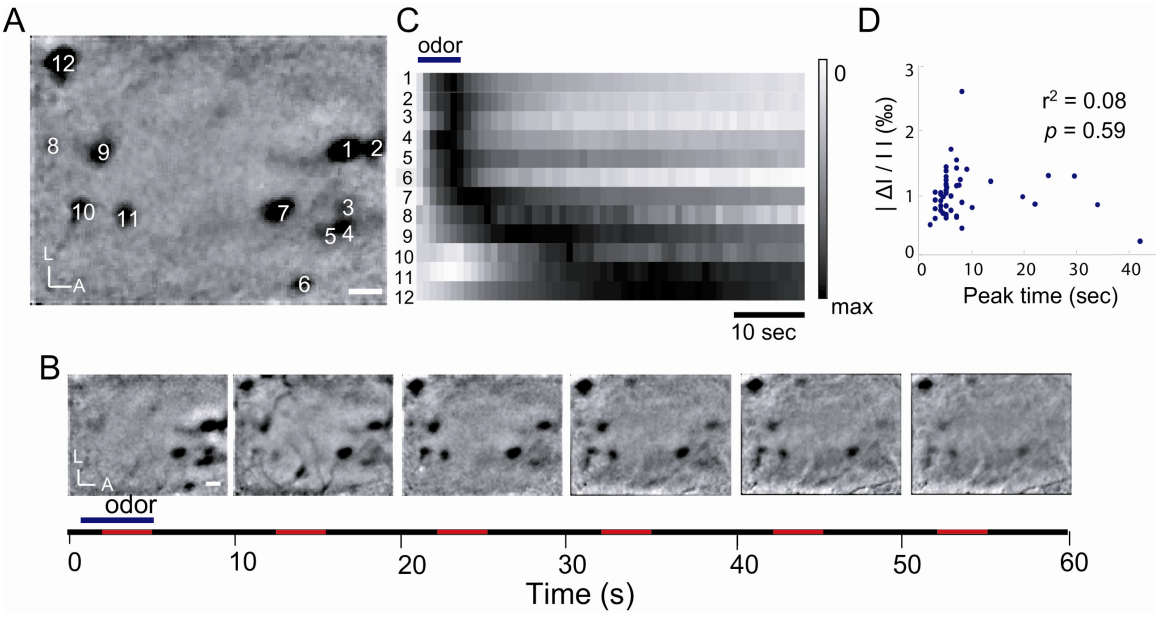
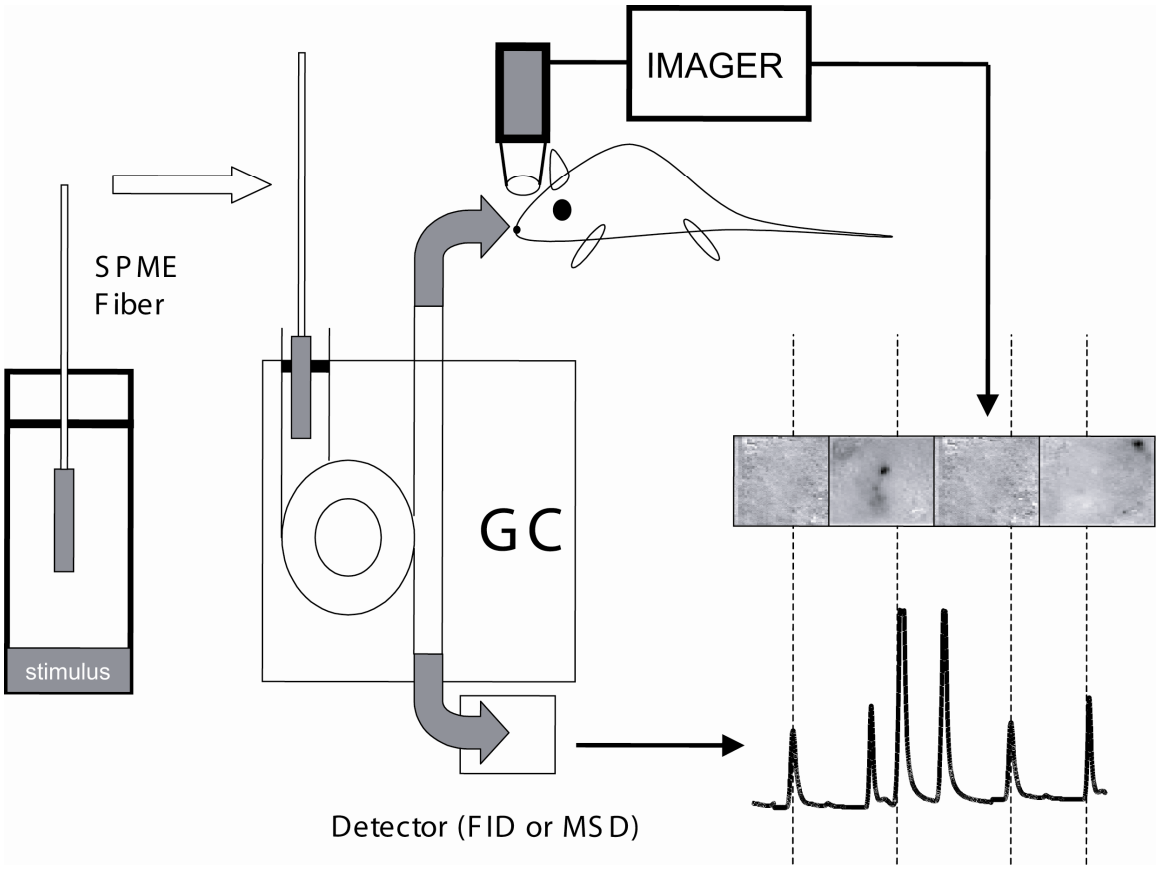
**Supplementary Figures**



