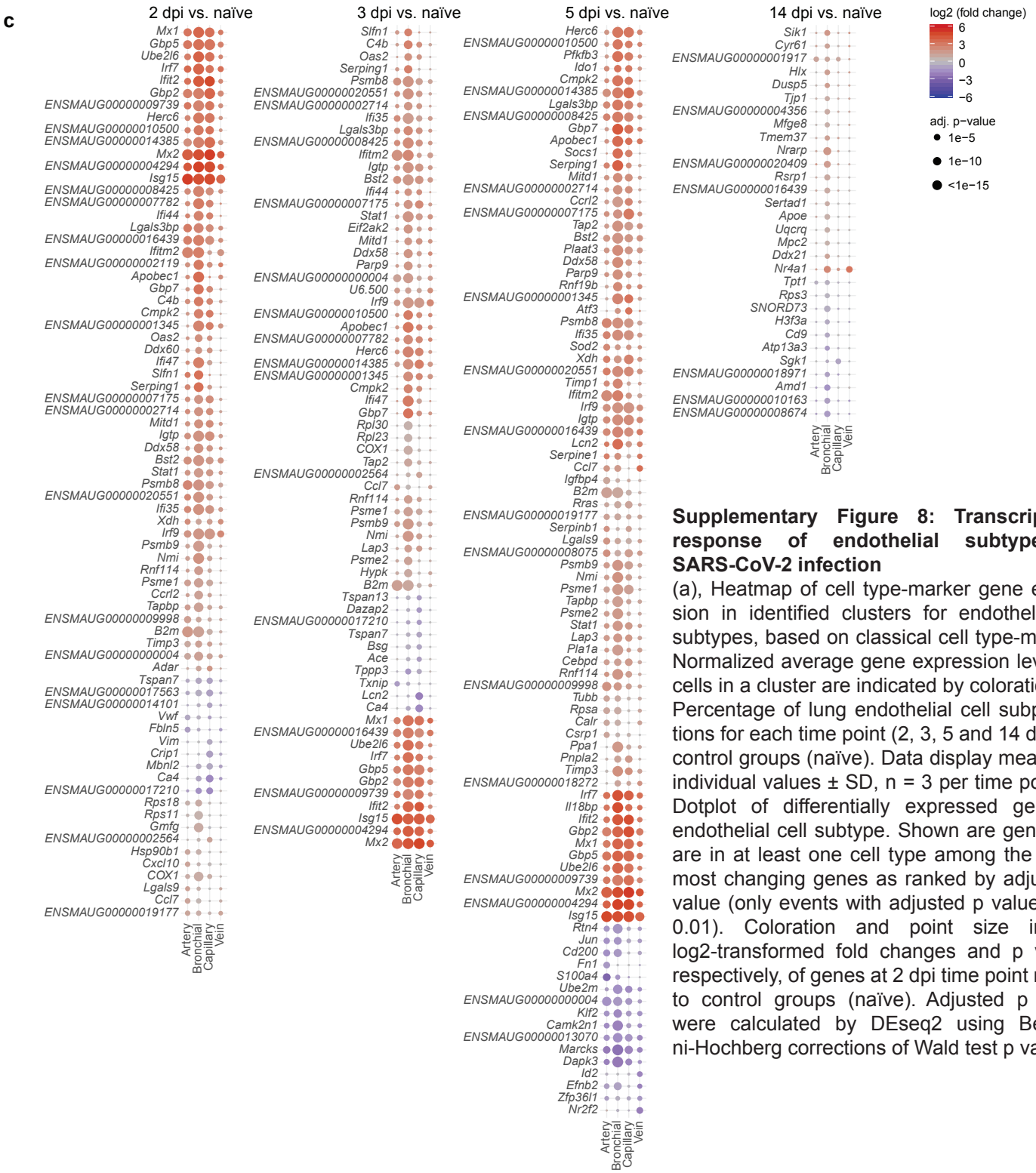

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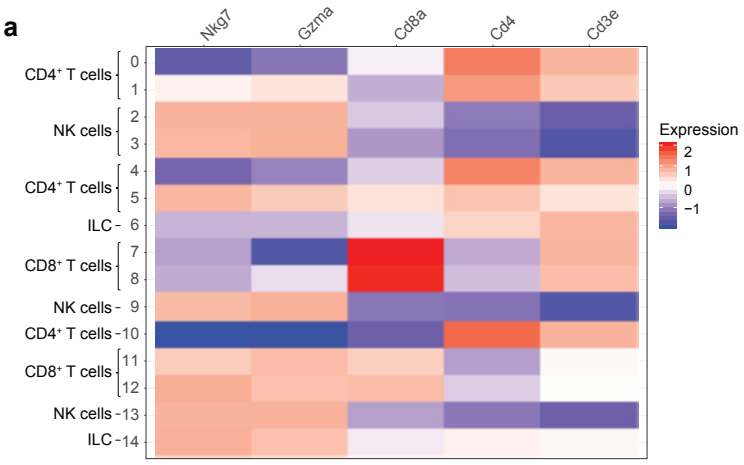
Figure S9



