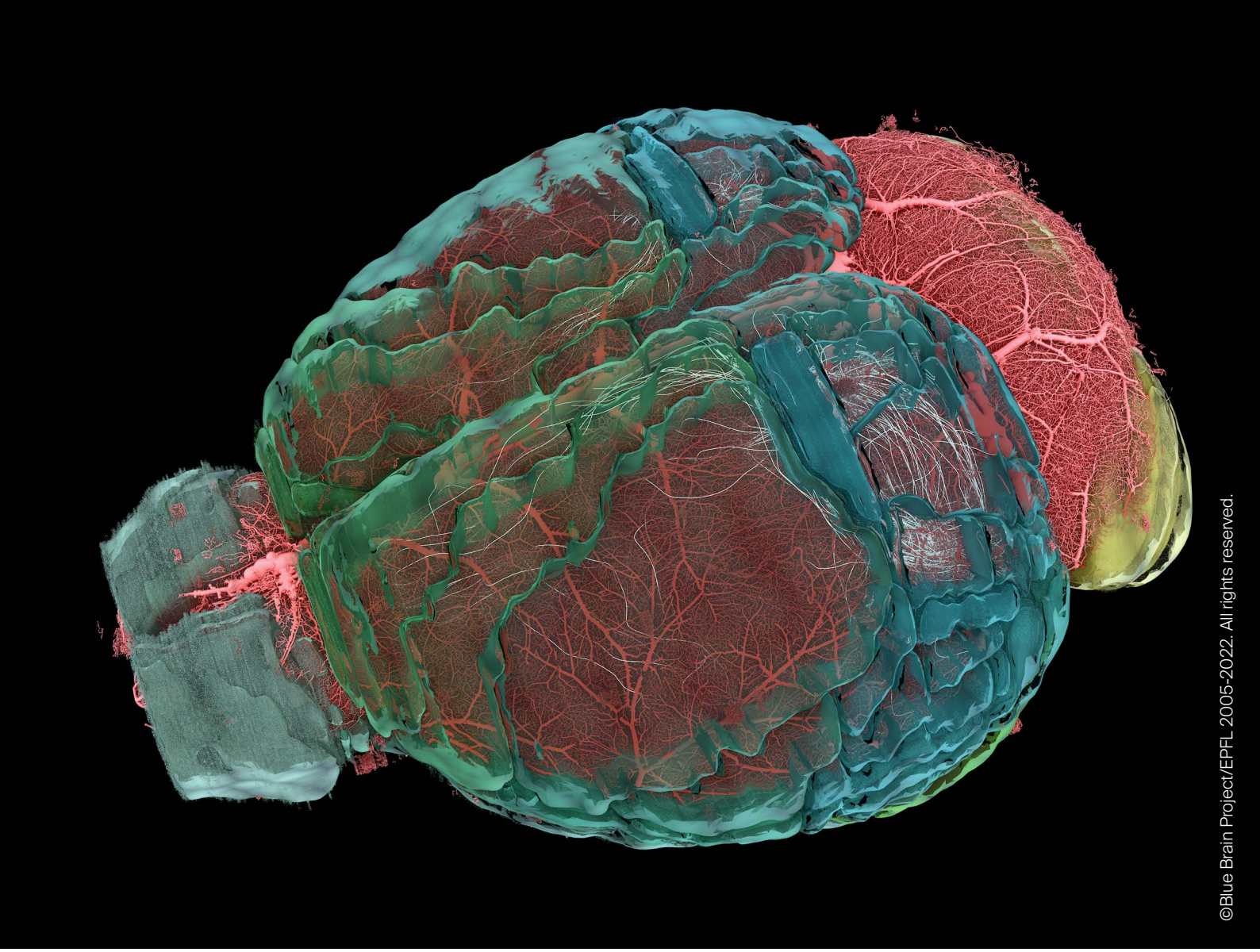
Blue Brain Project

The goal of the EPFL Blue Brain Project is to digitally reconstruct and simulate the mouse brain offering a new approach to understanding the multi-level structure and function of the brain.

A key element of Blue Brain's data-driven research approach is Scientific Visualization. In Simulation (*in silico*) Neuroscience, use of Scientific Visualization makes aspects of the brain models visible, which otherwise would only exist as numbers in a computer. This is very similar to how a microscope makes things visible to an experimental researcher's eye. Through these images, you will see how digital models of rodent brain tissue and large-scale simulations are transformed into data-driven representations that can be inspected and used by Blue Brain Scientists and the Neuroscience Community.

