

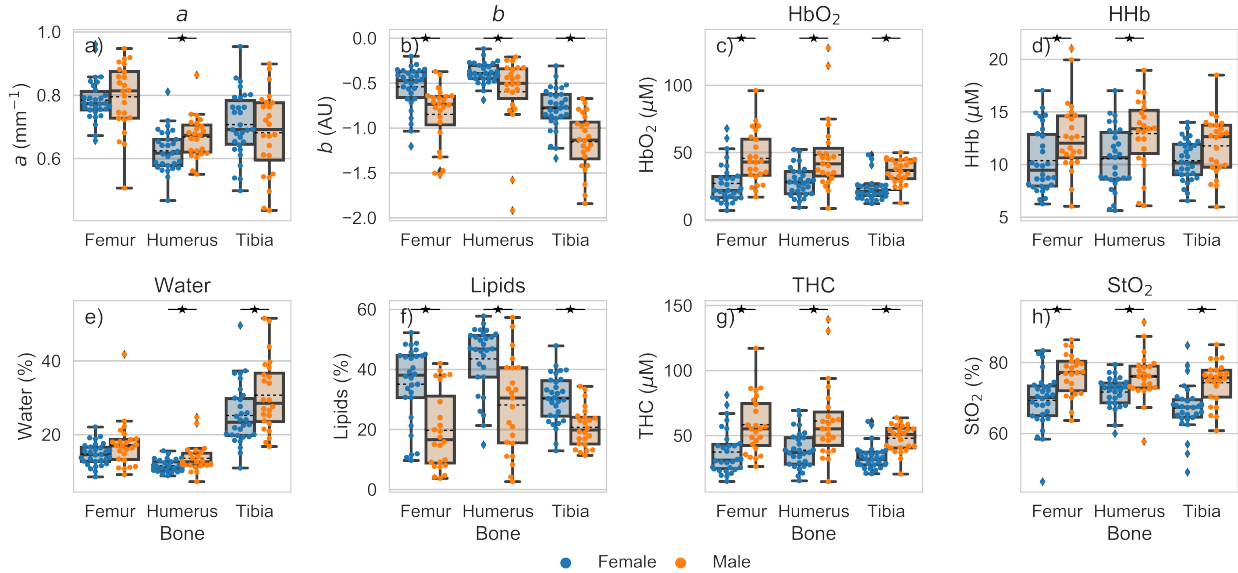
671 **Supplementary Material**

672 *S1 Sex Differences*

673 The mean and standard deviation of oxyhemoglobin, deoxyhemoglobin, water, lipids, total hemoglobin,  
 674 and tissue oxygen saturation are reported for males and females for each bone in Table S1 and Fig-  
 675 ure S1.

**Table S1** Mean and standard deviation for optical properties and chromophore concentrations in bones for males and females.

Variable	Sex	Femur	Humerus	Tibia
$a$ ( $\text{mm}^{-1}$ )	Female	$0.8 \pm 0.1$	$0.6 \pm 0.1$	$0.7 \pm 0.1$
$a$ ( $\text{mm}^{-1}$ )	Male	$0.8 \pm 0.1$	$0.7 \pm 0.1$	$0.7 \pm 0.1$
$b$ (AU)	Female	$-0.5 \pm 0.2$	$-0.4 \pm 0.1$	$-0.8 \pm 0.2$
$b$ (AU)	Male	$-0.9 \pm 0.4$	$-0.6 \pm 0.4$	$-1.2 \pm 0.3$
HbO <sub>2</sub> ( $\mu\text{M}$ )	Female	$26.9 \pm 14.9$	$28.2 \pm 11.0$	$22.9 \pm 8.5$
HbO <sub>2</sub> ( $\mu\text{M}$ )	Male	$45.9 \pm 19.6$	$48.2 \pm 27.7$	$36.3 \pm 9.2$
HHb ( $\mu\text{M}$ )	Female	$10.4 \pm 3.0$	$10.5 \pm 3.0$	$10.4 \pm 1.9$
HHb ( $\mu\text{M}$ )	Male	$12.4 \pm 3.5$	$12.8 \pm 3.2$	$11.7 \pm 2.8$
Water (%)	Female	$14.7 \pm 3.1$	$11.6 \pm 1.7$	$25.2 \pm 8.2$
Water (%)	Male	$17.6 \pm 6.4$	$13.7 \pm 3.8$	$31 \pm 9.5$
Lipids (%)	Female	$35.1 \pm 12.7$	$43.5 \pm 11.1$	$30.3 \pm 8.1$
Lipids (%)	Male	$21.2 \pm 14.5$	$28.7 \pm 15.6$	$21.1 \pm 6.6$
THC ( $\mu\text{M}$ )	Female	$37.3 \pm 17.2$	$38.7 \pm 13.8$	$33.3 \pm 9.5$
THC ( $\mu\text{M}$ )	Male	$58.3 \pm 22.2$	$61.0 \pm 29.6$	$47.9 \pm 10.6$
StO <sub>2</sub> (%)	Female	$69.3 \pm 7.7$	$71.7 \pm 4.3$	$67.2 \pm 6.8$
StO <sub>2</sub> (%)	Male	$77.2 \pm 5.9$	$76.3 \pm 6.6$	$74.6 \pm 5.9$



