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Supplementary Information for

Title: Retinal Capillary Oximetry with Visible Light Optical Coherence Tomography

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Figures S1 to S9

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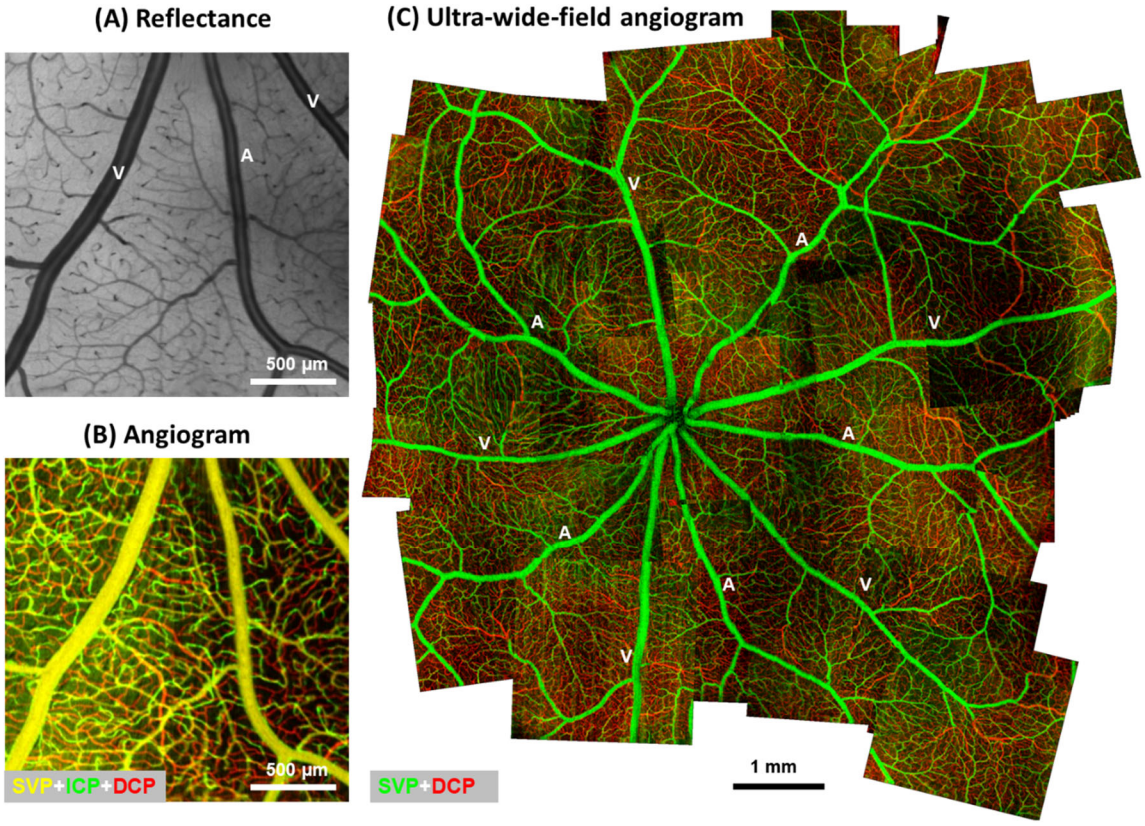


Figure S1: (A) An *en face* reflectance image showing inter-plexus capillaries appearing as dark spots. A: artery. V: vein. (B) Overlaid *en face* angiograms of the three vascular/capillary plexuses demonstrate the detailed retinal circulatory organization. SVP: superficial vascular plexus. ICP: intermediate capillary plexus. DCP: deep capillary plexus. (C) Ultra-wide-field angiogram stitched from multiple scans with smaller field of view.