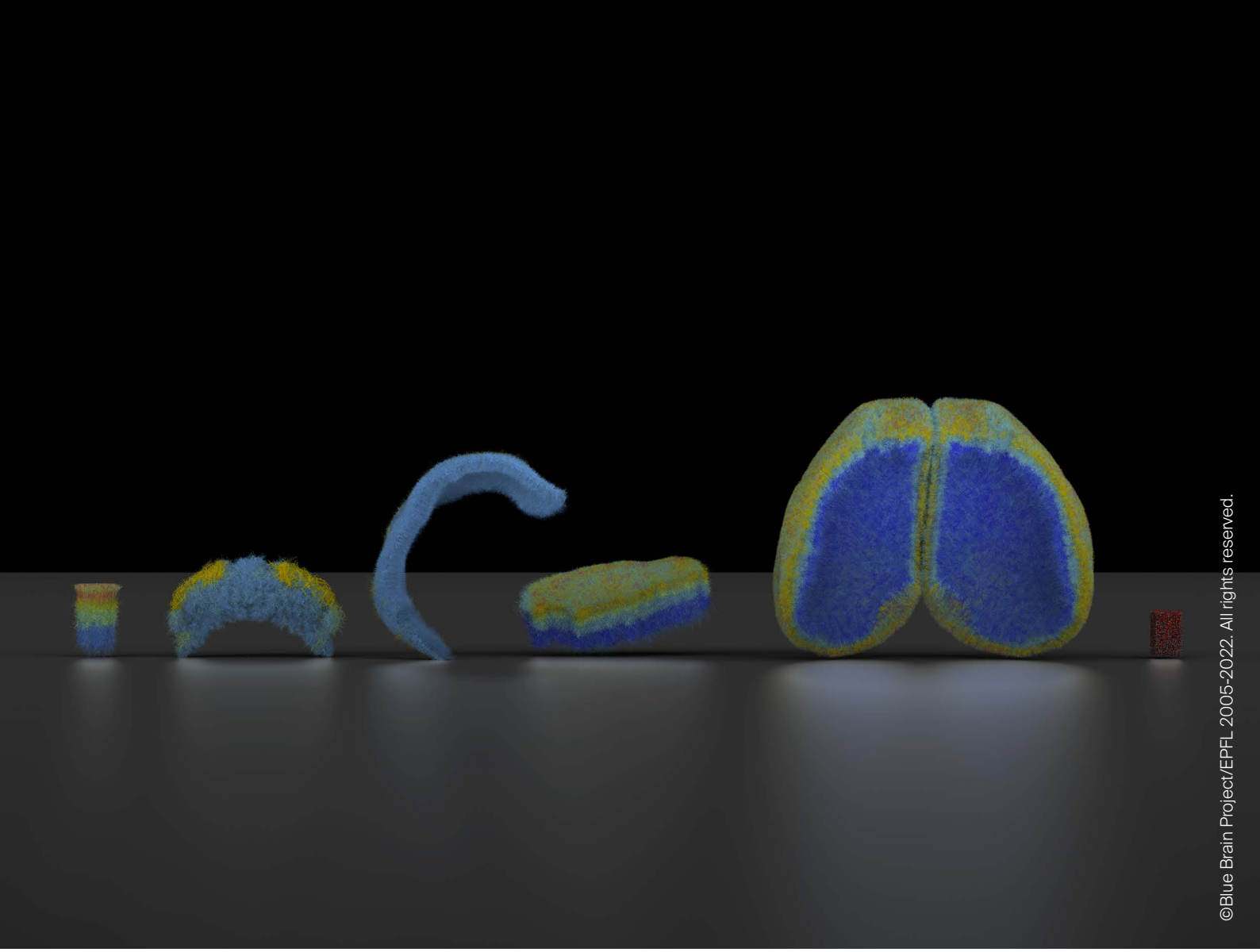
Join us on a deep dive into the brain.



Visualization of a dorso-lateral view of the two hemispheres of the rodent brain

Going from left to right, the structures that can be distinguished are the two olfactory bulbs and their vascularization (colored in light blue and pink respectively), the two hemispheres separated by the central fissure and their vasculature system, and the main arteries and the massive capillary system covering the cerebellar structures (in pink and yellow respectively). White matter bundles are also partially shown (in white).

