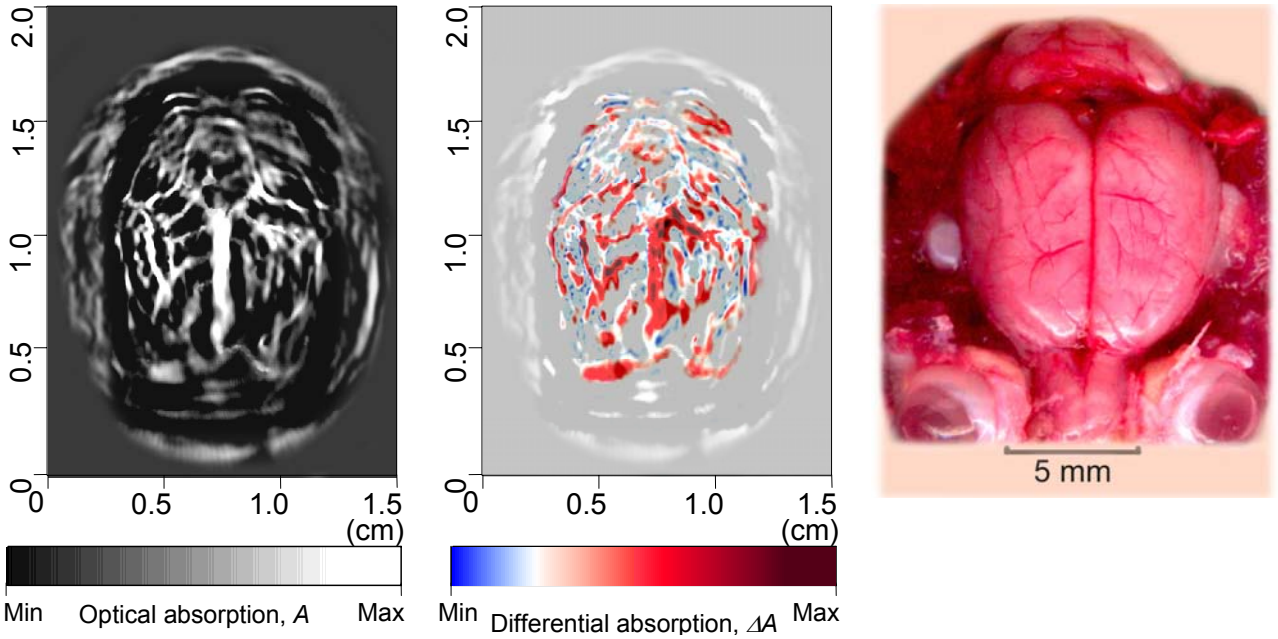

Supplementary Figure 1 Non-invasive photoacoustic tomography (PAT) of cerebral hemodynamic responses to the alteration from hyperoxia to hypoxia. (A) Non-invasive PAT image of vascular distribution in the rat cerebral cortex, which was acquired with the skin and skull intact. (B) Non-invasive functional PAT image of cerebral hemodynamic responses to altering the inspired gas from 100% O_2 to 5% O_2 acquired with the skin and skull intact. This functional map is superimposed on the image of the vascular distribution shown in (A). (C) Open-skull photograph of the rat cortical surface obtained after the PAT experiment.

Method: Before imaging, the hair on the head of each adult Sprague Dawley rat (~350 g) was removed gently with the skin and skull intact. A dose of 87 mg/kg Ketamine plus Xylasine 13 mg/kg was administered intramuscularly to briefly anesthetize the rat and supplemental injections of a similar anesthetic mixture (~10 mg/kg/hour) kept the rat motionless throughout the experiment. During the experiment, the body temperature of the rat was kept at ~37°. The breathing gas was applied to the rat via a home-built mask (2 l/min). Firstly, the image of the cerebral cortex during hyperoxia was acquired when the rat spontaneously breathed 100% O_2. Then the inhalant was switched to a mixed gas (5% O_2, 5% CO_2 and 90% N_2). ~15 minutes after the rat began breathing this mixed gas, an image of the cortical surface in hypoxia was acquired. Subtracting the PAT image for hyperoxia from the PAT image for hypoxia produced a functional map of the cerebral hemodynamic responses to the alteration of the inhaled gas.

Results and analysis: After the alteration from hyperoxia to hypoxia, the optical absorptions at the positions of blood vessels in the cerebral cortex increased significantly. It is known that deoxy-hemoglobin has a slightly lower, rather than higher, extinction coefficient than the oxy-hemoglobin at the 532-nm wavelength. Therefore, the increase in optical absorption in hypoxia was not caused by a decrease in oxygen saturation but is believed to be induced by an increase in cerebral blood volume (or flow). However, the nature of the signal generated by hypoxia and its clinical significance requires further investigation.