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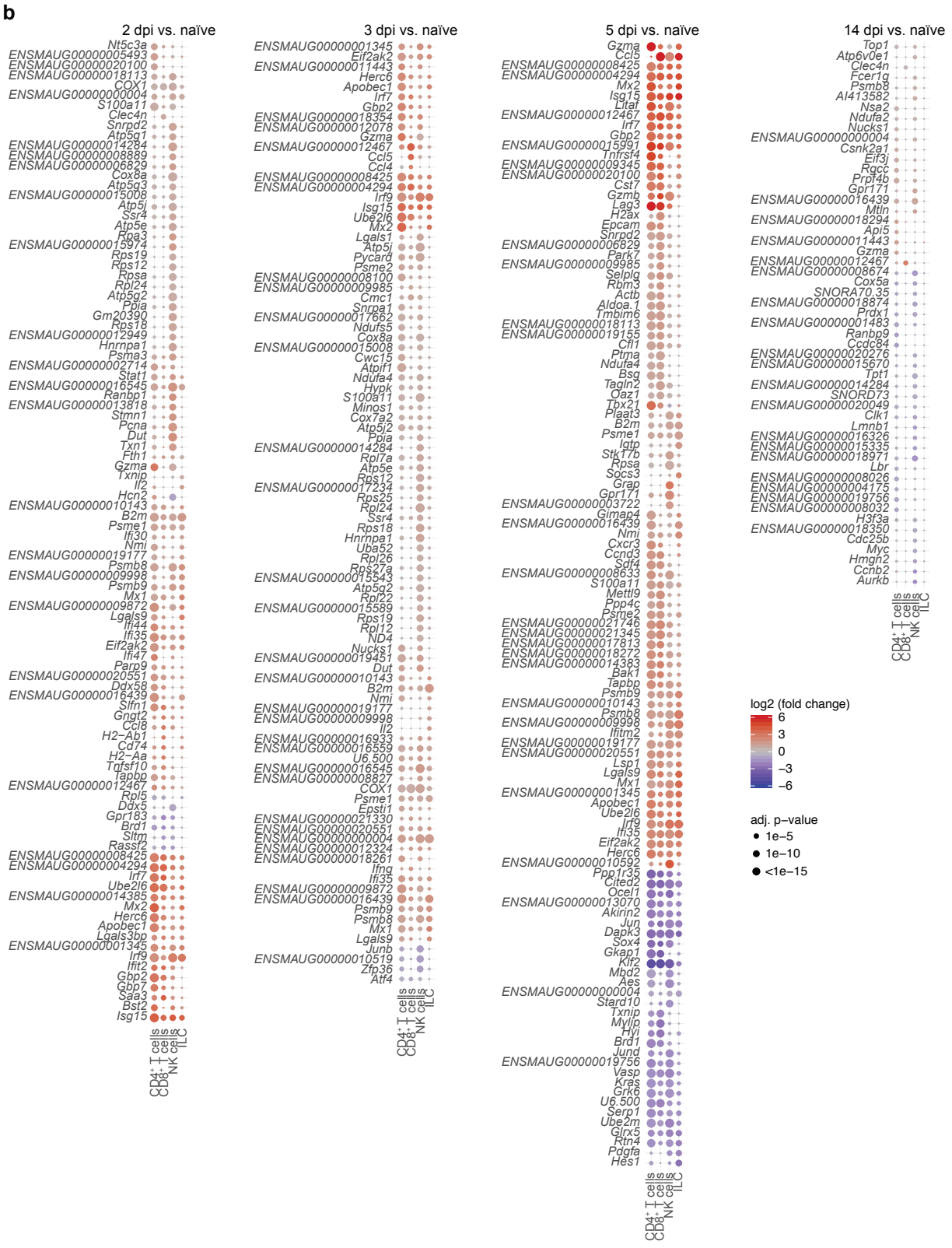

Table S1: Oligonucleotides used in this study.

