

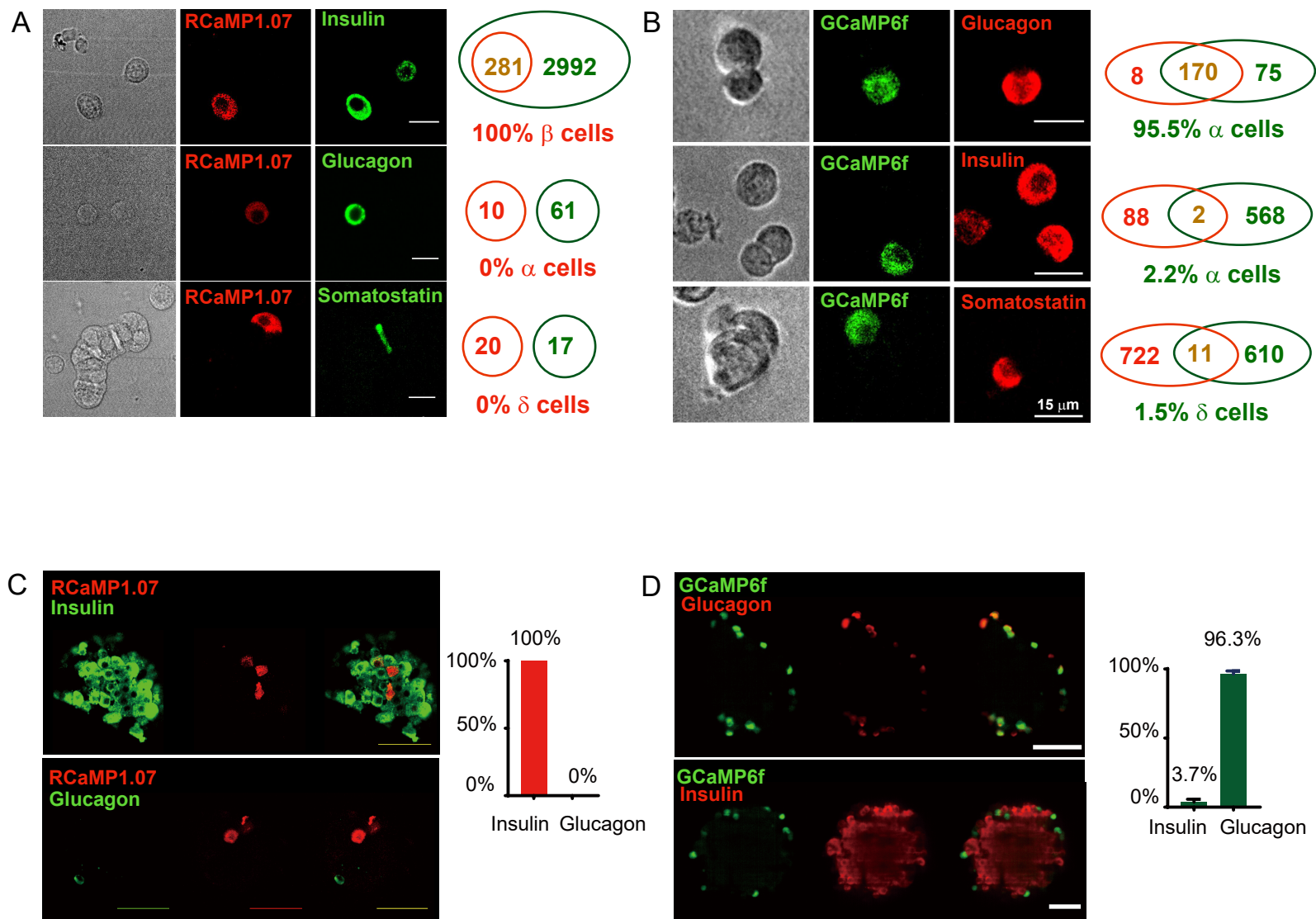


Fig. S1 RCaMP1.07 Expressing Islet Cells from Ins2-RCaMP1.07 Mice Are Insulin Positive, GCaMP6f Cells Glucagon Positive