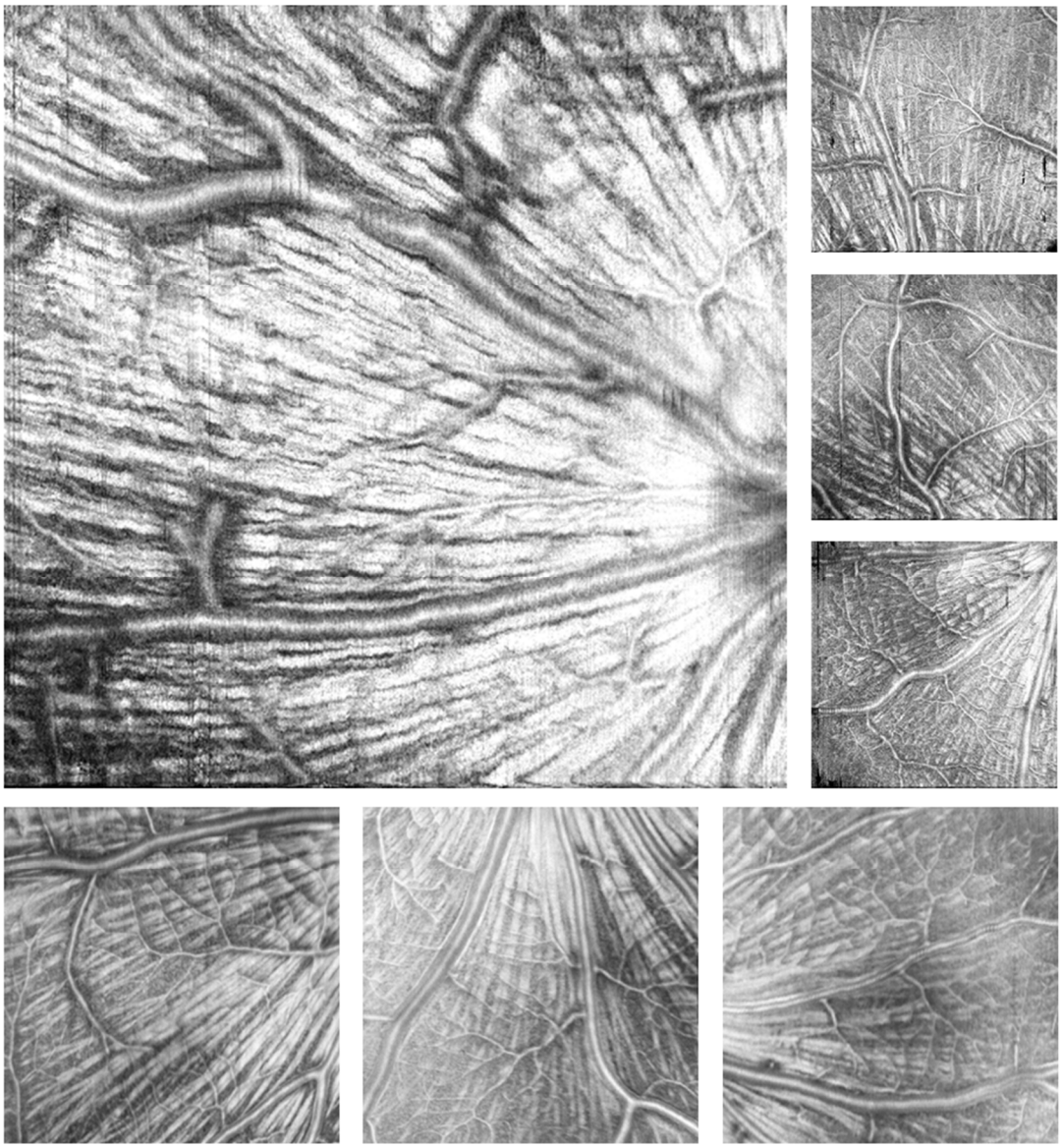


Figure S2: *En face* projections of the nerve fiber slab at various regions of different rat retinas show that the superficial vascular plexus runs anterior to the never fiber bundles.

