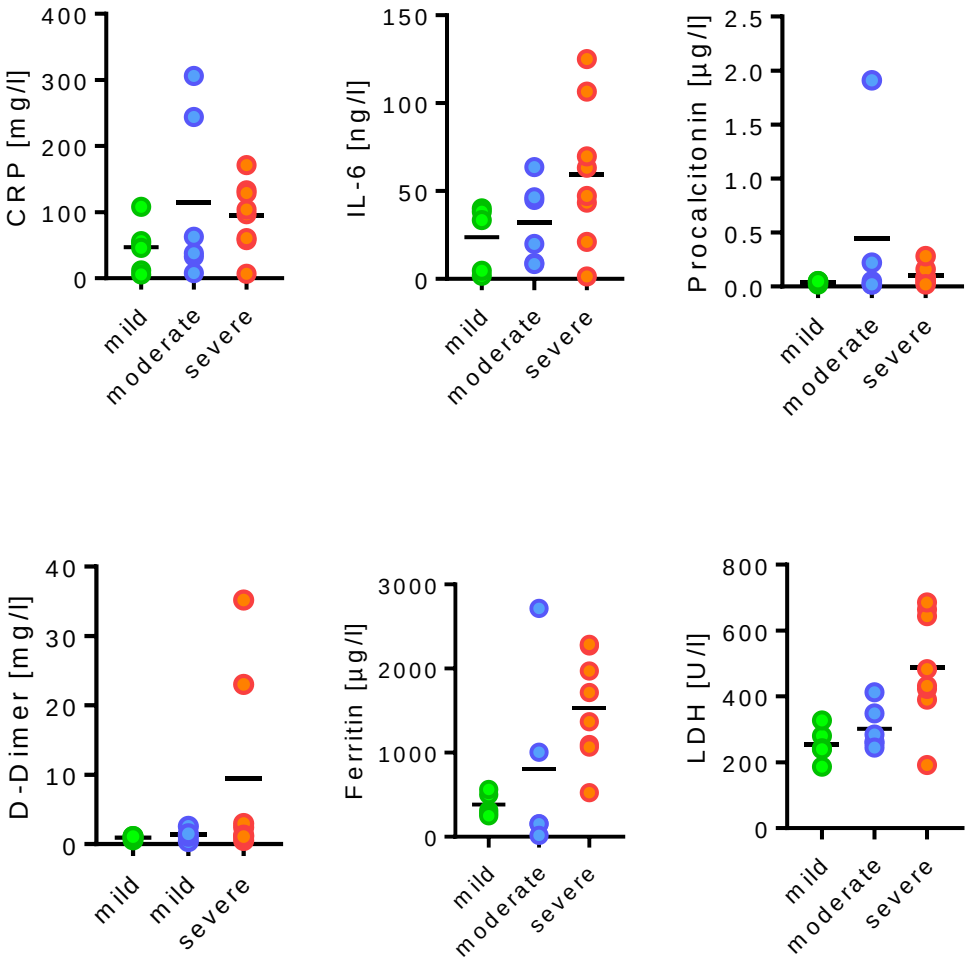
Supplementary Figure 1

Panel 1	Panel 2	Panel 3
CD21	CD21	CD21
CD20	CD39	CD39
CD73	PD-1	PD-1
CD24	CD20	CD20
CD38	CD73	CD73
CD27	CD24	CD24
IgM	CD38	CD38
IgD	CD27	CD27
CD86	IgM	IgM
CD11c	IgD	IgG
CD39	CD86	CD138
CXCR3	CD11c	CD11c
CD19	CD19	CD19
L/D	CXCR3	T-bet
	CD3	CD3
	L/D	L/D