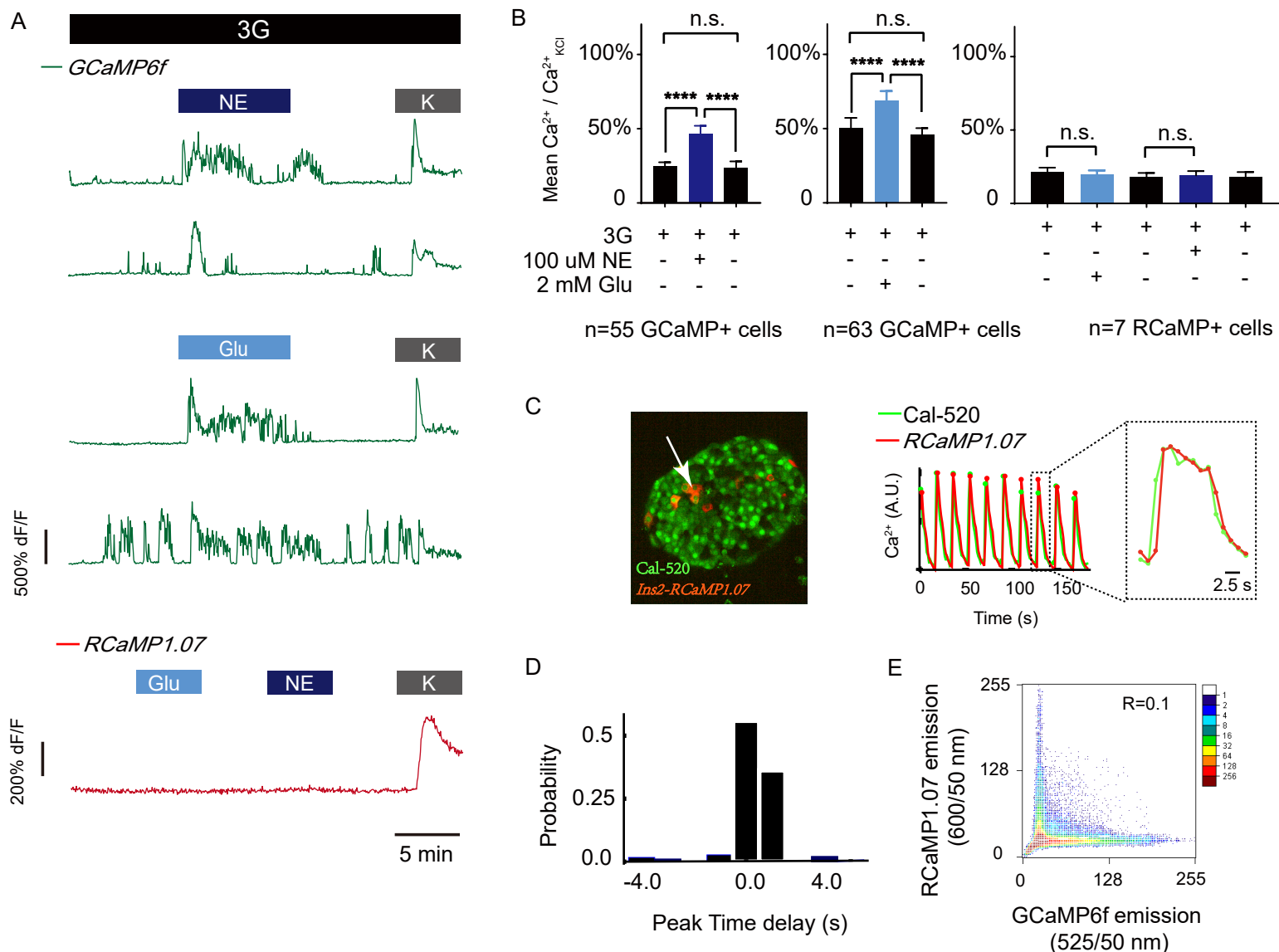


Fig. S2 GCaMP6f and RCaMP1.07 Emission Reflects Ca^{2+} Dynamics in α and β Cells Accurately

$\alpha\beta$ features

$$T = t_{\beta'_2} - t_{\beta_2}$$

$$\Delta\theta = \frac{t_{\alpha_2} - t_{\beta_2}}{t_{\beta'_2} - t_{\beta_2}}$$

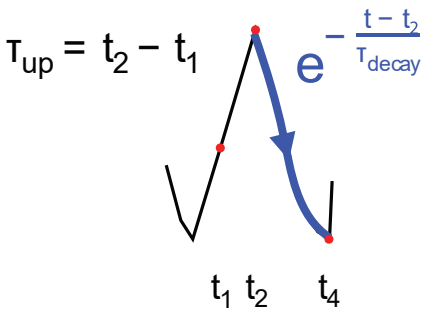
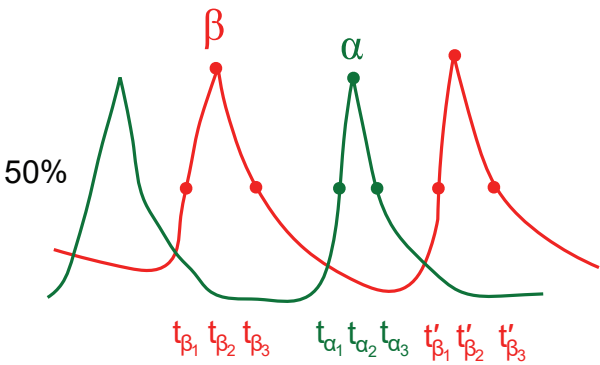
$$T_{\beta\alpha_50} = t_{\alpha_3} - t_{\beta_3}$$

$$T_{\alpha\beta_50} = t_{\beta'_3} - t_{\alpha_3}$$

$$T_{\beta\alpha_peak} = t_{\alpha_2} - t_{\beta_2}$$

$$T_{\alpha\beta_peak} = t_{\beta'_2} - t_{\alpha_2}$$

$$\frac{\alpha_{FWHM}}{\beta_{FWHM}} = \frac{t_{\alpha_3} - t_{\alpha_1}}{t_{\beta_3} - t_{\beta_1}}$$



