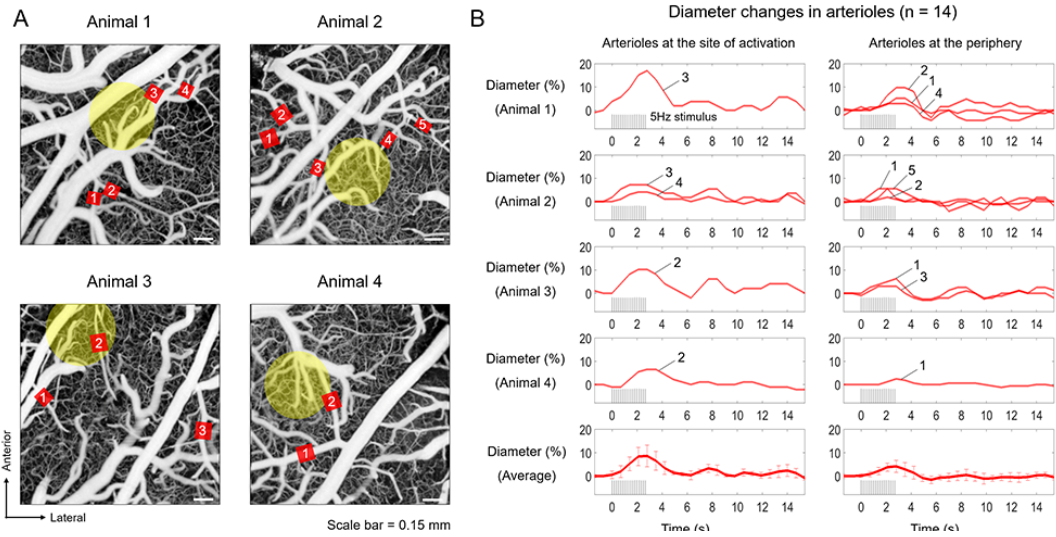


[Supplementary figure S1]

Description:

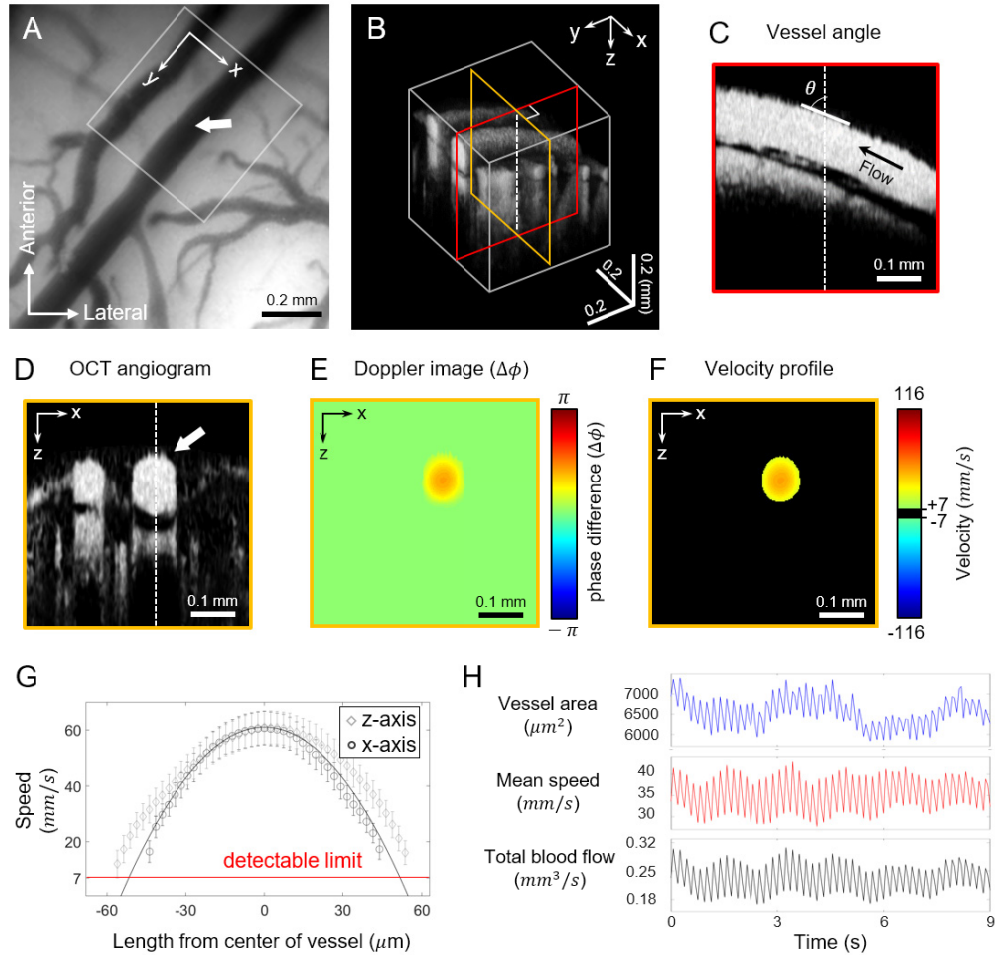
A procedure of selecting region of activation using OISI is shown. (A) CCD images of the exposed cortex in different animals. Branches of middle cerebral artery (MCA) are indicated by white arrows. (B) OISI images showing localized response induced by the single whisker stimulation. Upstream arteries that show prominent response in OISI image are indicated by blue arrows. (C) OCT angiograms corresponding to the regions indicated by the black squares in B. The sites of activation are shaded in yellow on the angiograms.



[Supplementary figure S2]

Description:

Stimulus-induced changes in diameter for individual arterioles are shown. (A) En face OCT angiograms of the animals. The arteriolar segments used for the measurement are indicated with red colored boxes. Activation sites are shaded in yellow. (B) Temporal changes in vessel diameters for the vessels indicated in A.



[Supplementary figure S3]

Description:

Measurement of absolute flow velocity in artery using Doppler OCT. (A) A CCD image of a cranial window showing pial artery indicated by a white arrow. (B) A volumetric OCT angiogram ( $500 \mu\text{m} \times 500 \mu\text{m} \times 500 \mu\text{m}$ ) corresponding to the region indicated by a white square in A. (C) A cross-sectional image of the artery was obtained along the length of the center of the vessel as indicated by a red box in B.

An angle between the vessel and the OCT beam was measured from the image. (D) A cross-sectional image obtained along the width of the artery indicated by an orange box in B is shown. The artery is indicated by a white arrow. (E) The corresponding Doppler image showing phase-difference profile of the artery. (F) Absolute velocity profile of the artery is shown. The minimum and the maximum measurable velocity was  $\pm 116$  mm/s and  $\pm 7$  mm/s, respectively. (G) Mean velocity profiles of the artery in the depth (z-) and lateral (x-) directions are shown with diamond and round markers, respectively (mean  $\pm$  SD). Each profile was obtained by averaging all profiles acquired during 10 seconds using Doppler OCT protocol 1. Note that the profile is broader in the depth direction than in the lateral probably because the artery was not in a plane perpendicular to the OCT beam, which can make the vessel cross-section oval. The theoretical laminar profile in solid black was computed using the parabolic equation:  $v = A(1 - (r/R)^2)$ . R: the mean vessel radius (55  $\mu$ m), A = the maximum value of the measured profiles, and r = the distance from the center of vessel. (H) Spontaneous fluctuations in the vessel area, mean blood flow speed, and total blood flow of an artery measured in an anesthetized rat without stimulation. The temporal resolution was 0.063 s. Note the spontaneous fluctuation in the vessel area and flow speed even without sensory stimulation.