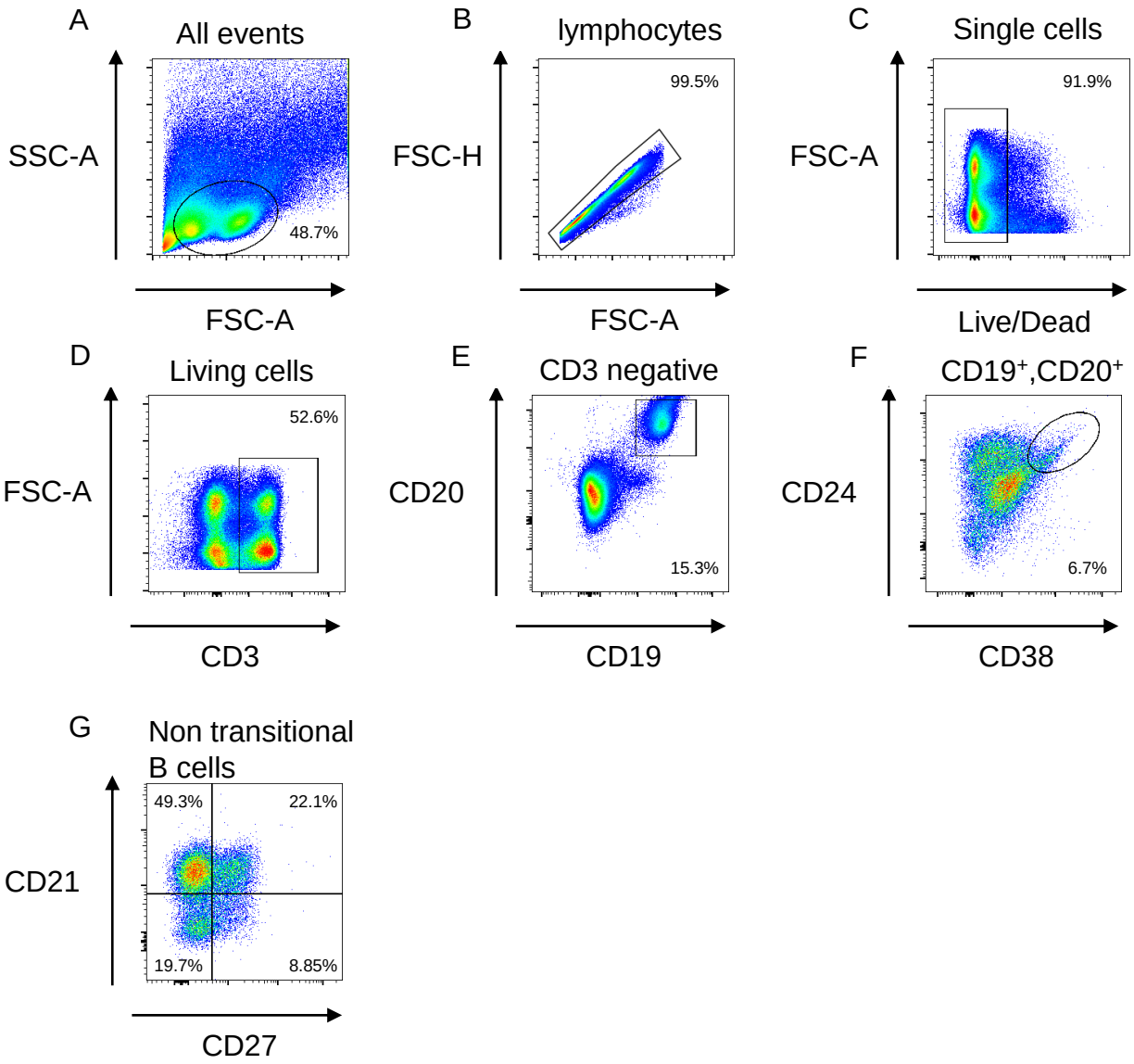
Supplementary Figure 1: Overview of panels used for flow cytometry. All markers were stained on the cell surface except for T-bet in panel 3.

