Supplementary Materials

Table S1. Clinical characteristics of SLE and control cohorts.

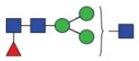
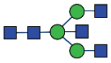
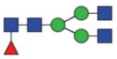
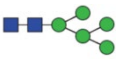
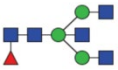
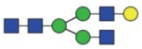
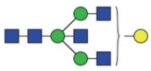
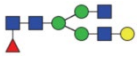
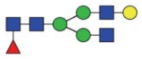
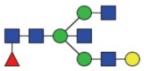
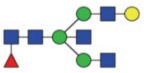
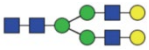
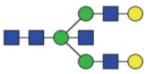
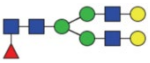
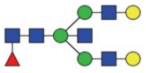
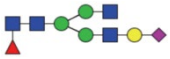
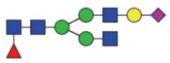
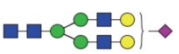
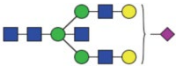
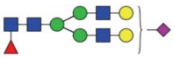
Demographic characteristics	SLE (n = 192)	Control (n = 180)	P value [b]
Age, mean (SD)	30.13 (4.51)	30.42 (4.17)	0.40
<35, n (%)	162 (84)	146 (81)	
≥35, n (%)	15 (16)	34 (19)	
Pregnancy status			-
Not pregnant, n (%)	36 (19)	90 (50)	
Pregnant, n (%)	156 (81)	90 (50)	
Gestational weeks at parturition, mean (SD)	37.20 (1.96)	39.22 (1.19)	<0.0001*
Birth weight of newborn (g), mean (SD)	2779 (572.6)	3292 (390.1)	<0.0001*
Fetal outcomes			
Live birth[a], n (%)	140 (90)	90 (100)	0.0013*
Full-term birth[a], n (%)	92 (59)	89 (99)	<0.0001*
Preterm birth[a], n (%)	46 (29)	1 (1)	<0.0001*
SGA[a], n (%)	17 (11)	0	0.0019*
Fetal loss[a], n (%)	16 (10)	0	0.0006*
Major pregnancy-related complications			
Pre-eclampsia, n (%)	21 (13)	0	<0.0001*
PPROM, n (%)	17 (11)	1 (1)	0.0033*

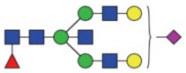
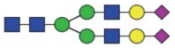
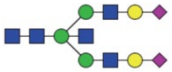
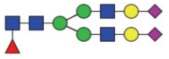
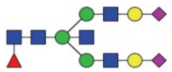
Abbreviations: SGA = small for gestational age; PPROM = Preterm premature rupture of the membranes

[a] Denominator used for proportion is the number of individuals with pregnancy outcomes (live birth or fetal loss).

[b] By Fisher's exact test for the categorical variables or two-sample t-test for the continuous variables. P value < 0·5 is annotated with "*".

Table S2. Descriptions of directly measured glycans and derived traits.

Glycan peak	Descriptions of major glycan structure	
GP1 [a]	Percentage of FA1 glycan in total IgG glycans	
GP2	Percentage of A2 glycan in total IgG glycans	
GP3	Percentage of A2B glycan in total IgG glycans	
GP4	Percentage of FA2 glycan in total IgG glycans	
GP5	Percentage of M5 glycan in total IgG glycans	
GP6	Percentage of FA2B glycan in total IgG glycans	
GP7	Percentage of A2G1 glycan in total IgG glycans	
GP8a	Percentage of A2BG1 glycan in total IgG glycans	
GP8b	Percentage of FA2[6]G1 glycan in total IgG glycans	
GP9	Percentage of FA2[3]G1 glycan in total IgG glycans	
GP10	Percentage of FA2[6]BG1 glycan in total IgG glycans	
GP11	Percentage of FA2[3]BG1 glycan in total IgG glycans	
GP12	Percentage of A2G2 glycan in total IgG glycans	
GP13	Percentage of A2BG2 glycan in total IgG glycans	
GP14	Percentage of FA2G2 glycan in total IgG glycans	
GP15	Percentage of FA2BG2 glycan in total IgG glycans	
GP16a	Percentage of FA2G1[6]S1 glycan in total IgG glycans	
GP16b	Percentage of FA2G1[3]S1 glycan in total IgG glycans	
GP17	Percentage of A2G2S1 glycan in total IgG glycans	
GP18a	Percentage of A2BG2S1 glycan in total IgG glycans	
GP18b	Percentage of FA2G2S1 glycan in total IgG glycans	

GP19	Percentage of FA2BG2S1 glycan in total IgG glycans	
GP20	Structure not determined	
GP21	Percentage of A2G2S2 glycan in total IgG glycans	
GP22	Percentage of A2BG2S2 glycan in total IgG glycan	
GP23	Percentage of FA2G2S2 glycan in total IgG glycans	
GP24	Percentage of FA2BG2S2 glycan in total IgG glycans	
S total [b]	Proportion of sialylated structures in total IgG glycans	
S1 total [b]	Proportion of monosialylated structures in total IgG glycans	
FG1S1/(FG1+FG1S1)	Proportion of monosialylated structures in monogalactosylated glycans	
FG2S1/(FG2+FG2S1+FG2S2)	Proportion of monosialylated structures in bigalactosylated glycans	

[a] GP=Glycan peak.