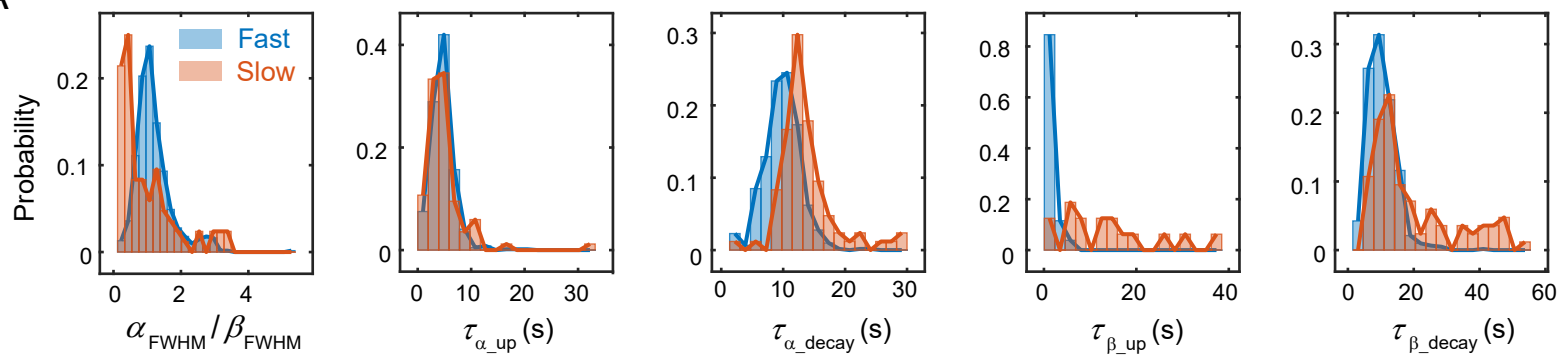
α cell features	β cell features
T_{α_up}	T_{β_up}
T_{α_decay}	T_{β_decay}
α_{FWHM}	β_{FWHM}

Oscillation Pair		
T	Θ	...
20s	0.7	...
70s	0.3	...
	...	
22s	0.8	...