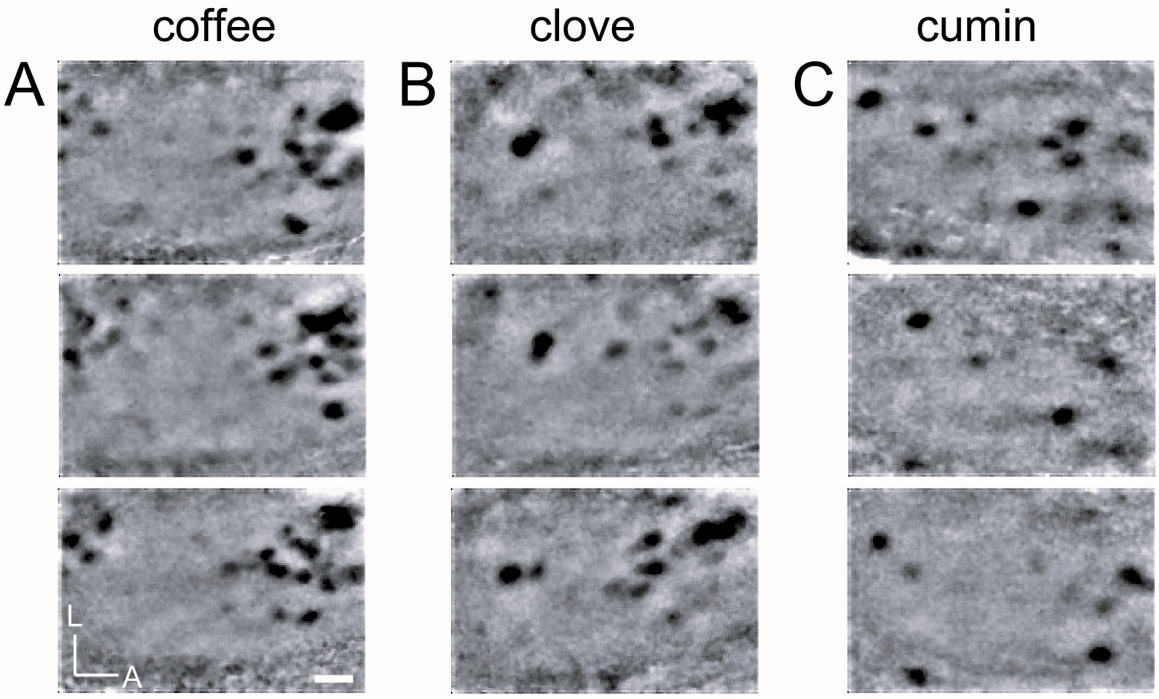

**Supplementary Figure 1. Time course of glomerular responses**.

A. Population response to coffee. Each of 12 strongly activated glomeruli is numbered. Scale bar = 200 µm. L, lateral; A, anterior. B. A series of images obtained after coffee presentation. The blue bar indicates odor delivery. Red bars denote the time windows from which the images above were drawn. Scale bar = 200 µm. L, lateral; A, anterior. C. Time course of activation for each numbered glomerulus in (A) for 60 seconds following coffee presentation. The color bar shows the normalized intensity range from 0 to max, and the blue bar indicates odor delivery. D. Scatterplot of time to peak versus glomerular response strength for all 50 glomeruli in Figure 1N.