Supplementary Figure 2



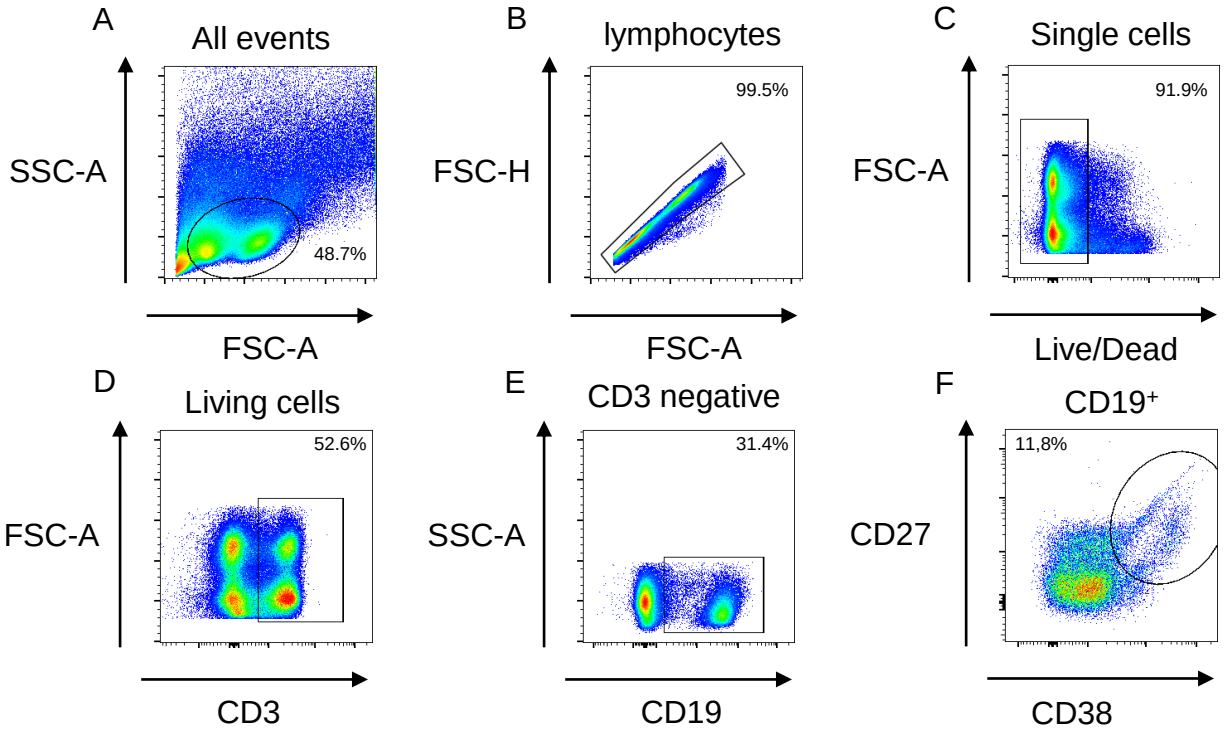
Supplementary Figure 2: Clinical laboratory parameters measured for COVID-19 patients classified in mild, moderate and severe disease course according to the WHO criteria for COVID-19.

Supplementary Figure 3



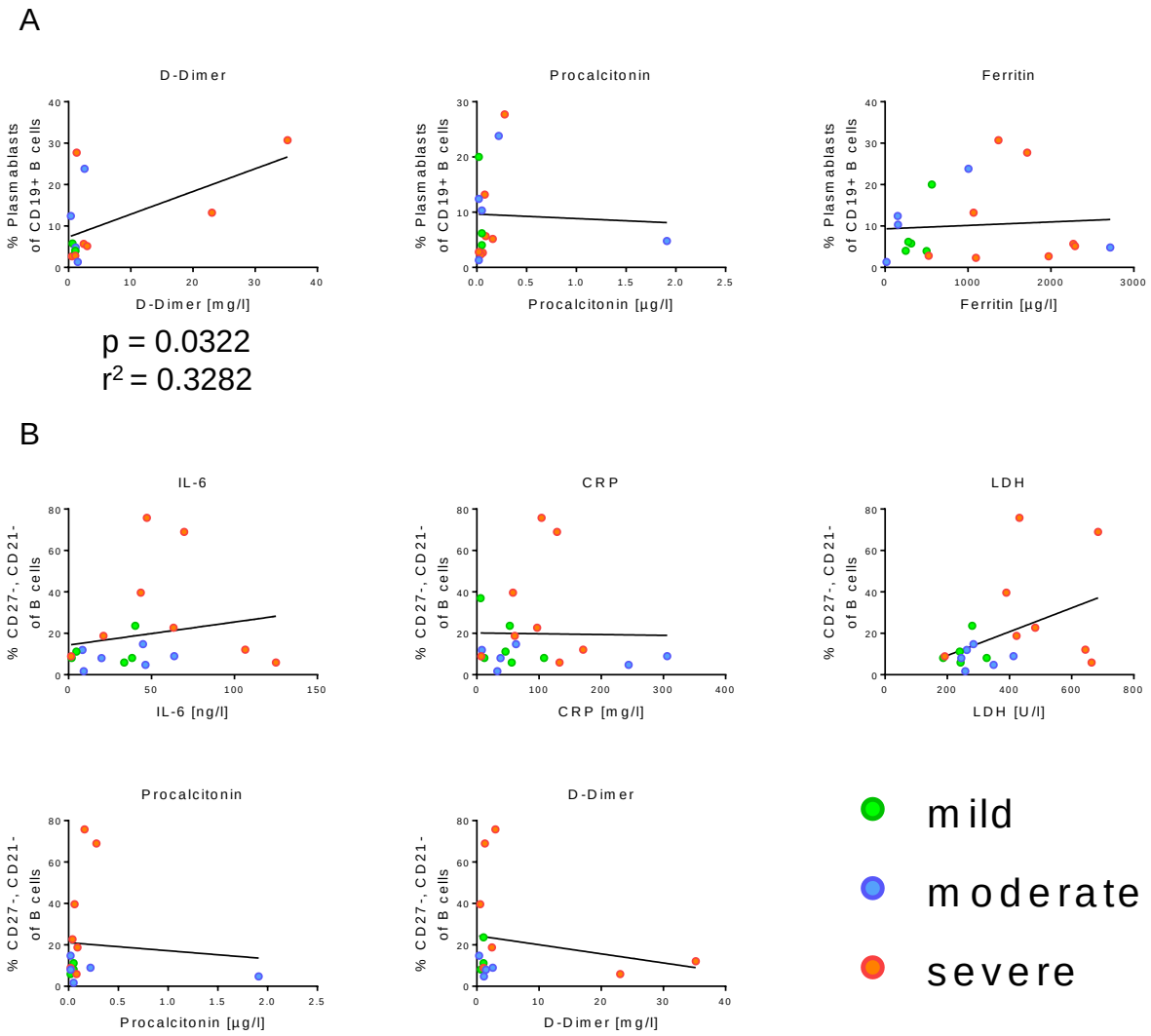
Supplementary Figure 3: (**A**) First, Lymphocytes were identified by forward scatter (FSC) and side scatter (SSC) gate. (**B**) Single cells were gated by a forward scatter height (FSC-H) and forward scatter area (FSC-A) gate. (**C**) Living cells were included only. (**D**) Only CD3 negative cells were included. (**E**) B cells were identified by $CD19^+$ and $CD20^+$ co expression. (**F**) $CD24^+$ and $CD38^+$ were selected to identify transitional B cells. (**G**) Naïve and memory subsets were identified using CD21 and CD27.

