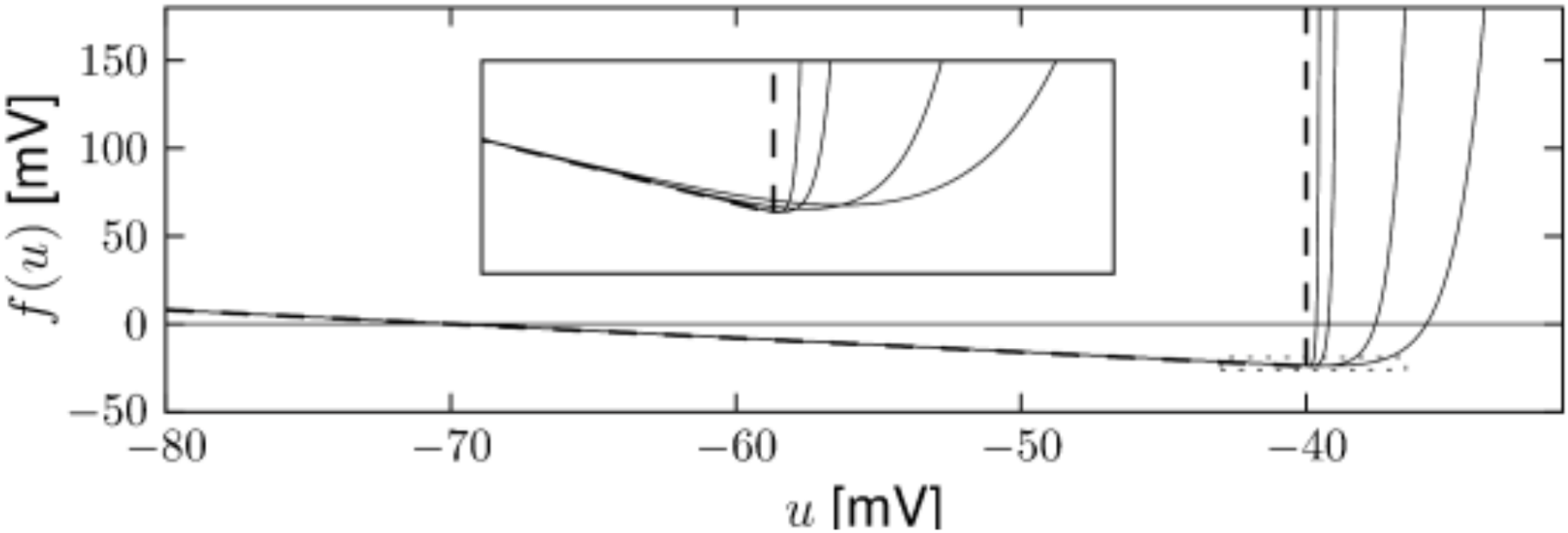

Fig. 5.3: Exponential and leaky integrate-and-fire model. The function $f(u)$ is plotted for different choices of the 'sharpness' of the threshold ($\Delta_T = 1,\ 0.5,\ 0.25,\ 0.05$ mV) In the limit $\Delta_T \to 0$ the exponential integrate-and-fire model becomes equivalent to a leaky integrate-and-fire model (dashed line). The inset shows a zoom onto the threshold region (dotted box).