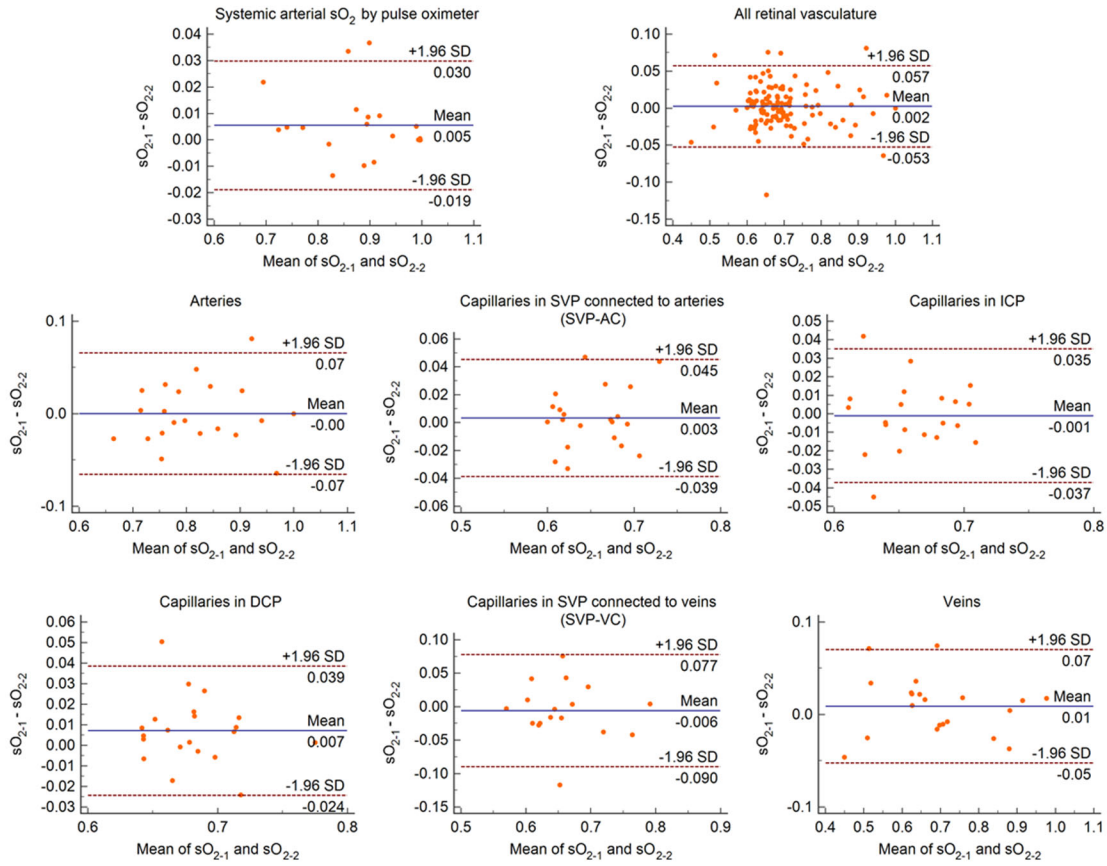


Figure S3: Bland-altman plots showing the repeatability of systemic arterial oxygen saturation (sO_2) by pulse oximeter, and OCT oximetry-measured sO_2 for different vascular plexuses between the first session ($sO_{2\text{-}1}$) and the second session ($sO_{2\text{-}2}$).