**Fig S1** Distribution of optical property parameters (a)  $a$  and (b)  $b$  and concentrations of (c) oxyhemoglobin, (d) deoxyhemoglobin, (e) water, (f) lipids, (g) total hemoglobin, and (h) tissue oxygen saturation for the humerus, femur, and tibia for females (blue) and males (orange). Each point is the average of left and right measurements for an individual. The box plot shows the mean (dashed black line), median (solid black line), interquartile range (box), and whiskers extending to 1.5 times the quartiles (thin black line). \* represents a statistical significance between females and males at  $p = 0.05$ . Panels (f) and (h) are also shown in Fig 5.

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## 677 S2 Body Symmetry

678 Optical properties and chromophore concentrations on left and right sides of the body were compared for each bone by taking the ratio of average left to right measurements. The mean and standard deviation for the ratio of oxyhemoglobin, deoxyhemoglobin, water, lipids, total hemoglobin, and tissue oxygen saturation are reported for each bone in Table S2. A one sample T-test was used to compare the distribution of ratios to 1 and no multiple comparison test was used.

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**Table S2** Mean and standard deviation for the ratio of left to right measurements of optical properties and chromophore concentrations in bones.

Variable	Femur (n=45)	Humerus (n=38)	Tibia (n=53)
$a$ ( $\text{mm}^{-1}$ )	$1.0 \pm 0.1$	$0.8 \pm 0.1$	$1.0 \pm 0.2$
$b$ (AU)	$1.0 \pm 0.3$	$0.7 \pm 0.3$	$0.9 \pm 0.2$
HbO <sub>2</sub> ( $\mu\text{M}$ )	$1.1 \pm 0.3$	$1.2 \pm 0.5$	$1.0 \pm 0.2$
Hb ( $\mu\text{M}$ )	$1.1 \pm 0.2$	$1.1 \pm 0.3$	$1.1 \pm 0.2$
Water (%)	$1.1 \pm 0.2$	$0.8 \pm 0.2$	$1.0 \pm 0.3$
Lipids (%)	$1.1 \pm 0.4$	$1.4 \pm 0.6$	$1.1 \pm 0.3$
THC ( $\mu\text{M}$ )	$1.0 \pm 0.3$	$1.1 \pm 0.4$	$1.0 \pm 0.2$
StO <sub>2</sub> (%)	$1.0 \pm 0.1$	$1.0 \pm 0.1$	$1.0 \pm 0.1$

683 At the femur, the  $a$  parameter ratio was the only DOSI-derived metric to statistically differ  
684 from 1 ( $p = 0.004$ ). The tibia had ratios statistically differ from 1 for the  $b$  parameter ( $p = 0.013$ )  
685 and deoxyhemoglobin ( $p = 0.042$ ). The ratios for the  $a$  and  $b$  parameters (both  $p < 0.001$ ), deoxy-  
686 hemoglobin ( $p = 0.034$ ), water ( $p < 0.001$ ), and lipids ( $p < 0.001$ ) all statistically differed from 1 at  
687 the humerus.

688 Generally speaking, the boniest locations had the most symmetry. Arm usage and muscle  
689 contribution at the humerus may contribute to the asymmetry. Handedness and footedness was not  
690 recorded for volunteers.