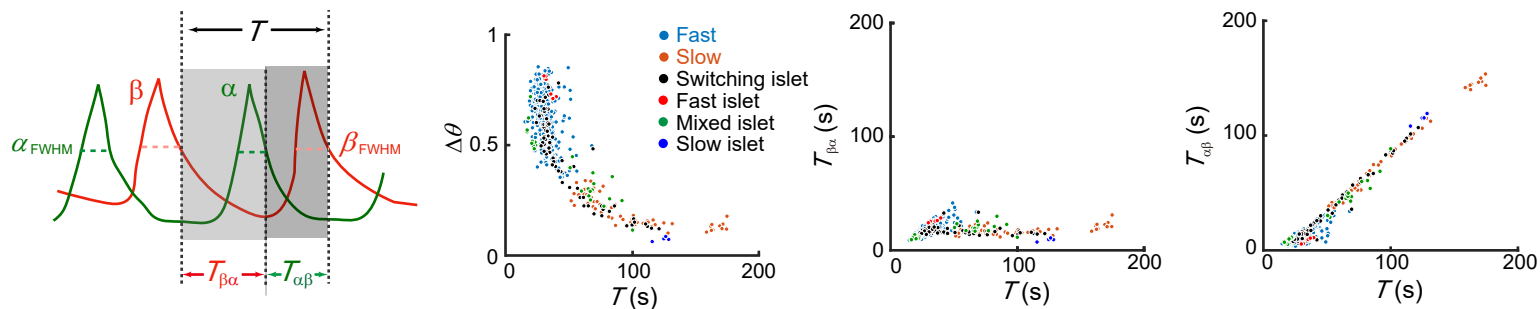
— Features(13) —

Fig. S3 Each α/β Oscillation Pair was Vectorized to 13 Features

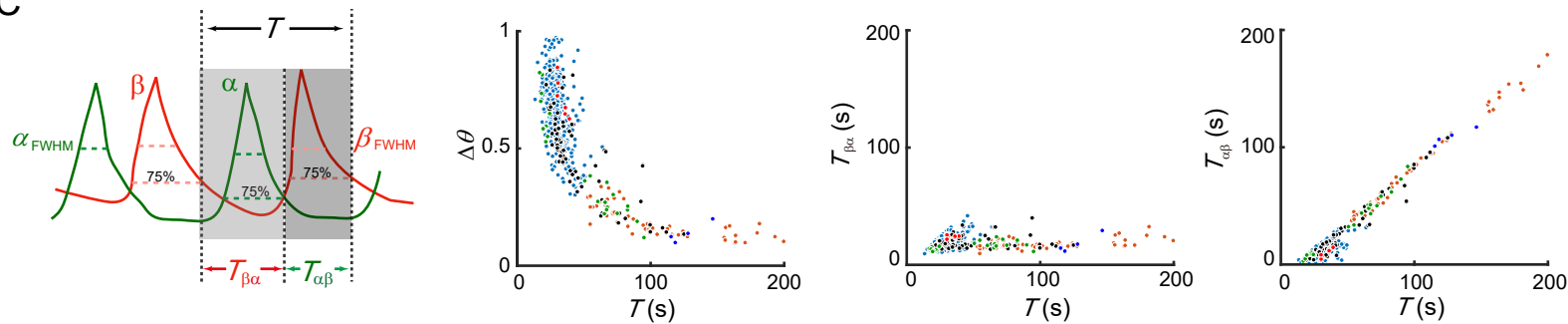
A



B



C



D

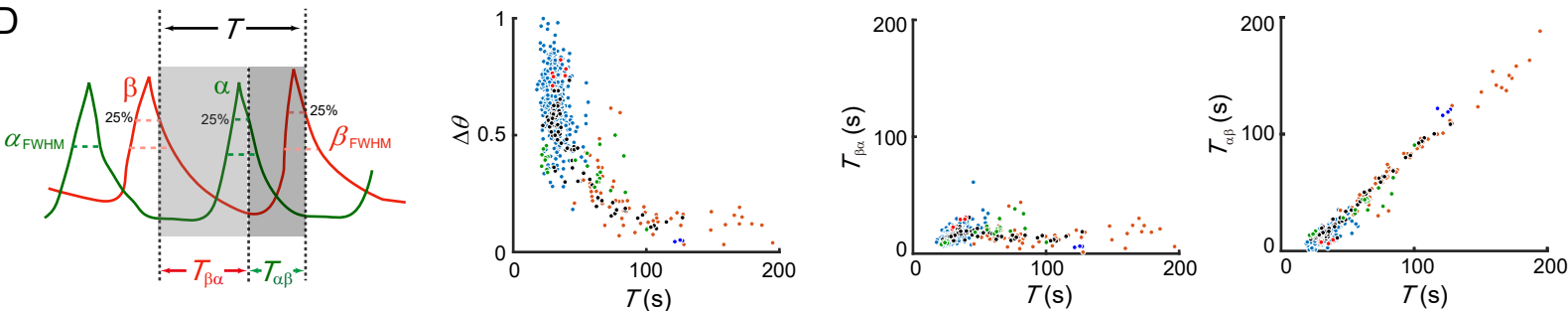
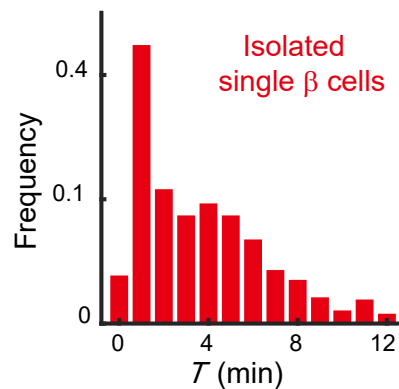
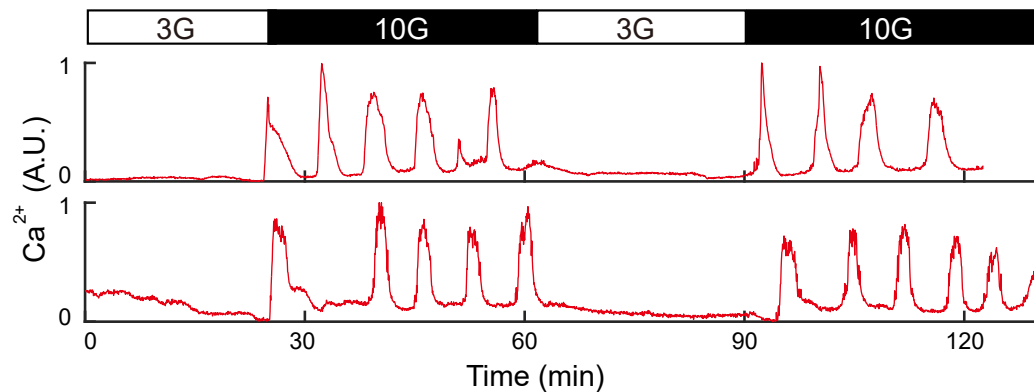