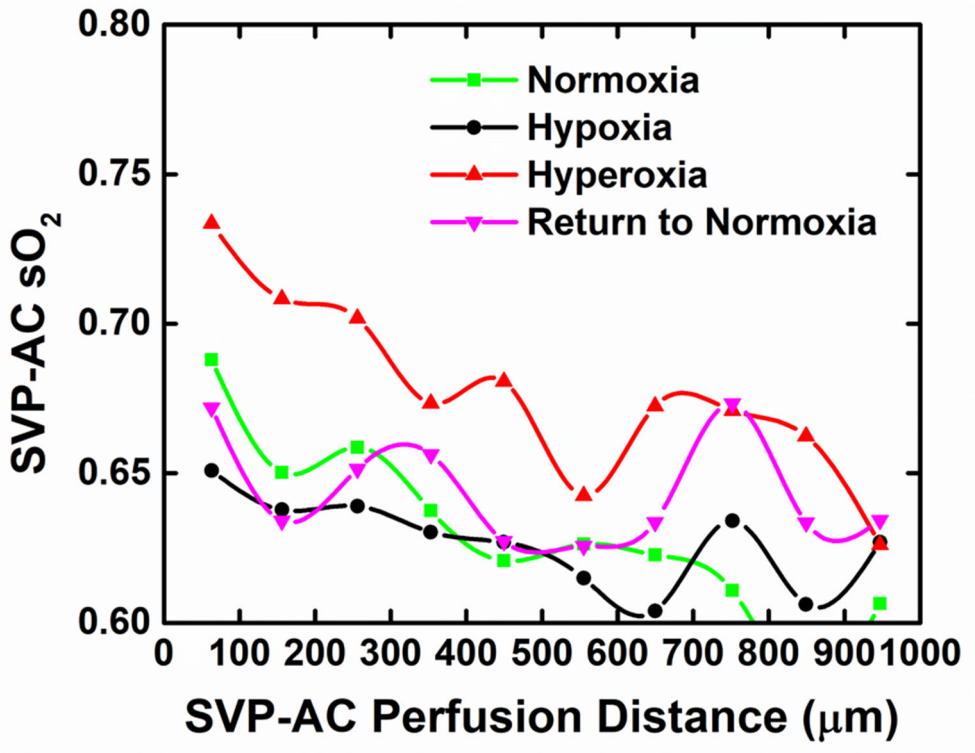


Figure S4: The sO_2 in SVP arterial capillaries (SVP-AC) decreases with increasing perfusion distance.

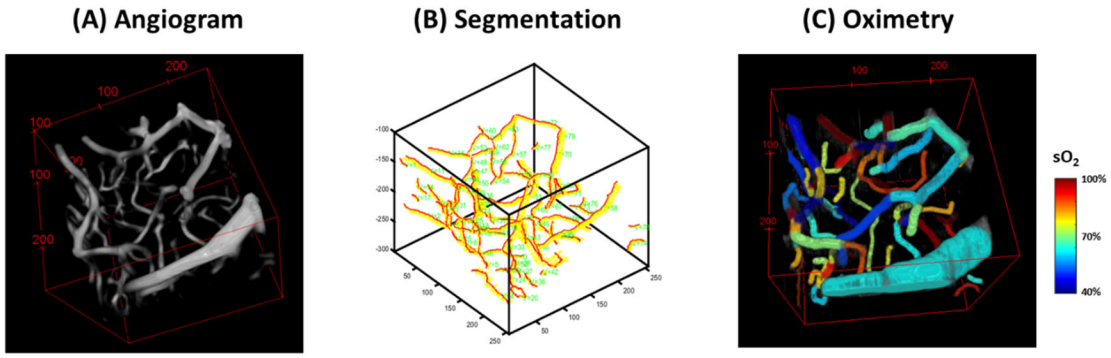


Figure S5: Capillary oximetry performed volumetrically with a 0.5×0.5-mm field of view using a similar strategy described in the text. (A) Angiogram volume scan. (B) Capillary segmentation. (C) Oxygen saturation (sO_2).