Supplementary Figure 4



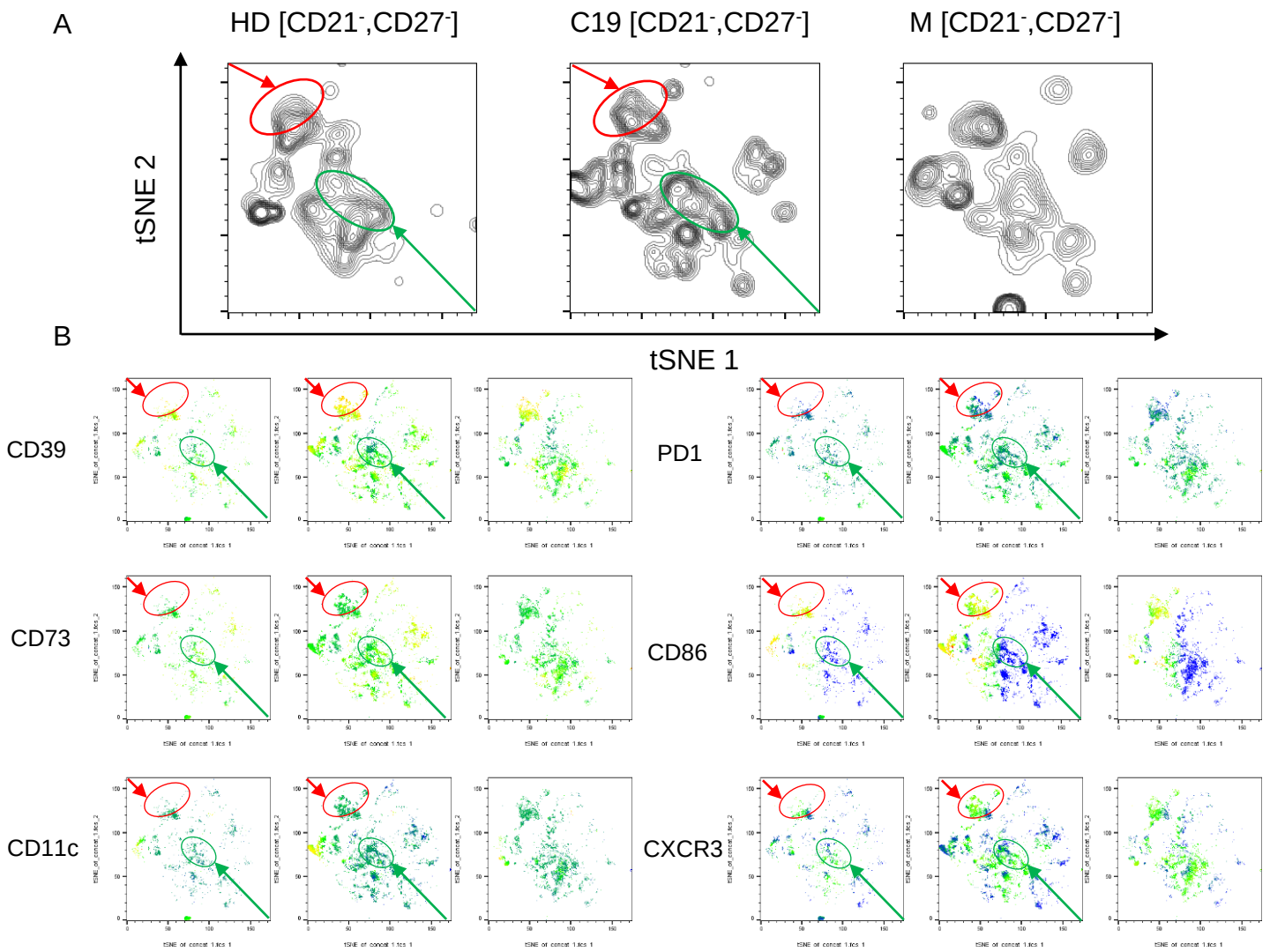
Supplementary Figure 4: (**A**) First, Lymphocytes were identified by forward scatter (FSC) and side scatter (SSC) gate. (**B**) Single cells were gated by a forward scatter height (FSC-H) and forward scatter area (FSC-A) gate. (**C**) Living cells were included only. (**D**) Only CD3 negative cells were included. (**E**) B cells were identified by $CD19^+$. (**F**) $CD27^+$ and $CD38^+$ were selected to identify plasmablasts

