

SUPPLEMENTARY MATERIAL

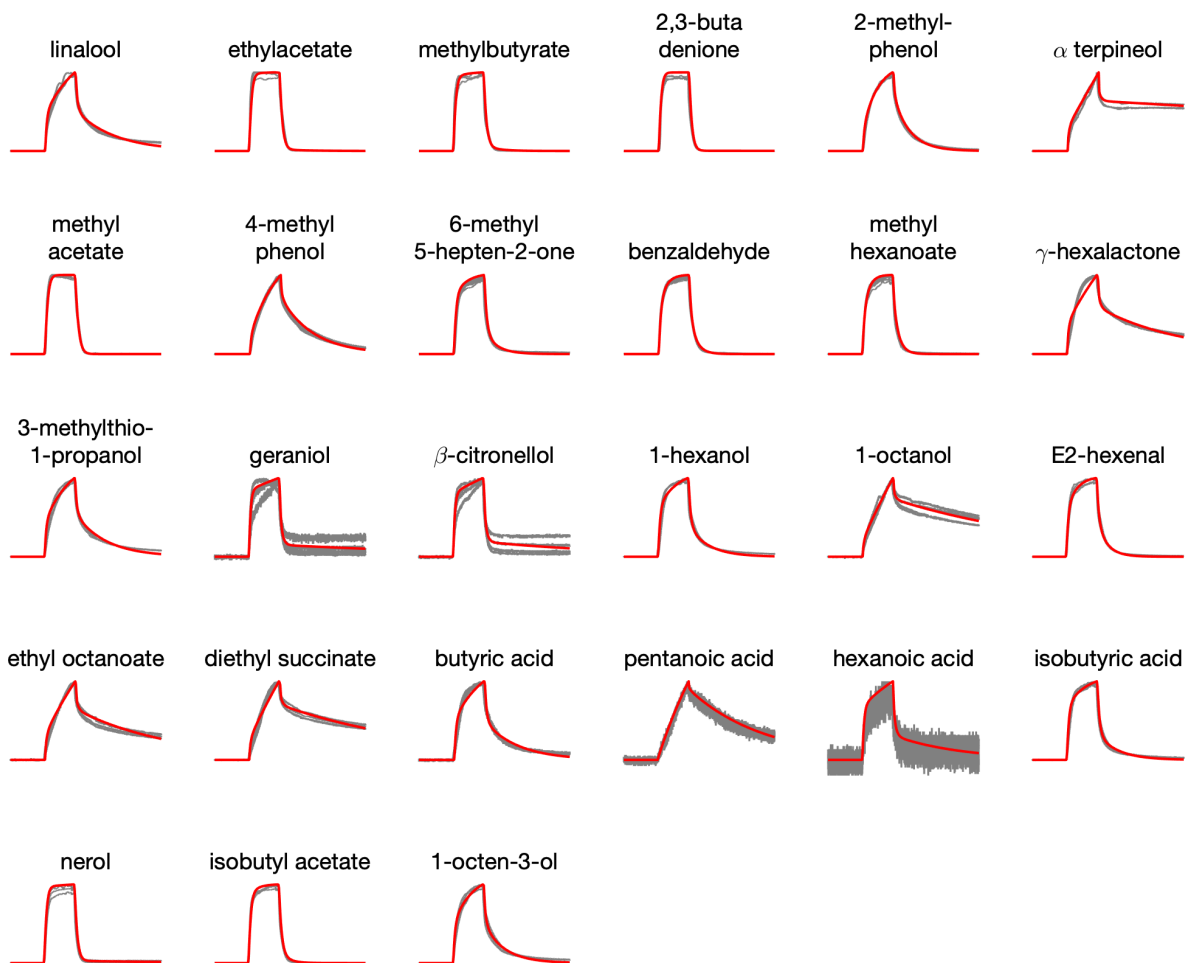


Figure S1. Diversity of odor pulse kinetics can be reproduced by a model of odorant interaction to surfaces. In each panel, gray traces show five trials of PID measurements of a 500ms pulse of that odorant. Red traces are predictions of the model (**Equations 11-12**) fit to this data. Parameters of model fits are shown in **Fig. 1**.