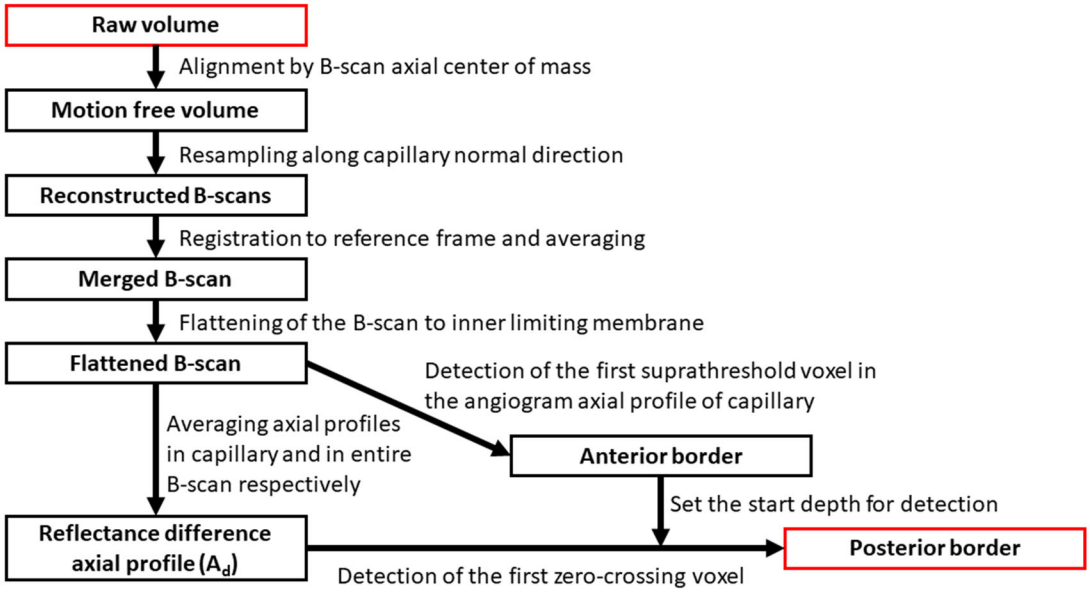


Figure S6: Schematic diagram of the posterior capillary border detection process.

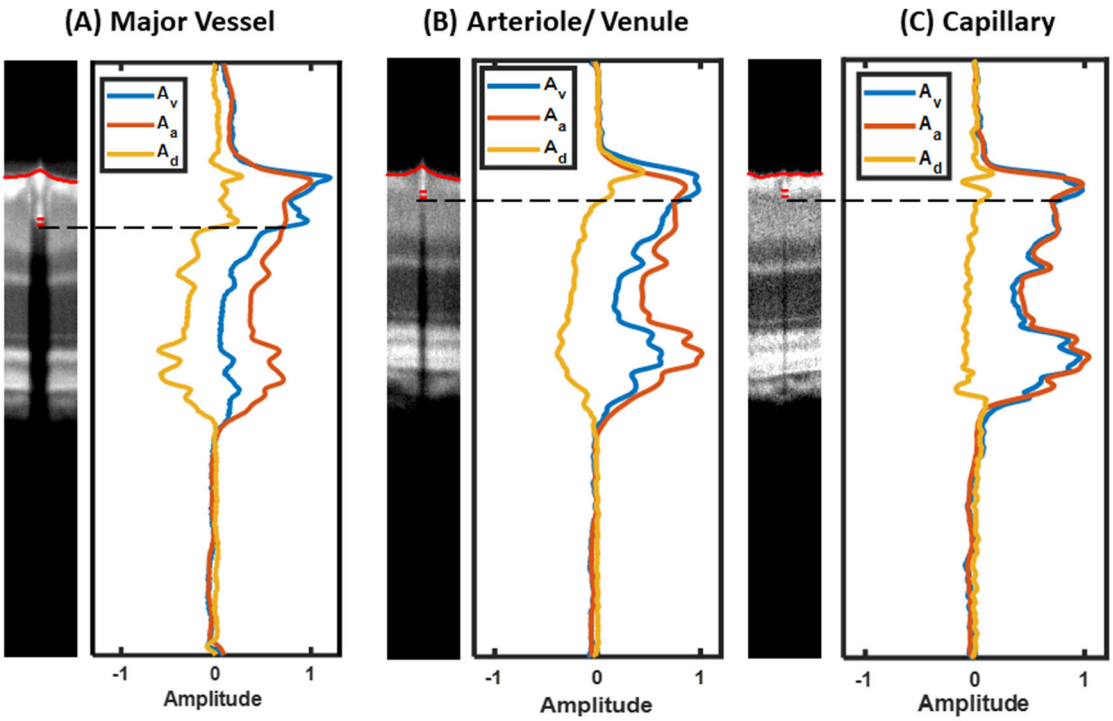


Figure S7: Posterior border detection at vessels with different diameters. A_v: vessel reflectance axial profile. A_a: averaged reflectance axial profile of the entire B-scan. A_d: difference of A_v and A_a. The vessel posterior border was determined by the zero-crossing depth of the difference profile A_d, with the anterior border determined by the first suprathreshold voxel in the axial profile of the averaged capillary angiogram.