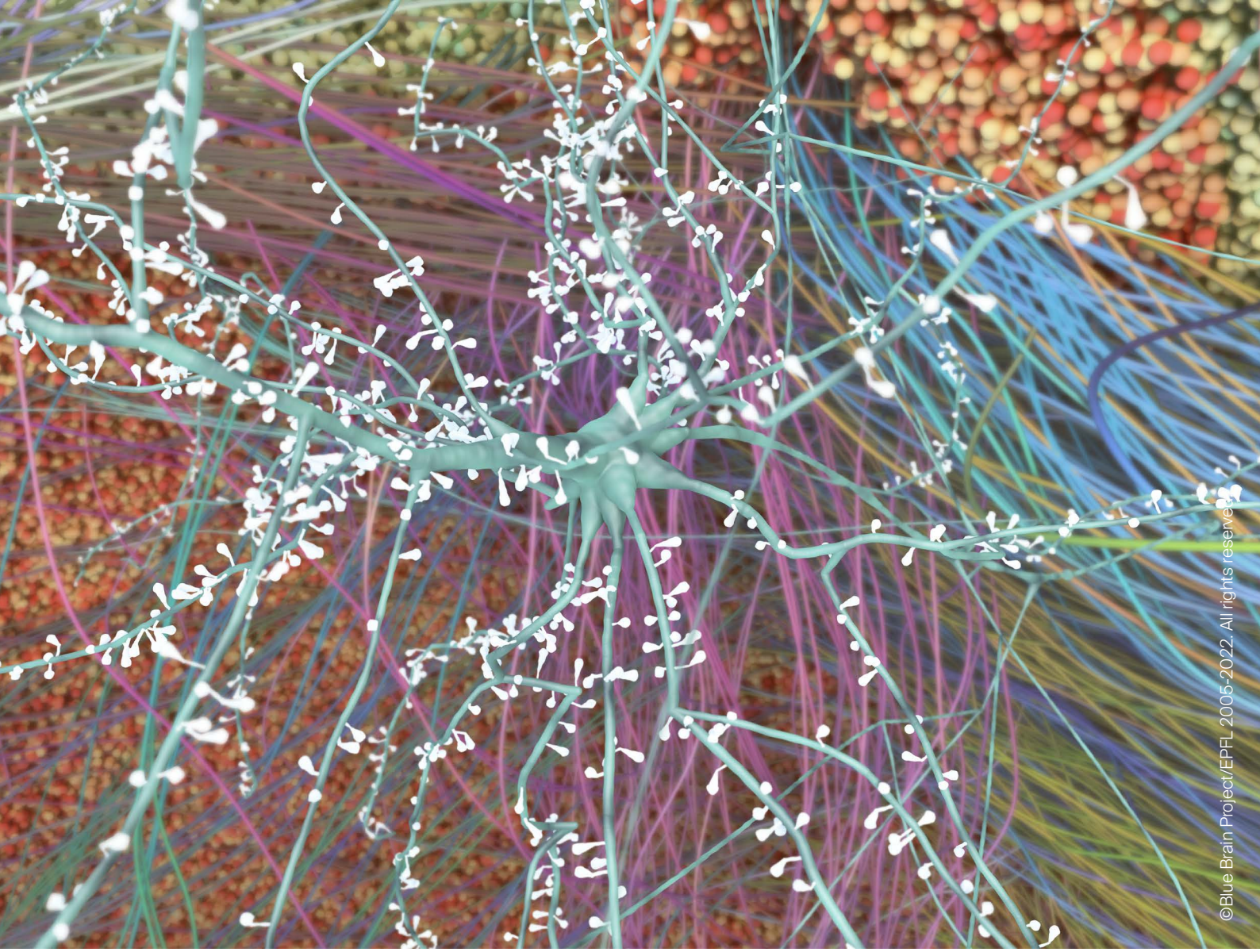
The vasculature network data was provided courtesy of the David Kleinfeld Laboratory, UC San Diego (Xiang Ji et al. 2021).



Visualization of the main rodent brain structures reconstructed (to date) by the Blue Brain Project

From left to right, in chronological order of reconstruction:

