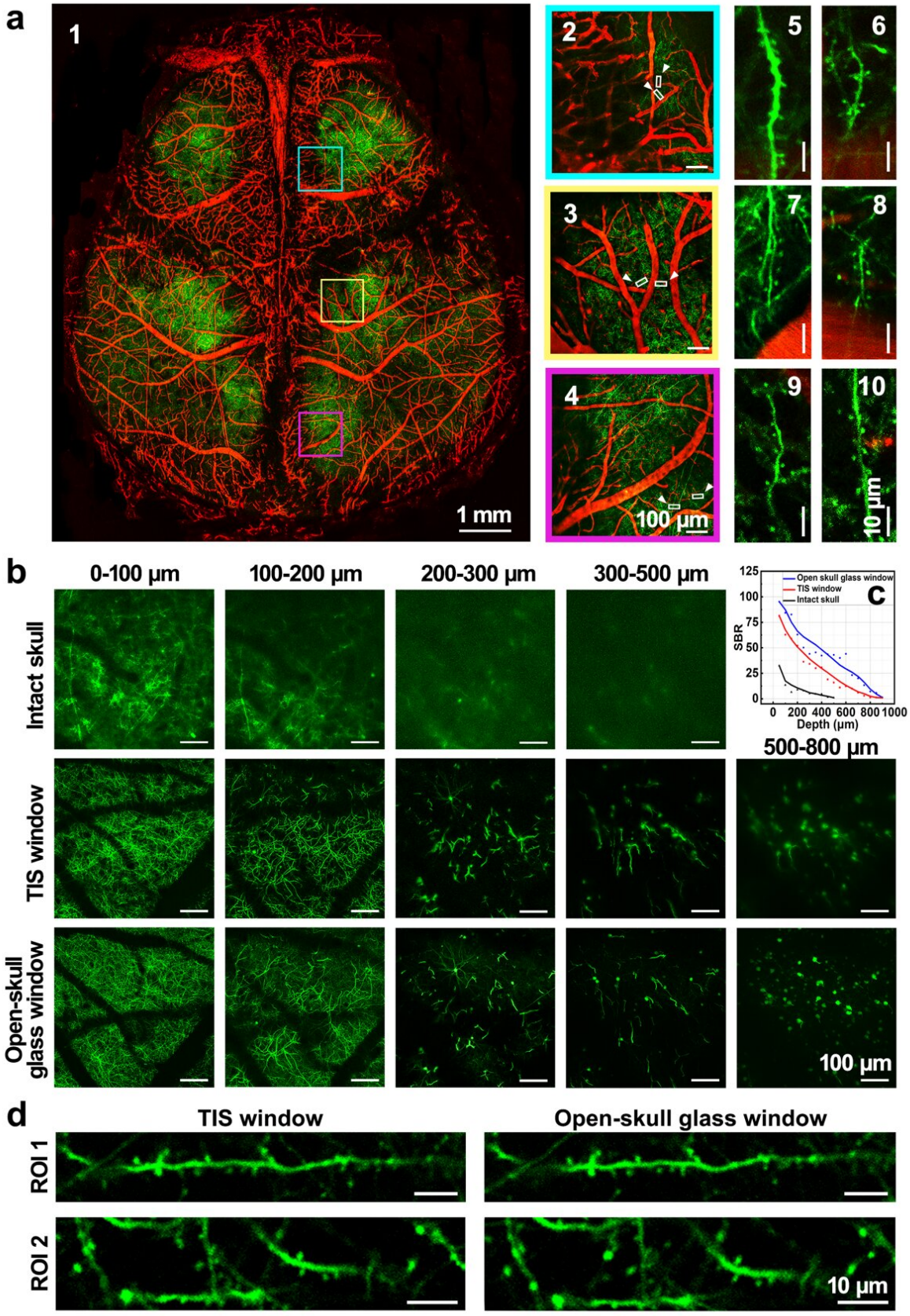
Medical Xpress

New approach to brain imaging leaves skulls intact in mice

September 5 2022


a
1
1 mm
2
3
4
100 μm
5
6
7
8
9
10
10 μm
b
0-100 μm
100-200 μm
200-300 μm
300-500 μm
500-800 μm
Intact skull
TIS window
Open-skull glass window
100 μm
c
Open skull glass window
TIS window
Intact skull
SBR
Depth (μm)
d
TIS window
Open-skull glass window
ROI 1
ROI 2
10 μm

a1 A large-field and dual-channel two-photon microscopic image of bilateral hemispheric cortical blood vessels (in red, Texas red) and neurons (in green, EGFP) after the TIS window establishment. a2-a4 High magnification images of the corresponding color frames in (a1) near the sutura (viewed with a 20× objective). a5-a10 High magnification (zoom in) images of the white frames (white arrow-indicated) in (a2)-(a4), respectively. b Typical images of two-photon microscopy of neurons at various depths before and after the TIS window establishment, as well as after the removal of the skull. c The SBRs of the images at various imaging depths under different conditions. d Comparison between the TIS window and open-skull glass window in dendritic spine imaging. The excitation wavelength was 920 nm (80 MHz, 140 fs). Credit: Dongyu Li, Zhengwu Hu, Hequn Zhang, Qihang Yang, Liang Zhu, Yin Liu, Tingting Yu, Jingtan Zhu, Jiamin Wu, Jing He, Peng Fei, Wang Xi, Jun Qian and Dan Zhu

Observing the brain without creating any breaks in the skull is an emerging technology for those studying various brain-related diseases. Current technology is advancing, but issues around light penetration, limited imaging quality and cortex depth significantly inhibit its progress. It has led to the current use of "skull windows."

The open-skull glass window and thinned-skull window are the two most widely used skull window techniques. The open-skull glass window requires the removal of part of the skull and covering the brain with a transparent glass slide. The thinned-skull window involves grinding part of the skull extremely thin (