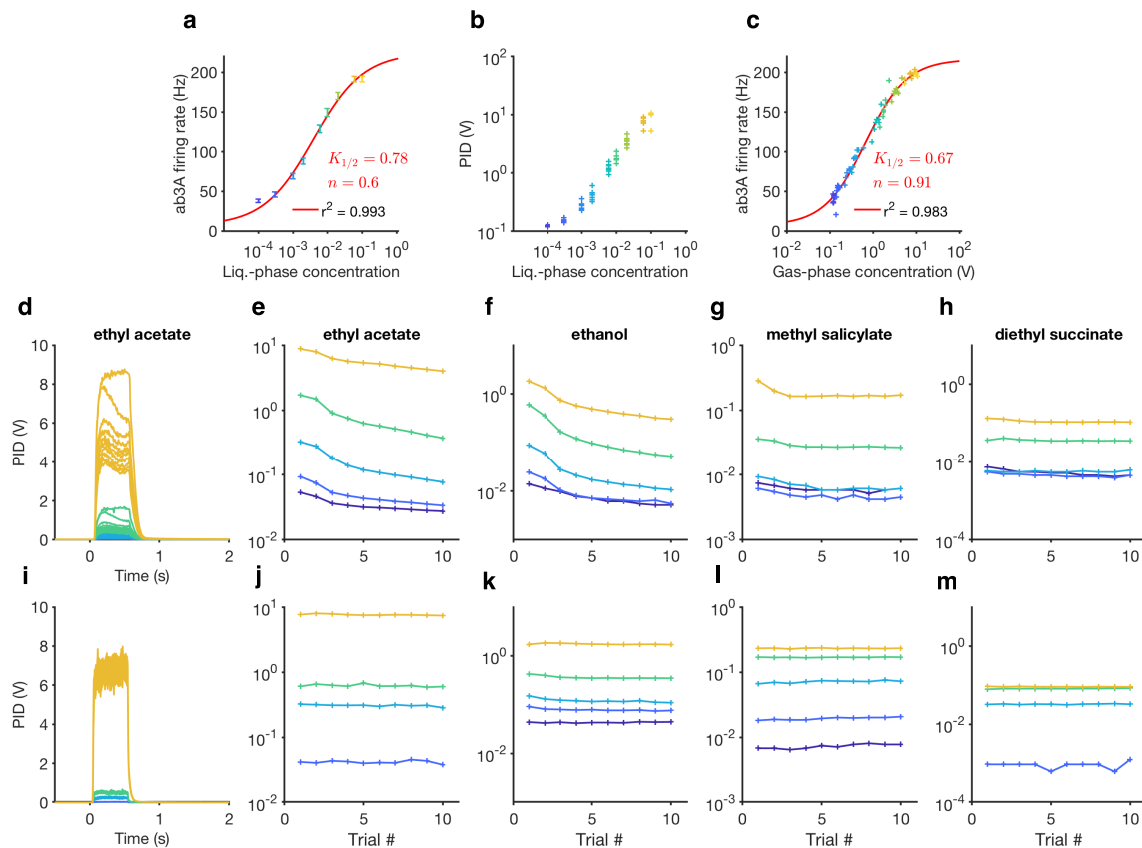


Figure S2: Gas-phase dilution enables steady delivery of short odorant pulses. **(a)** Peak firing rate of ab3A ORNs as a function of liquid-phase dilution of ethyl acetate odorant in paraffin oil in “cartridges”. The red line is a best-fit Hill function. **(b)** Measured pulse amplitude *vs.* liquid phase concentration shows trial-to-trial variability and nonlinearity of measured gas phase concentration. **(c)** Peak firing rate of ab3A ORNs replotted *vs.* measured gas-phase concentration for every pulse. The red line is a best-fit Hill function. Note that the best-fit parameters are different in **(a)** and **(c)**. **(d-h)** 500 ms pulses of odorant delivered using liquid phase dilution. **(d)** Measured stimulus *vs.* time for different values of liquid-phase dilution of ethyl acetate. **(e-h)** Maximum pulse amplitude *vs.* trial for four different odorants. **(i-m)** 500 ms pulses of the same odorants delivered using gas-phase dilution.