Fig. S4 Results for Different Definitions of Periods and Waiting Times

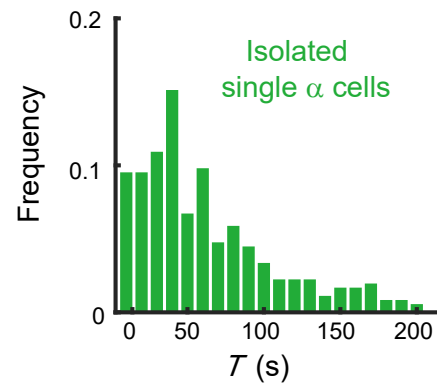
A



B



C



D

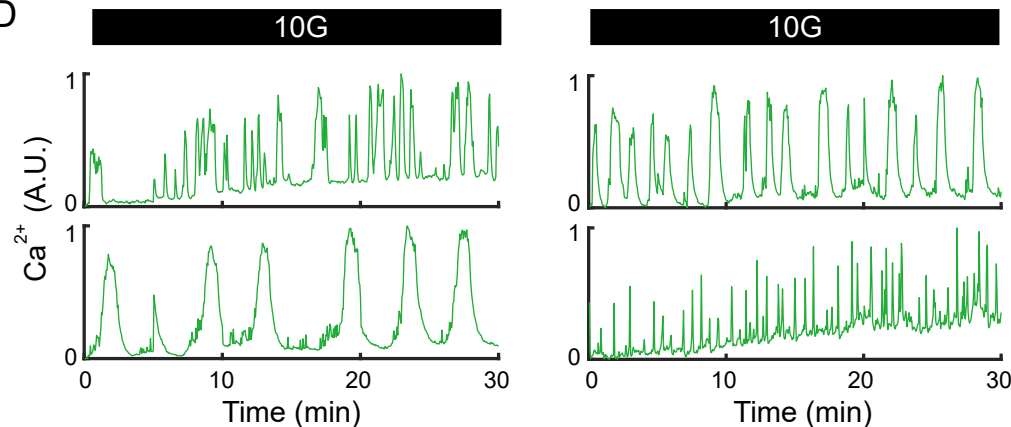


Fig. S5 Isolated Single α Cells Show Faster Oscillation than Isolated Single β Cells

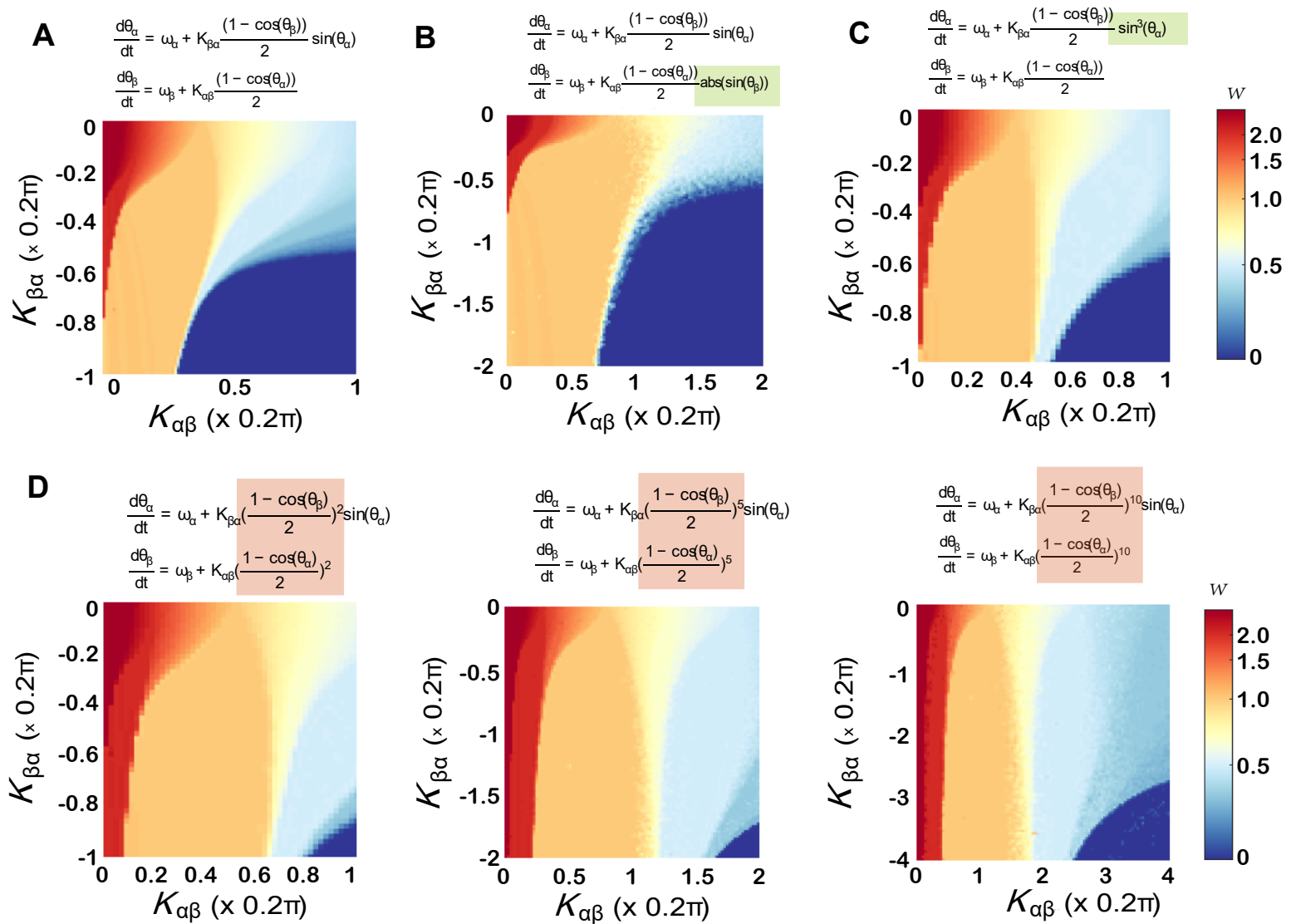


Fig. S6 The Structure of the Phase Diagram Is Robust to the Functional Forms of Paracrine Interactions

$$\frac{d\theta_\beta}{dt} = \omega_\beta + K_{\alpha\beta} f_s(f_t(\theta_\alpha)) \quad \frac{d\theta_\alpha}{dt} = \omega_\alpha - K_{\beta\alpha} f_s(f_t(\theta_\beta)) f_{r\alpha}(f_t(\theta_\alpha))$$