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### 692 *S3 DOSI Body Scan*

693 As a proof of concept to explore chromophore variation across the body, a volunteer partici-  
694 pated in a comprehensive body scan. A 6 by 6 cm square grid was transferred onto the skin surface  
695 using a transparency and nonpermanent surgical marker. The grid spanned from the center of

696 manubrium across the clavical to the proximal humeral head and down the arm to the distal ends  
697 of radius and ulna and down the ribs, hip, and thigh to foot. Grid locations are shown in Figure S2.

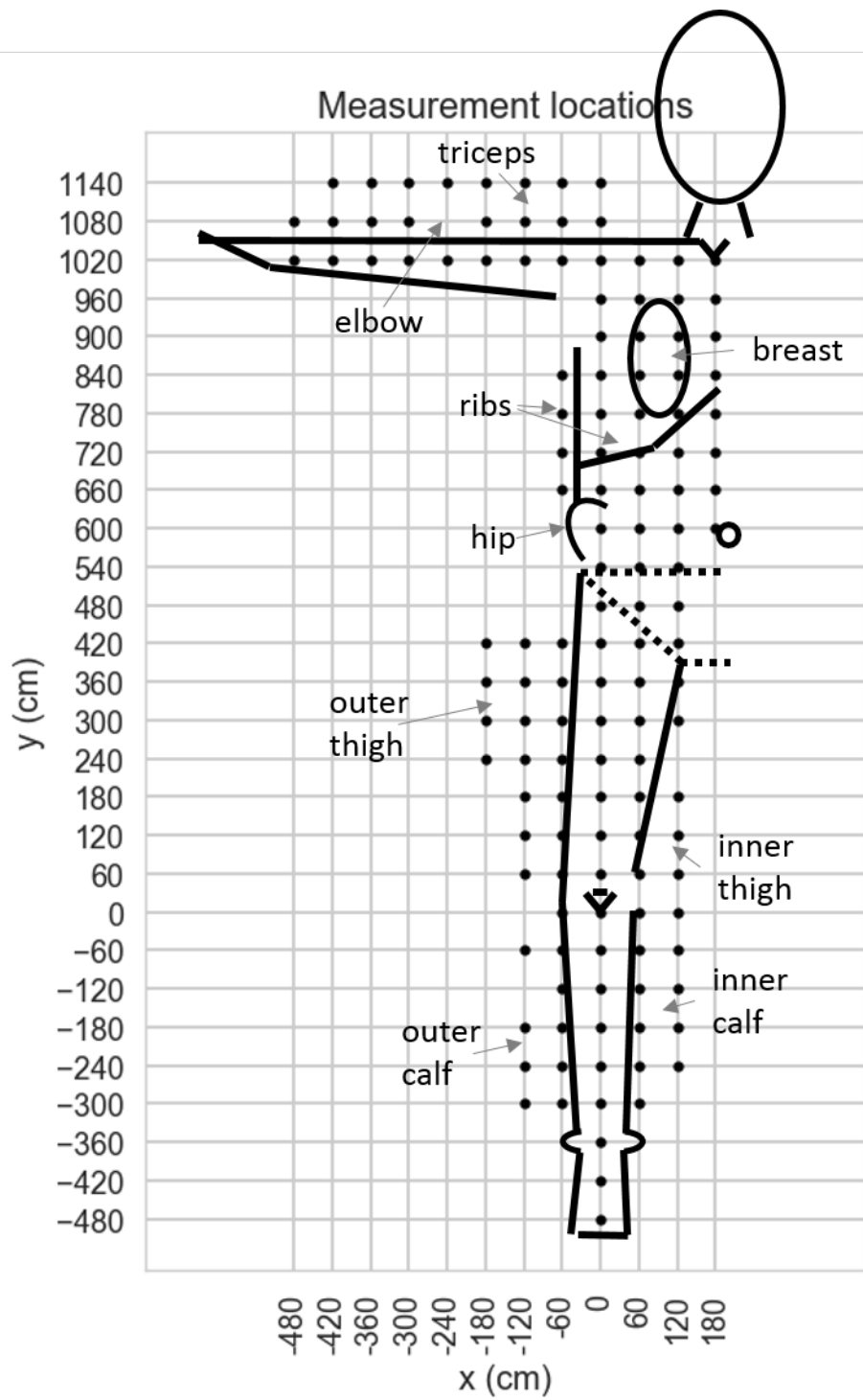
698 The strict quality control protocols for light leakage from Section 2.5 were not used for this  
699 measurement. All measurements were processed using the methods described in Section 2.4.  
700 Chromophore values were displayed as 2D maps and the Pearson's correlation coefficient was  
701 used to quantify the relationship between DOSI metrics at a given measurement location.