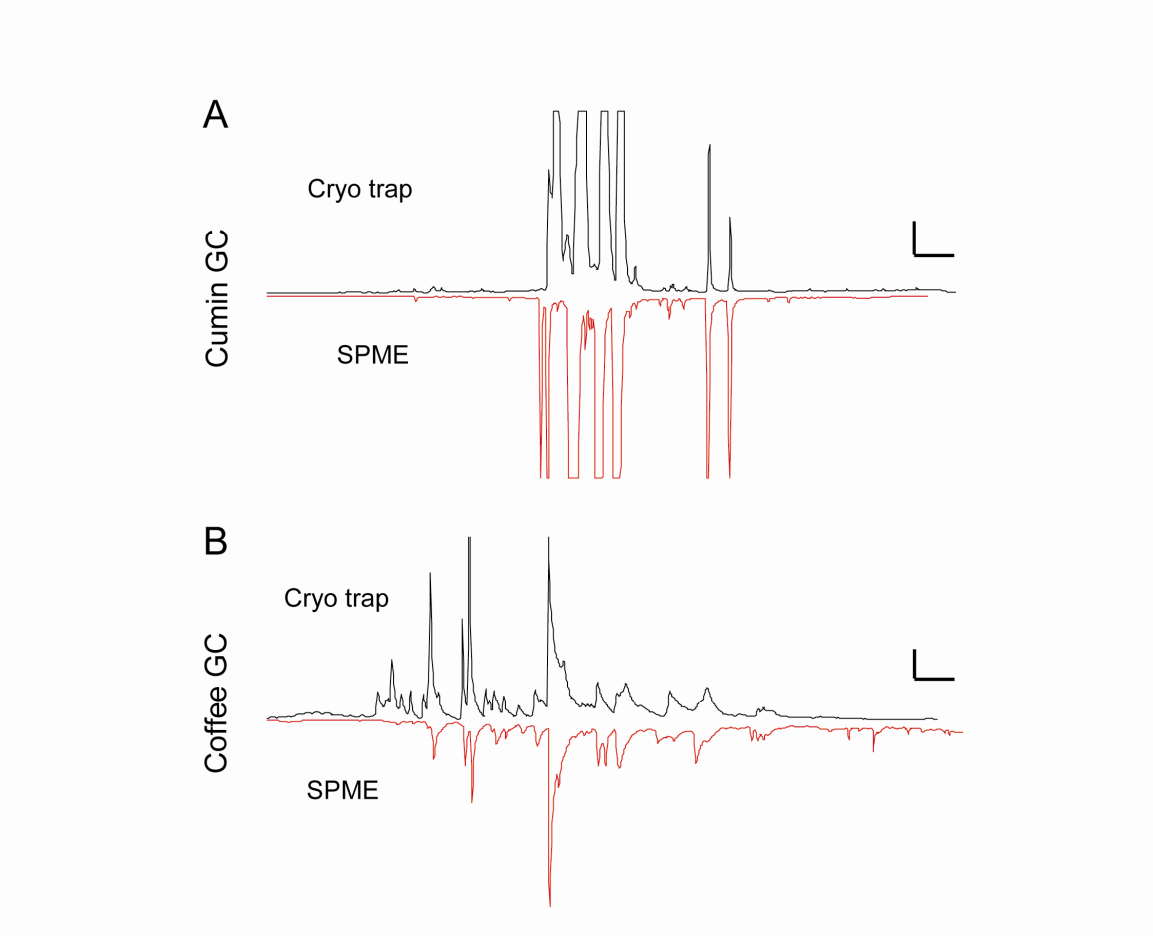

**Supplementary Figure 2. Schematic of the gas chromatography- intrinsic signal imaging (GC-I) technique.**

Solid phase microextraction (SPME) fibers were used to adsorb volatiles from the headspace above a natural stimulus for 30 – 60 s. Subsequently, the SPME fiber was inserted into the heated injection port of a gas chromatograph (GC), releasing the adsorbed volatiles. Depending on the chosen GC separation column, individual components were eluted sequentially according to either boiling point (BP-5 column) or polarity (BP-20 column). Half of the effluent from the column was directed to a flame ionization detector (FID) or