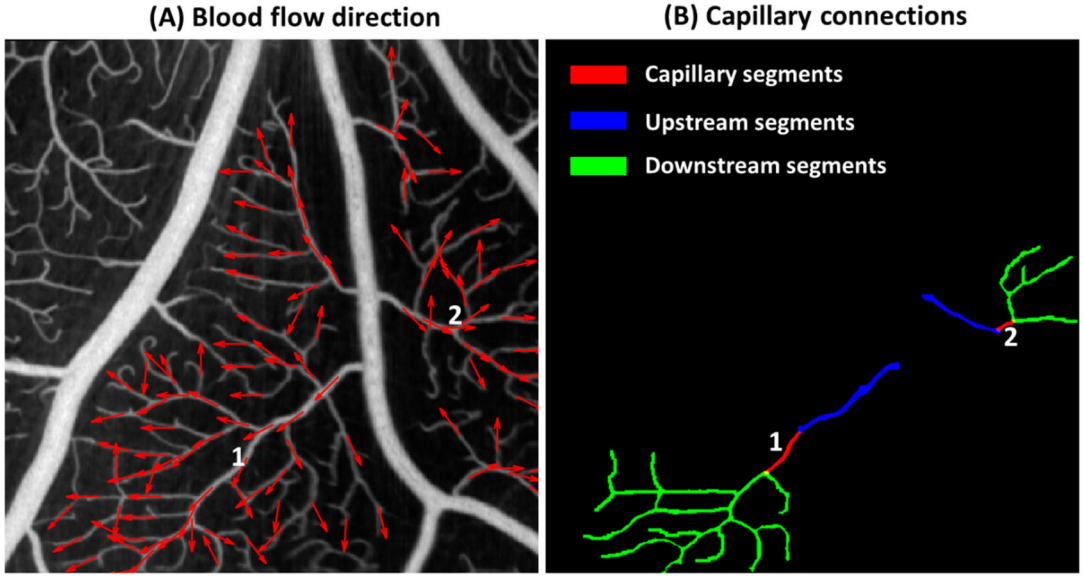
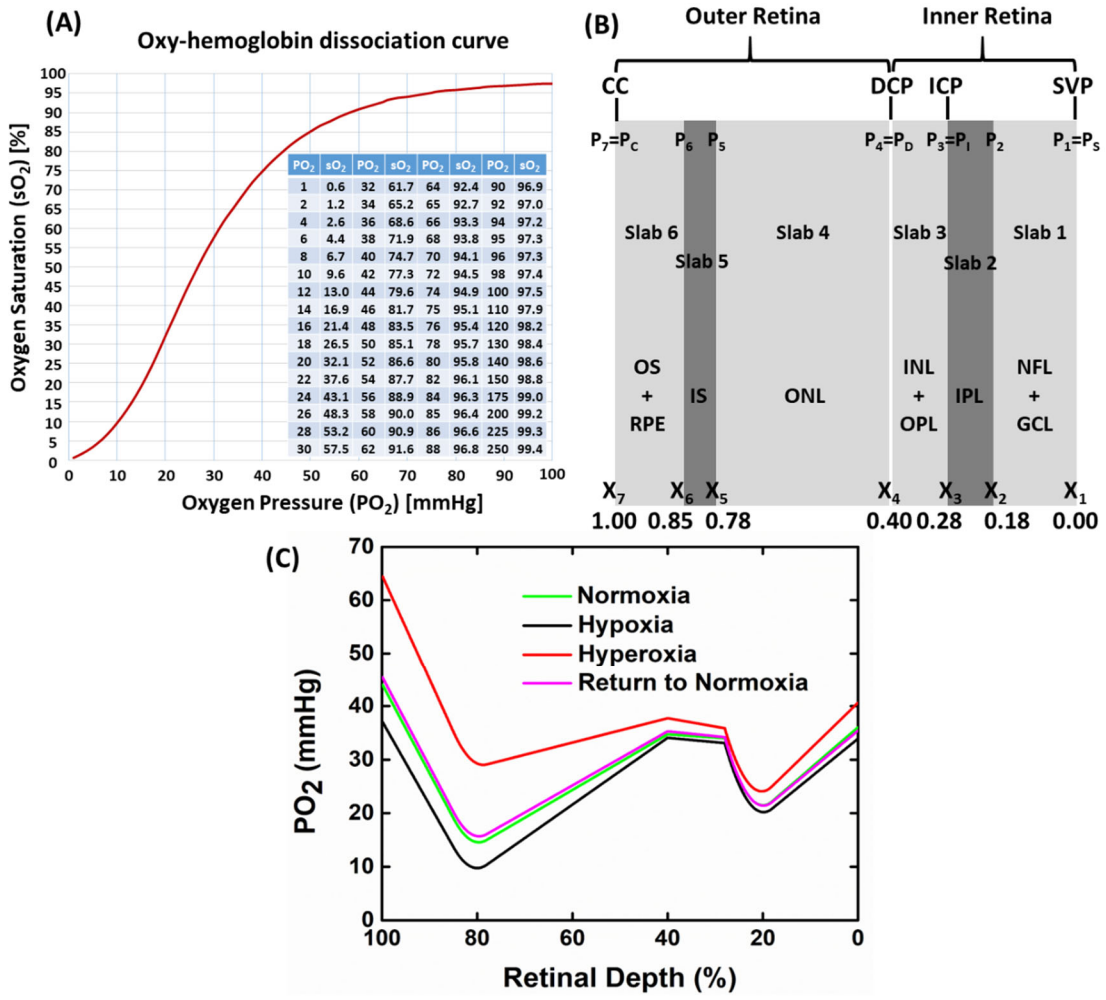