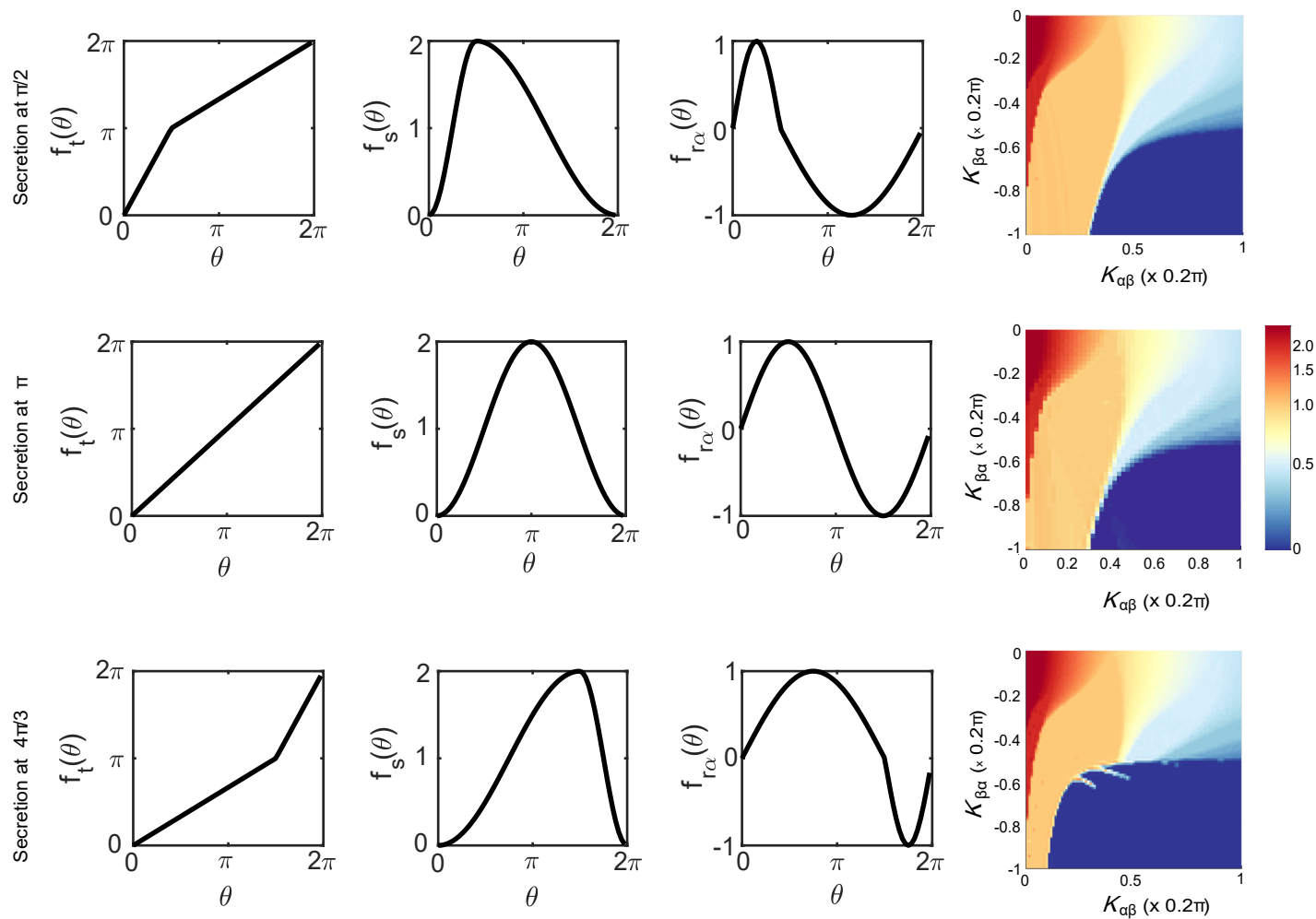


Fig. S7 The structure of the phase diagram is robust to the phase of hormone secretion