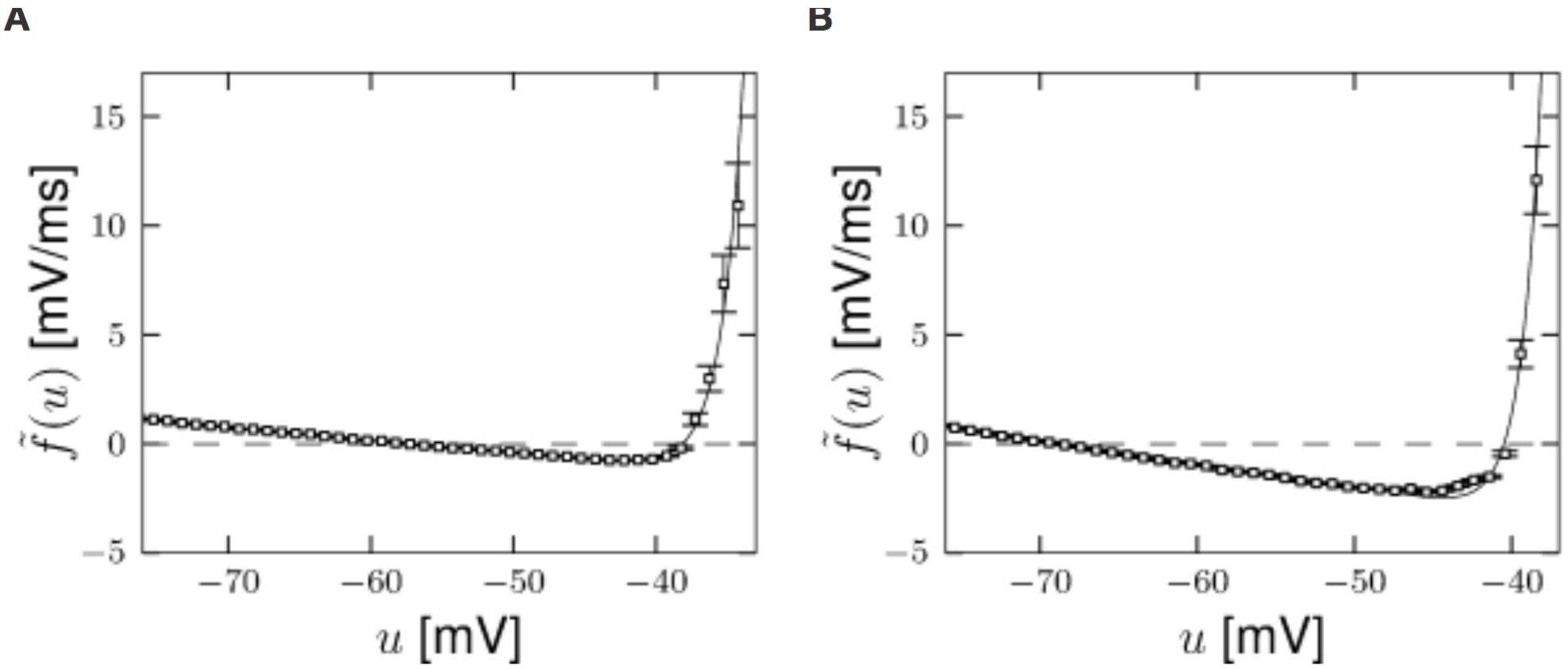

Fig. 5.4: Extracting nonlinear integrate-and-fire models from data. The function $f(u)$ characterizing the nonlinearity of an integrate-and-fire model according to Eq. (5.2) is derived from experimental data using random current injection into neurons. **A** Cortical pyramidal cells. Experimental data points (symbols) and fit by an exponential integrate-and-fire model. **B** As in A, but for an inhibitory interneuron. Data courtesy of Laurent Badel and Sandrine Lefort (35).