Supplementary Figure 5



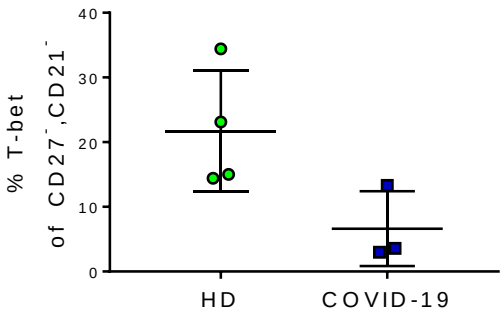
Supplementary Figure 5: Correlations between IL-6, CRP, LDH, procalcitonin, D-Dimer and ferritin levels and frequencies of (**A**) plasmablasts on $CD19^+$ B cells and (B) atypical memory B cells on $CD19^+CD20^+$ B cells in COVID-19 patients. For bivariate correlation analysis the Spearman correlation and Pearson correlation were applied. P-values smaller than 0.05 were considered significant.

Supplementary Figure 6



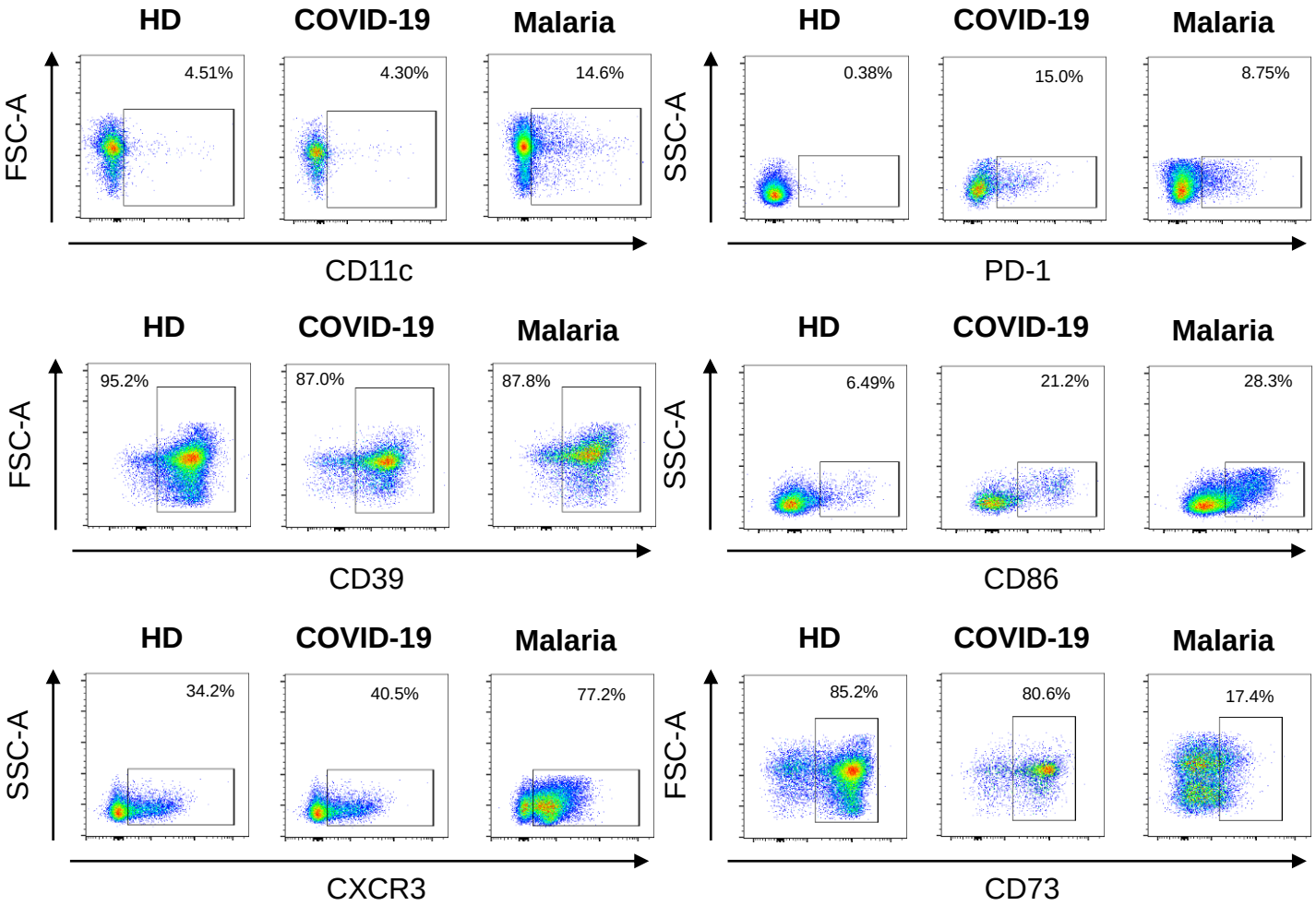
Supplementary Figure 6: (**A**) FlowJo tSNE projection of atypical memory B cells (contour plot) from healthy donors (HD), COVID-19 (C19), and malaria (M) patients. Red circle: high expression of CD39, CD86, and CXCR3, green circle: high expression of PD-1 and low expression of CD86 and CXCR3 (**B**) tSNE projections are shown of the expression of the indicated surface molecules on $CD21^{-}CD27^{-}$ atypical memory B cells.

Supplementary Figure 7



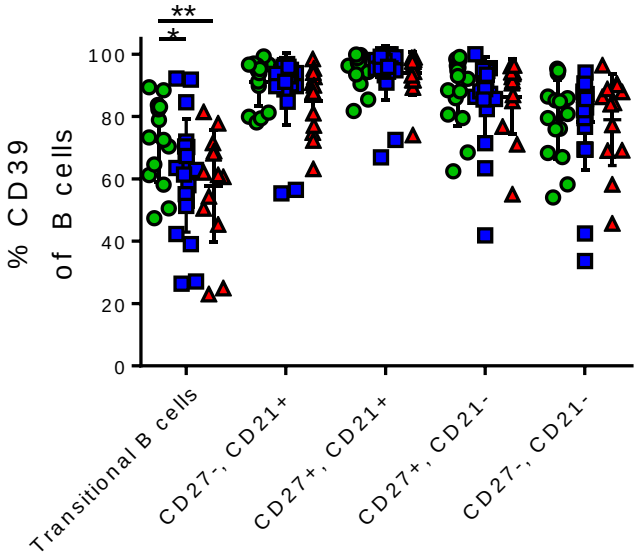
Supplementary Figure 7: Frequency of cells expressing T-bet among atypical memory B cells in healthy donors (HD) and COVID-19 patients.