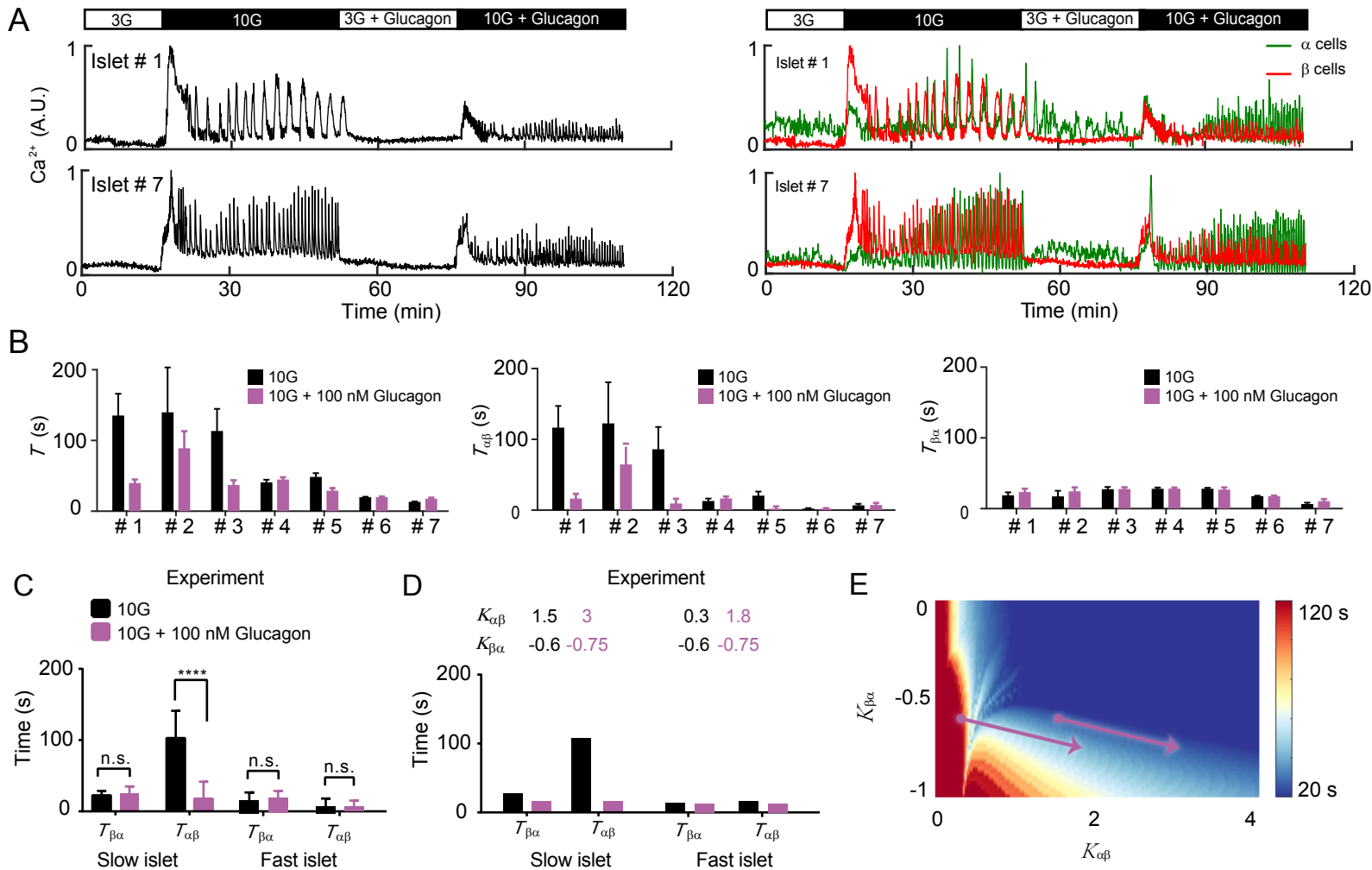


Fig. S8 Glucagon Speeds up Oscillation of Slow Islets but not Fast Islets

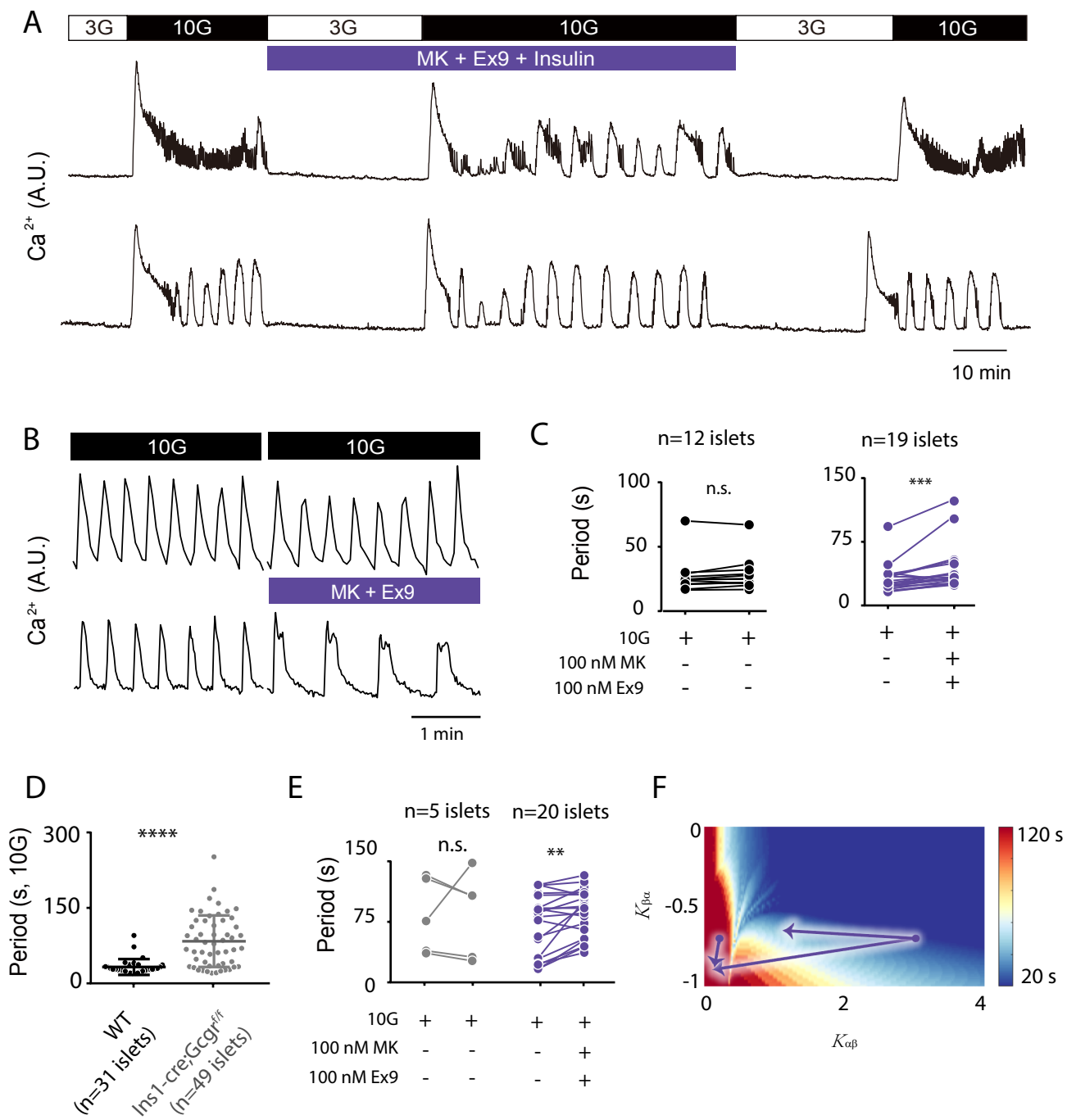