Primer/probe	**Sequence 5'–3'**
SARS-CoV-2 forward	ACAGGTACGTTAATAGTTAATAGCGT
SARS-CoV-2 reverse	ATATTGCAGCAGTACGCACACA
SARS-CoV-2 probe	FAM-ACACTAGCCATCCTTACTGCGCTTCG-BHQ
RPL-18 forward	GTTTATGAGTCGCACTAACCG
RPL-18 reverse	TGTTCTCTCGGCCAGGAA
RPL-18 probe	FAM-TCTGTCCCTGTCCCGGATGATC-BHQ

Table S2. Identified proteins in respective proteome analysis

Differentially regulated in lung and reported to be regulated in human BAL fluid (22 proteins)		Showing the same direction of change (10 proteins)	Differentially regulated proteins in lung that have been reported to be regulated in human plasma (13 proteins)
Sept11	Ctsz	Sept11	C4b
Sod2	Grb2	Sod2	Ace
Hspa5	Eif6	Hspa5	S100a8
Tppp3	Gprc5a	Tppp3	Serpind1
Galm	Rps19	Galm	Ighm
Csrp1	Lap3	Csrp1	Hp
Dpysl2	Cd9	Dpysl2	B2m
Vat1	Samhd1	Vat1	Hpx
Igkv7-33	Aqp5	Igkv7-33	Itih3
Lgals3bp		Lgals3bp	Serping1
Cotl1			Igkv7-33
Pls3			Cfi
Psme1			Lgals3bp

Showing the same trend (9 proteins)	Differentially expressed in serum (37 proteins)		Proteins reported in human COVID19 studies (20 proteins)	
S100a8	Apoc1	Cfd	Apoc1	Actg1
Ighm	Cetp	Aldh1a1	C4b	
Hp	C4b	Pon1	Gsn	
B2m	Smco3		C6	
Itih3	Gsn	Apoc3	Apoa1	
Serping1	C6	Mbl1	Clu	
Igkv7-33	Apoa1	Clec3b	Serping1	
Cfi	Hbae5	Hpx	Hp	
Lgals3bp	Igkv7-33		Hpx	
	Clu	Hbb-y	Lbp	
	Serping1	Agt	Itih3	
	Hp	Calb1	Rbp4	
	Adipoq	Actg1	Ttr	
	Dusp2	Amy1	Cfd	
	Pltp	Aldob	Pon1	
	Cndp1	ENSMAUG00000021094	Apoc3	
	Lbp	ENSMAUG00000016284	Clec3b	
	Itih3	ENSMAUG00000001023	Igkv7-33	
	Rbp4	ENSMAUG00000004376	Agt	
	Ttr			

Table S3. Frequencies (%) of *Ace2*, Tmprss2, *Furin*, *Bsg*, *Nrp1, Ext1* mRNA–positive and SARS-CoV-2 positive cells amongst indicated cell populations.