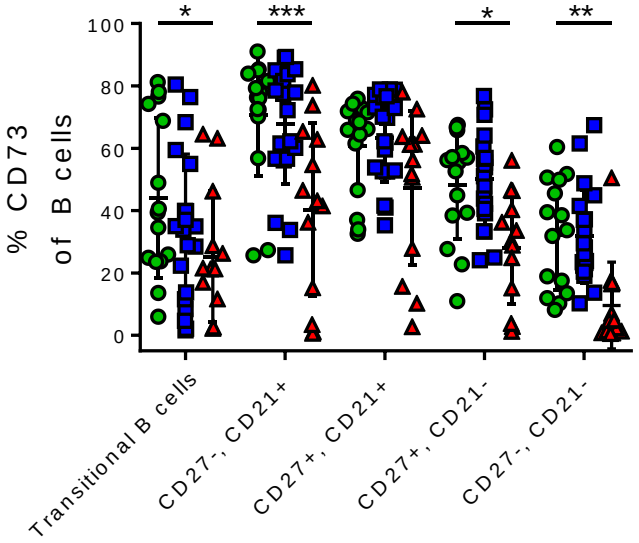
Supplementary Figure 8

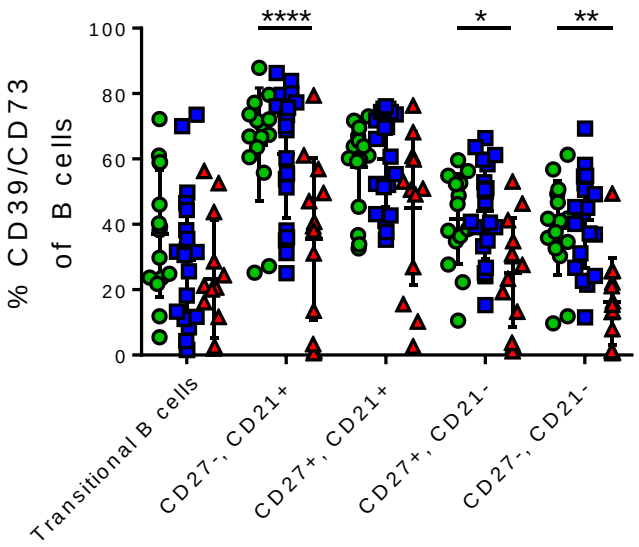


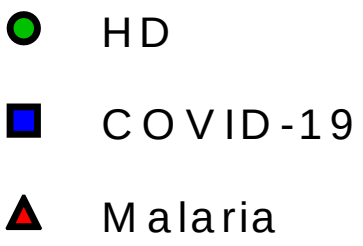
Supplementary Figure 8: Representative dot plots of CD11c, PD-1, CD39, CD86, CXCR3 and CD73 on $CD19^{+}$,$CD20^{+}$ B cells for healthy donors (HD), COVID-19 and malaria patients.