702 Volunteer 3367-046, a 27 year old white non-Hispanic female with 27.8% body fat percentage,  
703 completed a comprehensive body DOSI scan. A total of 149 DOSI measurements were taken, of  
704 which 133 (89%) passed the quality control procedure outlined in Section S3.

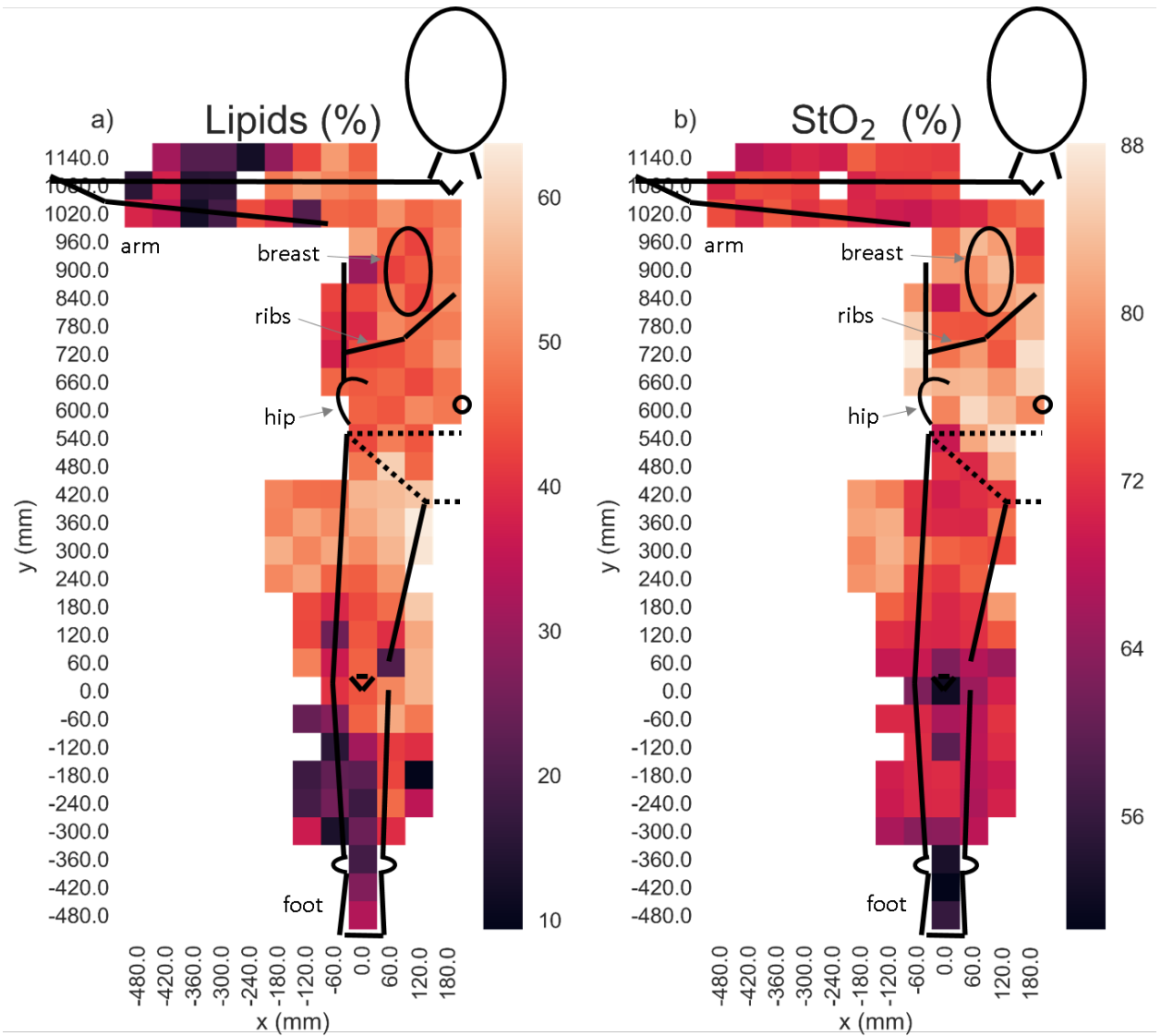
705 Figure S3 shows the spatial distribution of lipids and tissue oxygen saturation in this volunteer.  
706 Lipids varied from 9.4% to 63.7% with an average of 41.5%. Tissue oxygen saturation was lowest  
707 on the foot (50.6%) and highest on the torso (88.1%). The mean tissue oxygen saturation for the  
708 body was 73.4%.