Gene	Day (d)	Alveolar epithelial cells type 1	Alveolar epithelial cells type 2	Ciliated epithelial cells	Endothelial cells	Fibroblasts	Alveolar macrophages	Monocytic macrophages	Interstitial macrophages
Ace2	0 dpi (naïve)	0.43±0.74	3.70±1.20	21.82±13.73	0.06±0.11	0.00	1.10±0.36	0.28±0.34	1.38±1.59
	2 dpi	0.98±1.70	3.79±1.00	4.44±7.70	0.00	0.00	1.09±0.58	0.30±0.19	0.50±0.86
	3 dpi	0.67±1.15	3.53±1.24	10.13±8.77	0.00	0.00	0.90±0.23	0.23±0.21	0.46±0.80
	5 dpi	0.00	4.83±1.52	0.00	0.00	0.00	0.14±0.25	0.25±0.16	1.10±1.28
	14 dpi	1.85±1.89	4.60±0.75	7.25±2.38	0.00	0.00	1.15±0.61	0.09±0.15	0.69±1.20
Tmprss2	0 dpi (naïve)	73.68±5.59	12.00±1.86	34.55±14.43	0.13±0.11	0.00	0.00	0.06±0.11	0.00
	2 dpi	44.91±8.72	5.76±0.66	27.29±14.75	0.11±0.19	0.00	0.07±0.12	0.24±0.26	0.00
	3 dpi	54.25±5.04	9.30±1.66	27.14±5.45	0.00	0.50±0.86	0.13±0.11	0.09±0.08	0.00
	5 dpi	56.19±18.23	11.98±2.16	6.58±7.93	0.00	0.00	0.14±0.25	0.08±0.07	0.00
	14 dpi	65.57±6.49	15.43±0.53	30.98±11.78	0.36±0.23	0.00	0.10±0.18	0.00	0.00
Furin	0 dpi (naïve)	30.63±1.02	16.55±3.07	29.29±9.74	18.95±1.20	10.50±5.86	10.21±2.47	25.95±1.46	18.75±6.56
	2 dpi	28.69±6.20	16.74±3.98	31.00±8.89	17.28±0.91	18.77±2.99	13.57±2.99	23.90±6.26	16.45±6.63
	3 dpi	34.97±4.62	22.97±2.42	26.24±9.55	19.09±0.99	16.61±8.21	12.58±1.10	28.69±0.55	19.72±5.95
	5 dpi	24.11±12.96	22.74±5.35	6.58±7.93	22.19±0.79	17.62±2.39	40.03±9.12	52.76±4.78	51.63±1.61
	14 dpi	30.71±5.03	20.67±1.69	42.16±11.14	19.31±0.91	14.13±5.82	12.32±4.06	26.70±5.07	25.16±8.76
Bsg	0 dpi (naïve)	100.0±0.00	93.93±1.35	96.97±5.25	94.36±3.50	96.07±2.40	95.10±1.37	76.55±7.16	83.81±3.96
	2 dpi	99.49±0.89	90.65±4.77	95.21±4.18	92.69±5.16	96.92±2.07	92.28±4.19	77.19±7.13	84.03±9.83
	3 dpi	98.73±1.11	92.80±0.95	96.30±6.42	95.12±2.42	98.71±1.20	93.39±1.62	80.17±1.03	85.90±2.87
	5 dpi	100.00±0.00	99.46±0.93	92.34±7.20	99.24±1.10	100.00±0.00	91.50±2.72	92.23±1.11	97.43±1.53
	14 dpi	99.70±0.52	97.71±0.62	98.04±3.40	98.11±1.55	100.00±0.00	97.28±0.82	87.00±2.76	95.36±2.10
Nrp1	0 dpi (naïve)	0.44±0.76	32.06±6.04	4.14±4.60	54.92±10.61	12.65±3.25	0.25±0.44	1.40±0.65	7.81±7.34
	2 dpi	0.90±0.80	32.99±5.15	1.28±2.22	45.48±9.69	10.75±5.14	0.22±0.37	2.18±0.98	6.43±4.89
	3 dpi	0.95±1.65	41.46±7.27	1.67±2.89	57.70±5.56	19.76±12.25	0.32±0.56	1.97±0.68	6.98±2.44
	5 dpi	0.72±1.26	35.24±4.96	8.96±5.74	55.25±8.27	10.16±5.77	12.33±6.84	16.66±2.06	34.58±15.48
	14 dpi	1.74±0.78	35.94±2.55	0.00	68.53±2.41	25.47±8.05	0.30±0.05	1.86±0.29	9.47±2.81
Ext1	0 dpi (naïve)	22.43±3.37	12.37±1.46	5.25±4.71	8.14±1.62	20.62±6.23	17.74±2.64	6.81±1.25	8.14±1.20
	2 dpi	12.66±5.06	9.73±3.97	9.97±11.29	7.38±3.38	17.89±4.81	11.46±2.73	7.48±1.39	8.75±4.24
	3 dpi	17.70±7.72	12.37±1.85	33.65±20.33	11.76±0.53	35.84±12.53	16.41±2.84	12.86±1.65	10.97±2.54
	5 dpi	19.89±7.84	15.24±5.47	8.36±8.71	9.06±1.21	25.12±0.59	22.93±5.25	27.84±1.82	27.74±4.85
	14 dpi	20.68±3.15	10.34±2.58	7.25±6.34	10.73±2.82	37.87±7.61	10.20±3.68	5.73±1.72	7.75±0.82
SARS-Cov-2	2 dpi	6.01±7.89	6.41±6.55	6.07±5.79	4.95±5.91	4.46±6.70	7.85±6.82	10.24±6.67	9.39±7.33
	3 dpi	10.48±13.31	12.05±6.41	15.50±4.45	9.15±7.70	10.05±6.01	12.20±8.66	11.47±7.40	15.76±11.03
	5 dpi	4.17±7.22	2.76±3.91	7.84±0.79	1.88±1.63	2.14±2.52	24.77±0.31	9.65±2.32	15.74±5.02
	14 dpi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

[1]Data are represented as mean±standard deviation. *Ace2*, Angiotensin-converting enzyme 2, *Tmprss2,* transmembrane serine protease 2, *Bsg*, Basigin, *Nrp1*, neuropilin, *Ext1* exos glycosyltransferase 1, SARS-CoV-2, severe acute respiratory syndrome coronavirus 2, dpi, days post infection