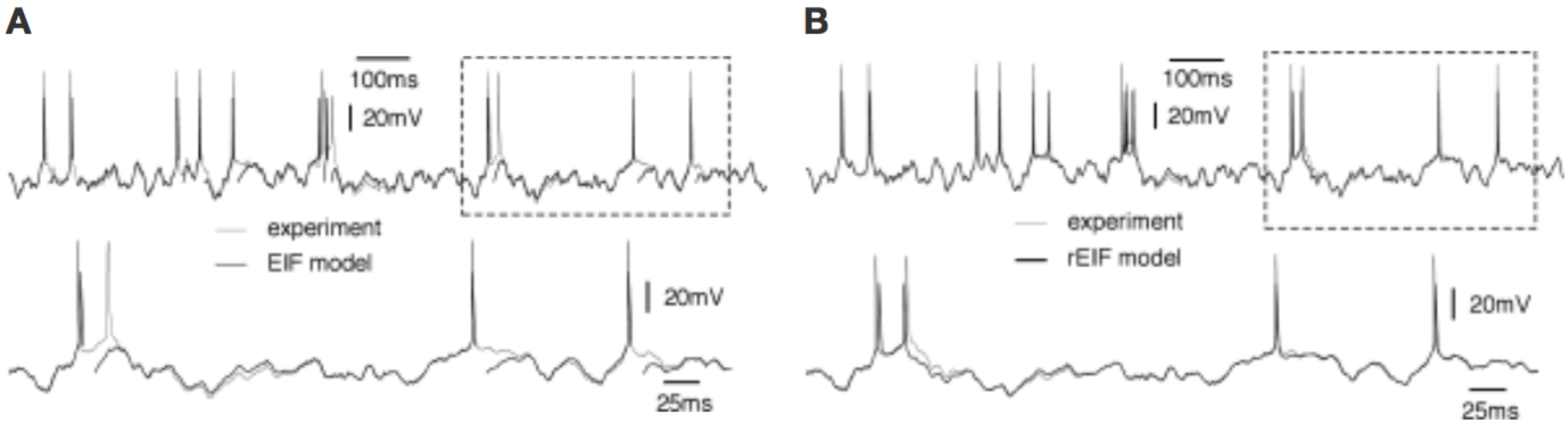

Fig. 5.5: Predicting the membrane voltage with an exponential integrate-and-fire model. **A.** Comparison of membrane voltage in experiments (thick line) with the predictions of the exponential integrate-and-fire model (thin line). The fit is excellent, except during a short period after a spike. **B.** Same as in A, but in a model with refractoriness. Modified from Badel et al. (34).

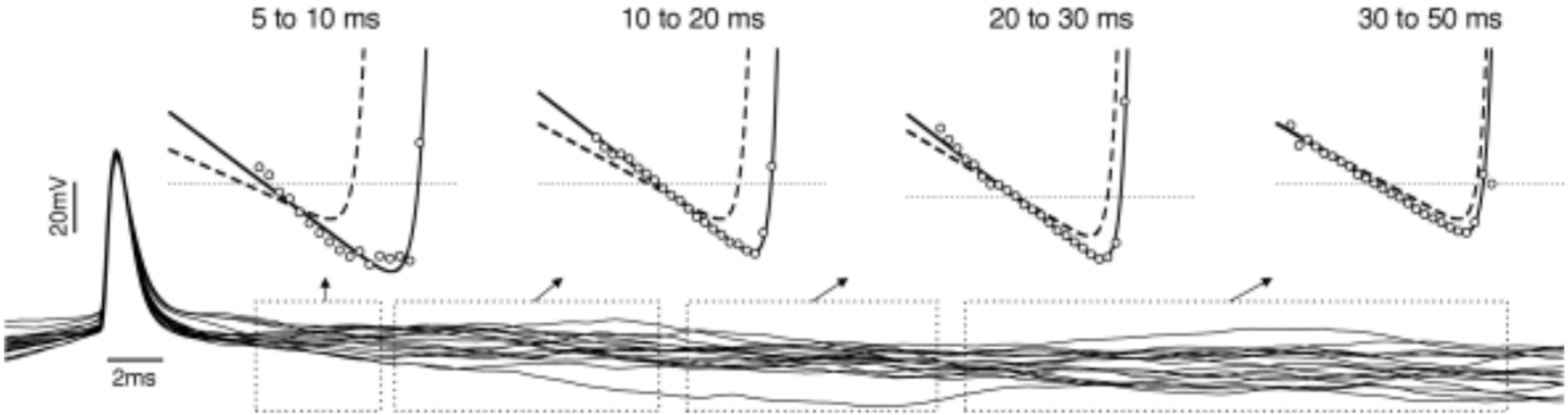

Fig. 5.6: Refractory effects in the exponential integrate-and-fire model. Top: Because of refractoriness immediately after a spike, the exponential integrate-and-fire model has a higher firing threshold and increased slope in the linear section. Data points and fit as in Fig. 5.4, but data points restricted to intervals 5-10ms (far left), 10-20ms (left), 20-30ms (right), or 30-50ms (far right) after a spike. As the time since the last spike increases, refractoriness decays and the parameters of the exponential integrate-and-fire model approach their standard values (dashed lines). Bottom: Sample voltage traces during and after a spike. Taken from Badel et al. (34).