Fig. S9 Blockage Glucagon Slow Down Islet Ca^{2+} Oscillation

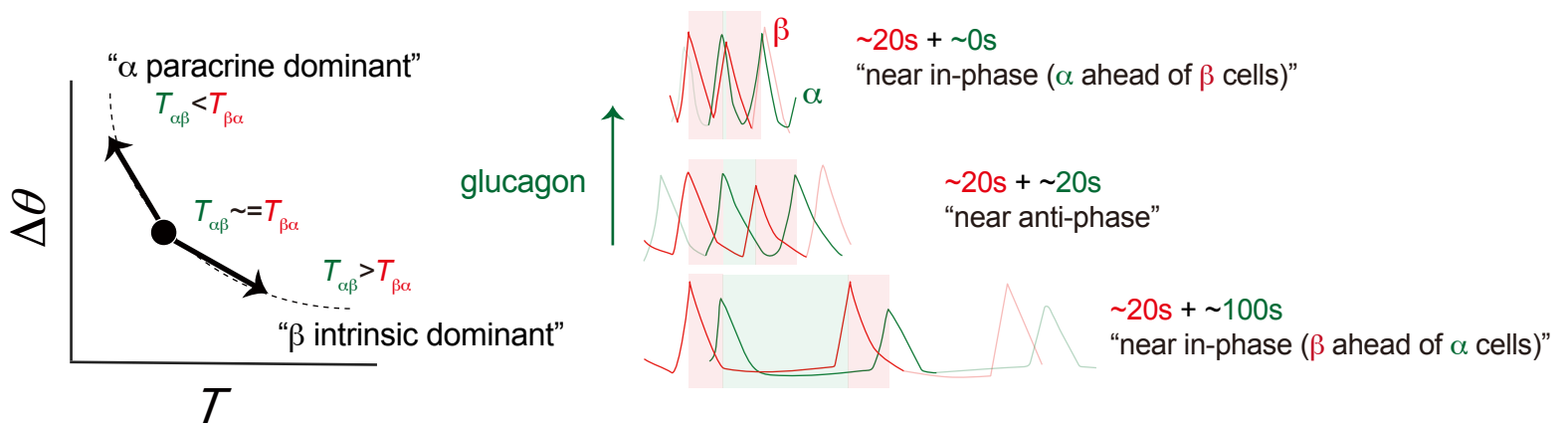


Fig.S10 The Value of Phase Shift Between the Phase-locked α and β Cells Depends on Oscillation Frequency