Figure S8: (A) blood flow direction and (B) examples of capillary (#1, #2) connections in SVP arterial capillaries revealed during the capillary morphology analysis. Capillary #1 is identified as a first order capillary as it has 22 downstream segments. Capillary #2 is identified as third order capillary as it has 6 downstream segments.



PO_2	sO_2	PO_2	sO_2	PO_2	sO_2	PO_2	sO_2
1	0.6	32	61.7	64	92.4	90	96.9
2	1.2	34	65.2	65	92.7	92	97.0
4	2.6	36	68.6	66	93.3	94	97.2
6	4.4	38	71.9	68	93.8	95	97.3
8	6.7	40	74.7	70	94.1	96	97.3
10	9.6	42	77.3	72	94.5	98	97.4
12	13.0	44	79.6	74	94.9	100	97.5
14	16.9	46	81.7	75	95.1	110	97.9
16	21.4	48	83.5	76	95.4	120	98.2
18	26.5	50	85.1	78	95.7	130	98.4
20	32.1	52	86.6	80	95.8	140	98.6
22	37.6	54	87.7	82	96.1	150	98.8
24	43.1	56	88.9	84	96.3	175	99.0
26	48.3	58	90.0	85	96.4	200	99.2
28	53.2	60	90.9	86	96.6	225	99.3
30	57.5	62	91.6	88	96.8	250	99.4

Figure S9: (A) Oxy-hemoglobin dissociation curve relates oxygen pressure (PO_2) with sO2 in the blood. (B) The retina is modeled as six slabs to simulate the axial PO_2 profile from PO_2 values (P_S, P_I, P_D, and P_C) at four capillary plexuses: SVP, ICP, DCP, and choriocapillaris (CC). X: normalized retina depth. NFL: nerve fiber layer, GCL: ganglion cell layer, IPL: inner plexiform layer, INL: inner nuclear layer, OPL: outer plexiform layer, ONL: outer nuclear layer, IS: photoreceptor inner segments, OS: photoreceptor outer segments, RPE: retinal pigment epithelium. (C) The calculated axial profiles of oxygen pressure (PO_2) in the rat retina from capillary sO_2 show trends that parallel the changes in inhaled oxygen concentration. Retina depth: 0%: ILM, 100%: BM.