mass spectrometry detector (MSD); the other half of the effluent was simultaneously delivered to the nose. Intrinsic signals from the dorsal surface of one MOB were acquired during odor delivery and aligned to the GC signal.



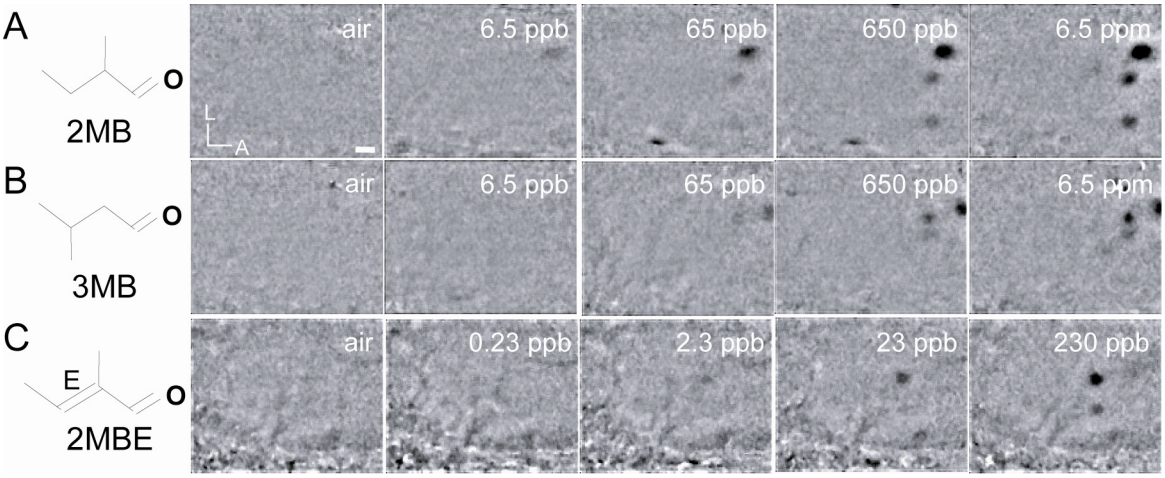

**Supplementary Figure 3. Activation patterns are similar across individuals.**

A-C. Intrinsic signal responses from three different animals to coffee (A), clove (B), and cumin (C). Visual comparison suggests that, as previously reported, glomeruli responsive to the same stimulus are located at similar positions in different animals (Rubin and Katz, 1999). Scale bar = 200 μm. L, lateral; A, anterior.