709 The correlation between several DOSI metrics are shown in Figure S4. The correlation coeffi-  
710 cient for tissue oxygen saturation and lipids was 0.3 ( $p < 0.001$ ) and the correlation coefficient for  
711 total hemoglobin concentration and lipids was -0.9 ( $p < 0.001$ ).

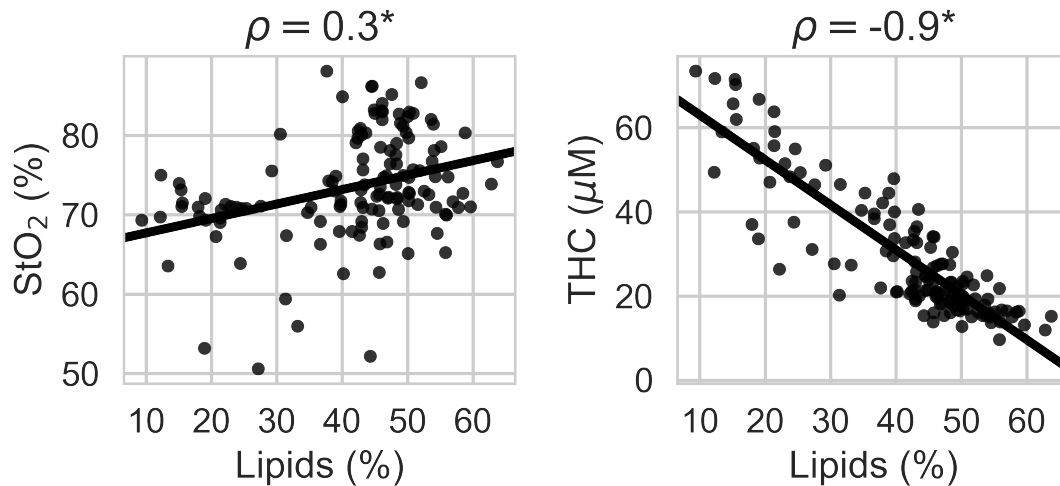
712 The DOSI comprehensive body scan was collected from only a single volunteer due to the  
713 effort and time needed to acquire this data. While generalizations cannot be made based on this  
714 single subject, the spatial variation of chromophores provides some insight to lipid, water, and  
715 hemoglobin distributions in the body. There was generally lower lipids and oxygen saturation at the  
716 periphery (arms and lower legs) compared with the torso and upper legs. Additionally, there was a  
717 strong negative correlation between DOSI lipids and total hemoglobin ( $\rho = -0.9$ ), which was similar  
718 to the correlation observed over the population. Curiously, a positive correlation between tissue



**Fig S2** Schematic of measurement locations for the body scan. Each point represents a measurement and arrows point to anatomic features.



**Fig S3** Spatial Distribution of (a) lipids and (b) tissue oxygen saturation for a 27 year old white non-Hispanic female with 27.8% body fat percentage. Schematic of the body is overlaid for orientation.



**Fig S4** Correlation of lipids and tissue oxygen saturation (a) and lipids and total hemoglobin concentration (b) within the body for a 27 year old white non-Hispanic female with 27.8% body fat percentage. \* represents statistical significance at a significance level of  $p = 0.05$

719 oxygen saturation and lipids was observed in the individual ( $\rho = 0.3$ ) while a negative correlation  
 720 was observed in the population ( $\rho = -0.3, -0.7, \text{ and } -0.7$  for tibia, femur, and humerus respectively).  
 721 As DOSI instrumentation continues to improve in acquisition speed and the ability to scan over  
 722 larger spatial areas, more analyses of intra-subject measurements may lead to new insights to  
 723 human pathophysiology.