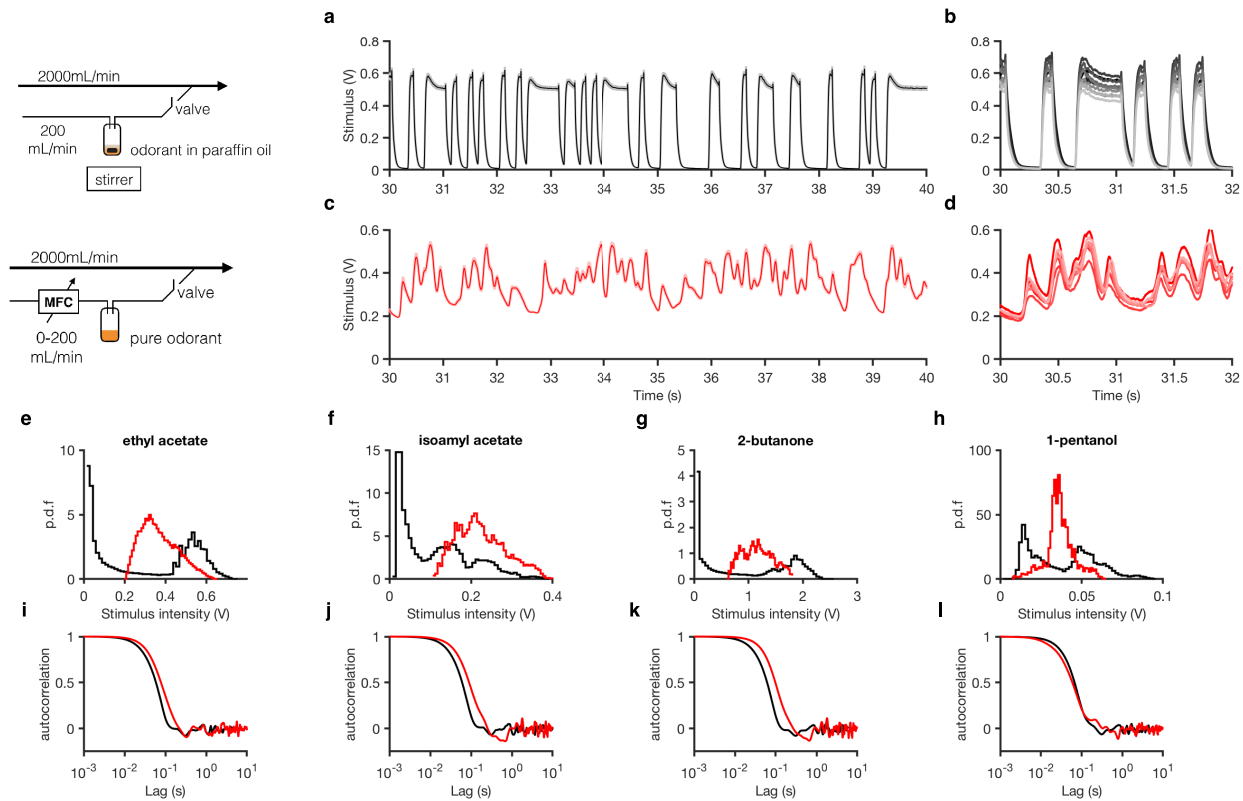


Figure S3. How to deliver intermittent odorant signals. (a-b)

Using a valve to generate binary random stimuli using ethyl acetate odorant. When the valve is turned on, the odor signal tends to its maximum value, and when the valve is off, it tends to 0. **(a)** Mean ethyl acetate concentration (shading is standard error of mean). **(b)** Individual traces. **(c-d)** Using a MFC to deliver ethyl acetate with fluctuations around a desired mean. Here, the MFC is used to modulate airflow through the odorant vial, leading to fluctuations in the odor concentration. The valve is used only to shut down the airstream at the end of the odor stimulus. **(c)** Mean ethyl acetate concentration (shading is standard error of mean). **(d)** Individual traces. **(e-l)** Distributions and autocorrelation functions of stimulus time series for various odorants. Black traces are delivered using the apparatus in (a-b) and red traces are delivered using the apparatus in (c-d).