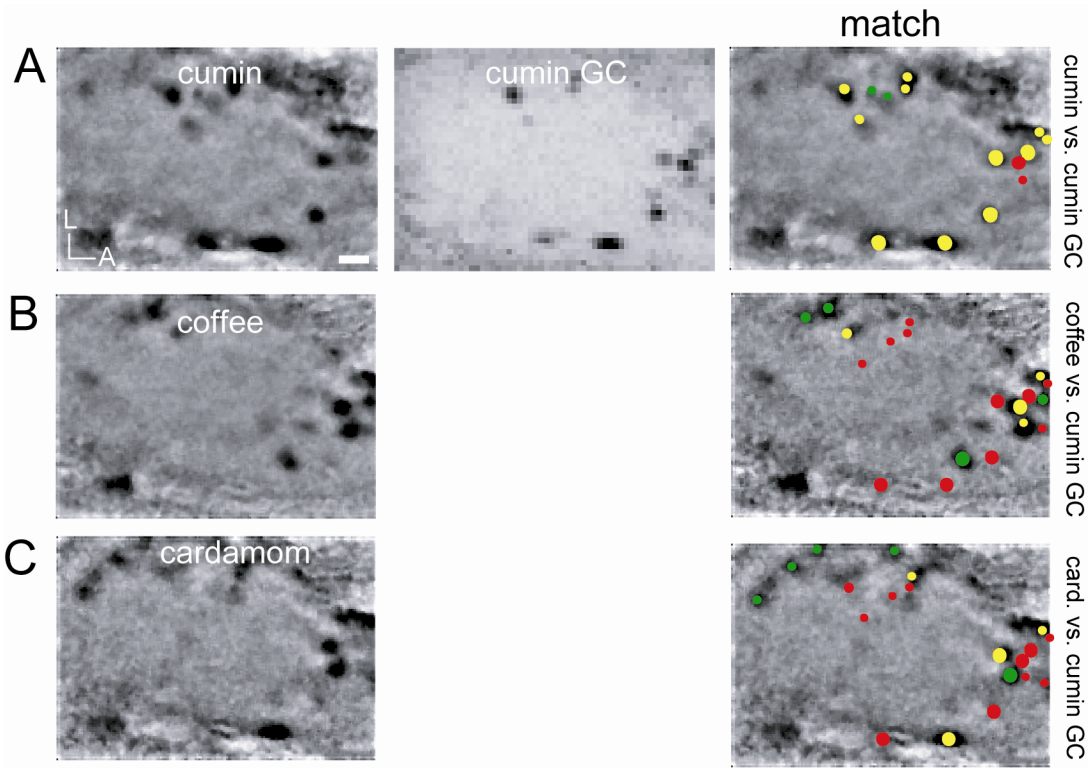



**Supplementary Figure 4. Comparison of GC signals obtained using the cryotrap or SPME concentration methods.**

A. GC profiles for cumin. The black trace shows the full GC trace obtained after using cryotrap to concentrate volatiles from cumin; the red trace shows data obtained using adsorption to a SPME fiber. Scale bar = 1 V / 50 s. B. GC profiles for coffee. Traces compare GC signals using the two concentration methods with coffee as described in (A). Scale bar = 100 mV / 50 s.