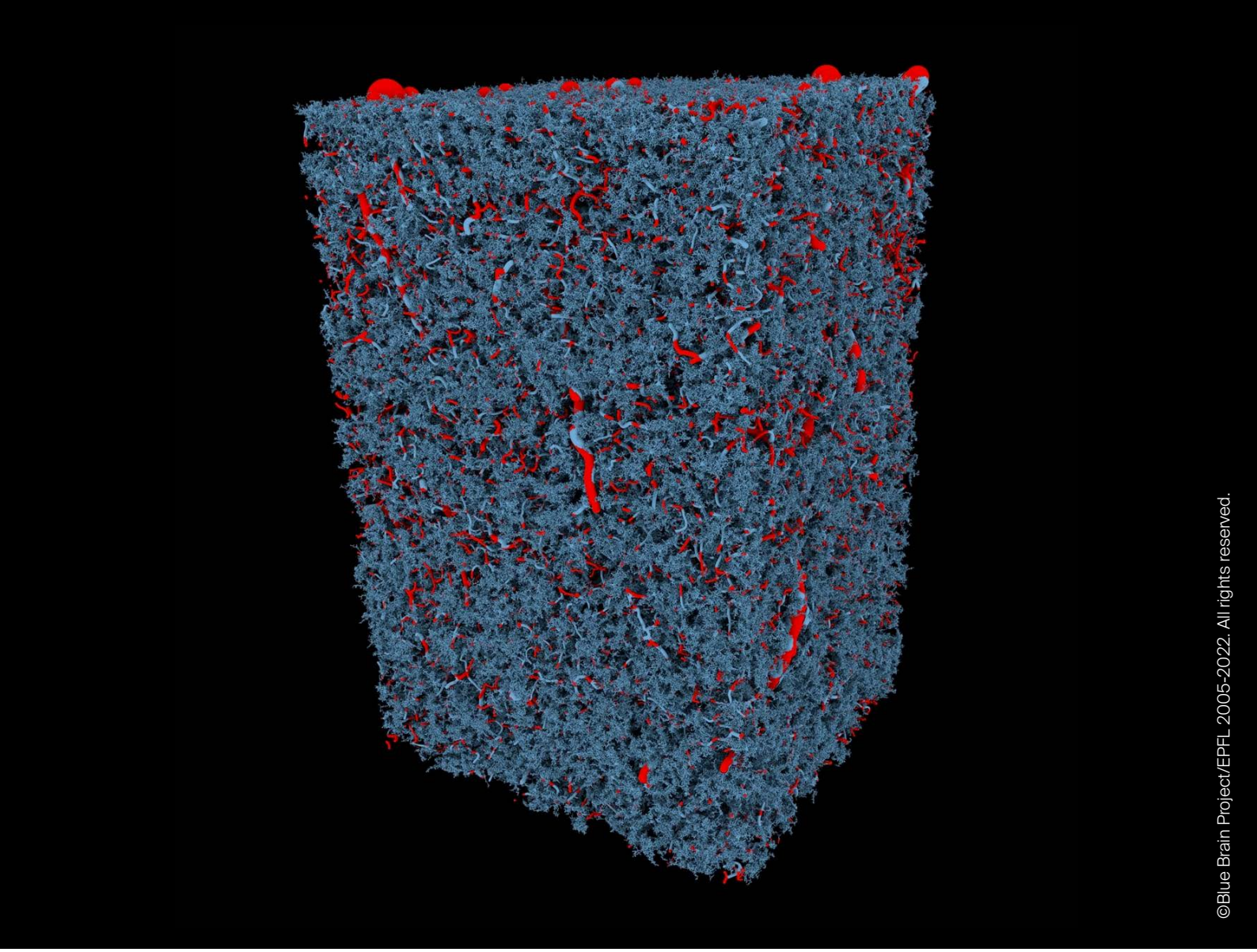
1. The Neocortical Column (the main processing unit of the neocortex) - 31,000 neurons
2. The Bilateral Thalamus (the main relay structure in the mammalian brain, which acts as a hub where sensory inputs converge) - 331,000 neurons
3. The Hippocampus CA1 field (involved in spatial navigation and memory functions) - 460,000 neurons
4. The non-barrel Somatosensory Cortex (the area dedicated to the processing of tactile sensory stimuli and representations) - 1,700,000 neurons
5. The Neocortex - with the two hemispheres in their entirety - 10,700,000 neurons
6. The reconstructed Glia-Vasculature system of the Neocortical Column (also known as NGV unit, providing the blood supply to neurons) - 16,000 neurons



Visualization of a detailed rodent neuronal morphology embedded in cortical tissue

Center: reconstructed pyramidal neuron and its dendritic arborization (in gray) and dendritic spines (white). The apical trunk can be distinguished (on the left side), as well as the main dendritic bifurcations.

Background: spherical structures represent the somas of neighboring neurons while the red, green and blue fiber represent intracortical white matter (the color code shows the directionality of the fibers in an xyz coordinate system).



Visualization of the reconstructed rodent NGV unit (neuro-glia-vasculature unit)

The vasculature is in red and the astrocytes are in blue. Top (pial side): superficial layers; bottom (ventricular side): infragranular layers. Large vessels divide into a myriad of capillaries, providing blood supply for the whole cortical column. Astrocytes are distributed throughout the entirety of the volume and make contact with the vasculature via endfeet.

The vasculature network data was provided by Bruno Weber, ETH Zurich.