[b] Calculation formulas of each derived trait are listed below:

S total = GP16a+GP16b+GP17+GP18a+GP18b+GP19+GP21+GP22+GP23+GP24

S1 total = GP16a+GP16b+GP17+GP18a+GP18b+GP19

FG1S1/(FG1+FG1S1) = 100×(GP16a+GP16b) / (GP8b+GP9+GP16a+GP16b)

FG2S1/(FG2+FG2S1+FG2S2) = 100×GP18b / (GP14+GP18b+GP23)

The naming system for glycan structures is presented below for reference:

Blue square indicates N-acetylglucosamine; Red triangle, fucose; Green circle, mannose; Yellow circle, galactose; Purple diamond, N-acetylneuraminic (sialic) acid. All N-glycans have two core GlcNAcs; F at the start of the abbreviation indicates a core fucose, (6) after the F indicates that the fucose is α1-6 linked to the inner GlcNAc; Mx, number (x) of mannose on core GlcNAcs; Ax, number of antenna (GlcNAc) on trimannosyl core; A2, biantennary with both GlcNAcs as α1-2 linked; A3, triantennary with a GlcNAc linked α1-2 to both mannose and the third GlcNAc linked α1-4 to the α1-3 linked mannose; A3', triantennary with a GlcNAc linked α1-2 to both mannose and the third GlcNAc linked α1-6 to the α1-6 linked mannose; A4, GlcNAcs linked as A3 with additional GlcNAc α1-6 linked to α1-6 mannose; B, bisecting GlcNAc linked α1-4 to α1-3 mannose; Gx, number (x) of linked galactose on antenna, (4) or (3) after the G indicates that the Gal is α1-4 or α1-3 linked; [3]G1 and [6]G1 indicates that the galactose is on the antenna of the α1-3 or α1-6 mannose; Sx, number (x) of sialic acids linked to galactose; the numbers 3 or 6 in parentheses after S indicate whether the sialic acid is in an α2-3 or α2-6 linkage.

Table S3. The association of major glycan traits and disease-related factors with fetal loss in SLE during the 2nd trimester

	Fetal loss (n=12)	No fetal loss (n=32)	P value [a]
Glycan traits			
S total, Mean (SD)	12.28 (4.21)	16.69 (3.62)	0.0013*
S1 total, Mean (SD)	11.25 (3.88)	15.44 (3.52)	0.0015*
SLEPDAI, Mean (SD)	8.08 (3.94)	3.00 (1.76)	<0·0001*
C3 (g/L), Mean (SD)	0.69 (0.21)	1.03 (0.19)	<0·0001*
C4 (g/L), Mean (SD)	0.11 (0.06)	0.20 (0.08)	0.0007*
Anti-dsDNA (IU/mL), Mean (SD)	48.90 (32.22)	24.17 (15.61)	0.011*

S total = Proportion of sialylated structures in total IgG glycans; SLEPDAI = Systemic Lupus Erythematosus Pregnancy Disease Activity Index; Anti-dsDNA = anti-double-stranded DNA antibody.

[a] By two-sample t-test or Mann-Whitney U test as appropriate. P value < 0·5 is annotated with "*".