Supplementary Figure 9



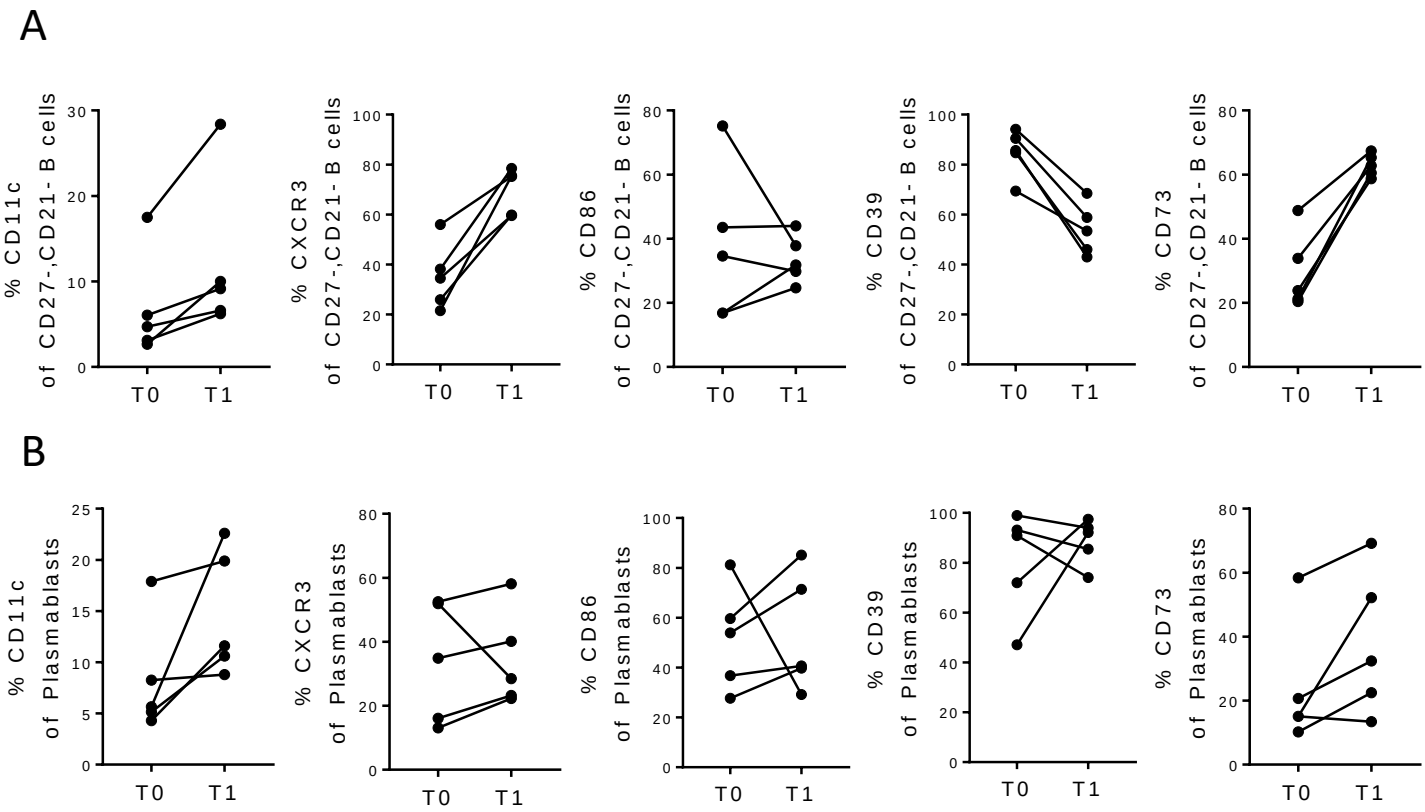






Supplementary Figure 9: Frequencies of CD39$^+$ and CD73$^+$ B cells at different stages of differentiation in HD, COVID-19 and malaria. Data are shown as mean ± SD, where *, **, *** and **** indicate p-values <0.05, <0.01, <0.001, and <0.0001.

Supplementary Figure 9



Supplementary Figure 9: Longitudinal analysis of the frequency of $CD11c^+$, $CXCR3^+$, $CD86^+$, $CD39^+$ and $CD73^+$ (**A**) $CD27^-$,$CD21^-$ B cells and (**B**) plasmablasts in COVID-19 patients.

Supplementary Table 1: COVID-19 cohort and COVID-19 disease severity

	COVID-19		
	mild	**moderate**	**severe**
Patient characteristics			
age [years]	51.5 ± 13.70	49.3 ± 10.62	65.4 ± 8.5
sex [female/male]	1|5	3|3	1|7
Blood pressure			
systolic RR [mean]	123.1 ± 8.8	129.3 ± 11.0	122.8 ± 9.5
diastolic RR [mean]	76.3 ± 2.0	77.6 ± 3.8	72.9 ± 4.1
Respiration			
SpO2 [max]	97.1 ± 1.3	95.8 ± 1.2	92.6 ± 1.2
SpO2 [min]	95.7 ± 1.6	91.6 ± 1.8	81.4 ± 8.3
respiratory rate [mean]	15.2 ± 1.4	17.3 ± 3.0	17.2 ± 2.1
respiratory rate [max]	18.2 ± 4.7	23.0 ± 6.7	25.25 ± 8.1
pneumonia	2 / 6	4 / 6	8 / 8
Clinical chemistry			
CRP [max]	55.3 ± 35.6	167.6 ± 159.1	173.75 ± 78.9
IL-6 [max]	24.2 ± 18.2	72.52 ± 80.6	1356 ± 3443
Ferritin [max]	391.4 ± 14.2	1072.025 ± 1393	2016.75 ± 756.3
Hospital			
time in hospital [mean]	3.84 ± 1.6	6.6 ± 2.7	13.125 ± 6.8
time ICU [mean]			8

Supplementary Table 2: Longitudinal Analysis of SARS-CoV-2 IgM and IgG production

Sample ID	sample date	Assay	value	result
C19-01	9	IgM	0.1	negative
	24	IgM	13	positive
	9	IgG	<3.80	negative
	24	IgG	136	positive
C19-04	13	IgM	0.215	negative
	26	IgM	11,1	positive
	13	IgG	<3.80	negative
	26	IgG	318	positive
C19-06	12	IgM	0.346	negative
	27	IgM	0.167	negative
	12	IgG	<3.80	negative
	27	IgG	<3.80	negative
C19-16	22	IgM	5.29	positive
	112	IgM	0.616	negative
	22	IgG	55.3	Positive
	112	IgG	37	Positive
C19-19	21	IgM	7.66	Positive
	107	IgM	0.168	Negative
	21	IgG	168	Positive
	107	IgG	136	Positive