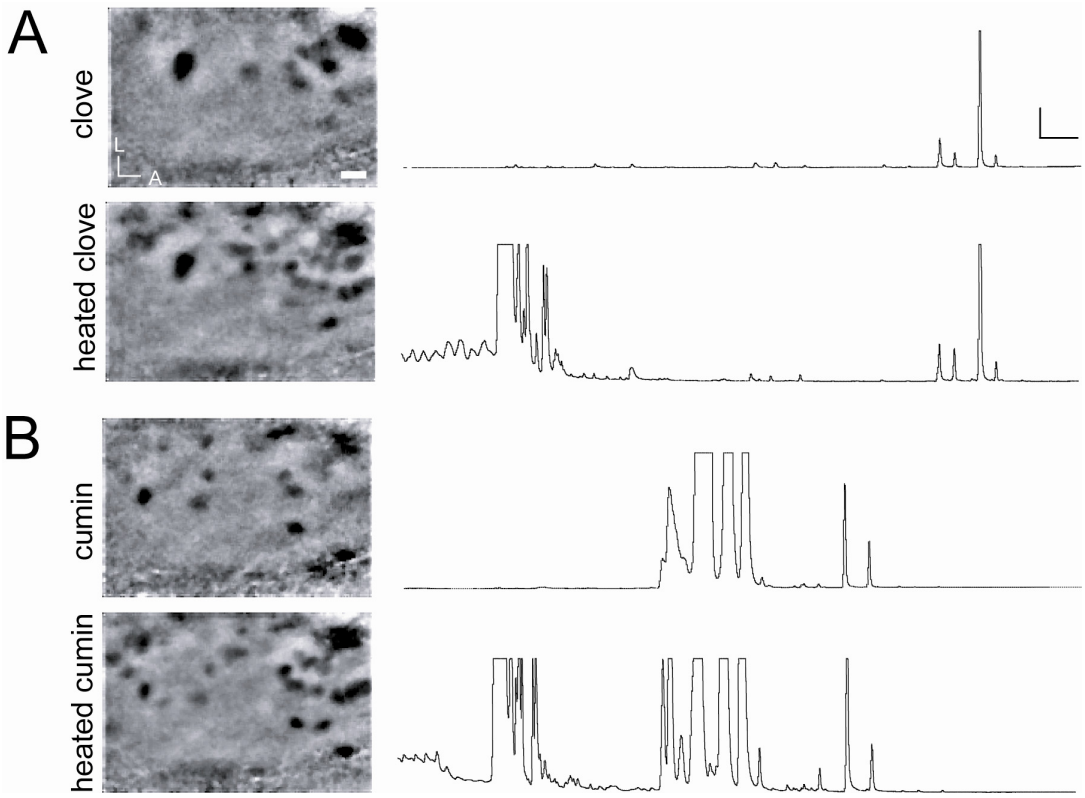



**Supplementary Figure 5.** A-C. Dosage responses to (A) 2MB, (B) 3MB and (C) 2MBE. The concentration delivered to the nose is indicated in the upper right corner for each image. Structures for each chemical are shown on the left. Scale bar = 200 μm. L, lateral; A, anterior.




**Supplementary Figure 6. Cumulative GC response maps exclusively match responses to the corresponding whole stimulus.**

A. Comparison of the response to whole cumin with the cumulative reponse to GC-separated cumin. The left panel shows the response to whole cumin, the middle panel shows the cumulative reponse to GC-separated cumin, and the right panel shows the match between these responses. Yellow dots indicate matched glomeruli. Red dots indicated glomeruli activated only during GC runs and green dots indicate glomeruli only activated by whole stimuli; large dots except green ones denote Z score in synthetic map <= –3 , and small dots denote –3 < Z score ≤–2. Sizes of green dots are based on Z scores in the whole map following the same convention as yellow and red dots. Scale bar = 200 μm. L, lateral; A, anterior. B. Comparison of the response to whole coffee with the cumulative response to GC-separated cumin. C. Comparison of the response to whole cardamom with the cumulative response to GC-separated cumin.




**Supplementary Figure 7. Heating stimuli generates new compounds that activate additional glomeruli.**

A. Intrinsic signal responses and GC traces for untreated clove and heat-treated clove. Note that additional glomeruli are activated in response to heated clove as compared to unheated clove, most notably in the anterior MOB. Scale bar = 200 μm. L, lateral; A, anterior. Similarly, the corresponding gas chromatograms on the left reveal a set of low molecular weight compounds generated after heating. Scale bar = 1 V / 100 sec. B. Intrinsic signal responses and GC traces for untreated cumin and heat-treated cumin. Panels organized as in (A).