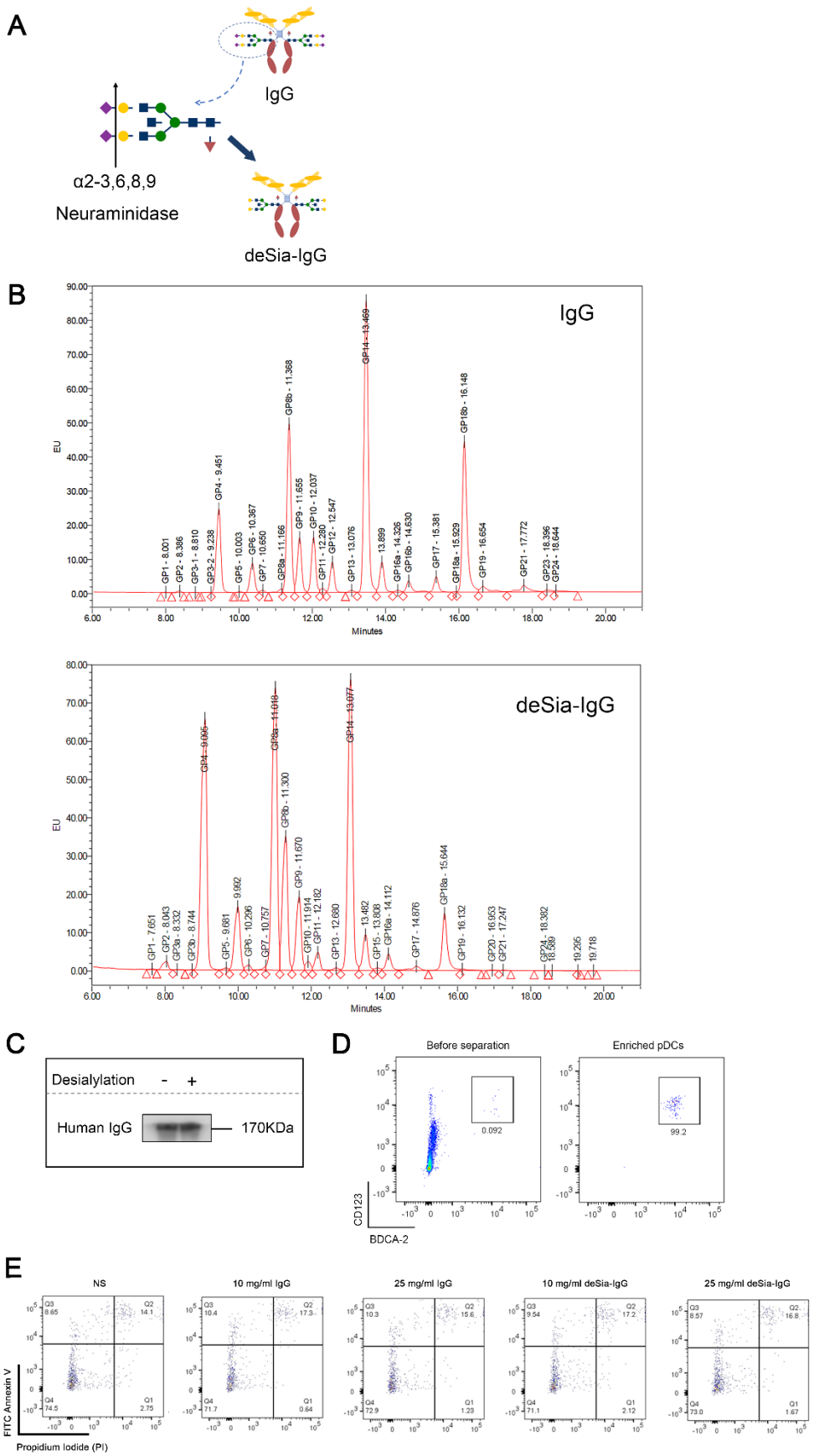


Figure S1. IgG and deSia-IgG did not affect the survival of pDC. (A) A schematic

diagram of desialylation process of IgG. (B) HILIC-UPLC was performed to confirm the effect of desialylation on IgG. (C) Western blot results confirmed that the molecular mass of IgG and deSia-IgG demonstrated no significant difference. (D) Purity of sorted pDCs was evaluated by flow cytometry by gating on $Lineage^{-}HLADR^{+}BDCA\text{-}2^{+}CD123^{+}$ cells. Purified pDCs were incubated with IgG and deSia-IgG at different concentrations, after which annexin V and PI were applied to assess cell viability (E). NS, non-stimulated.

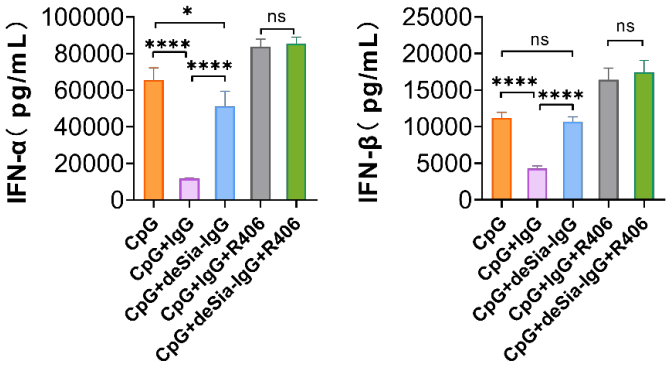


Figure S2. The effect of Syk inhibition on type I interferon production by pDCs. Human primary pDCs were pooled from five healthy female donors. * $P < 0.05$, *** $P < 0.001$, **** $P < 0.0001$. ns, not significant.