Supplementary Information

Machine-Learning-Guided Quantitative Delineation of Cell Morphological Features and Responses to Nanomaterials

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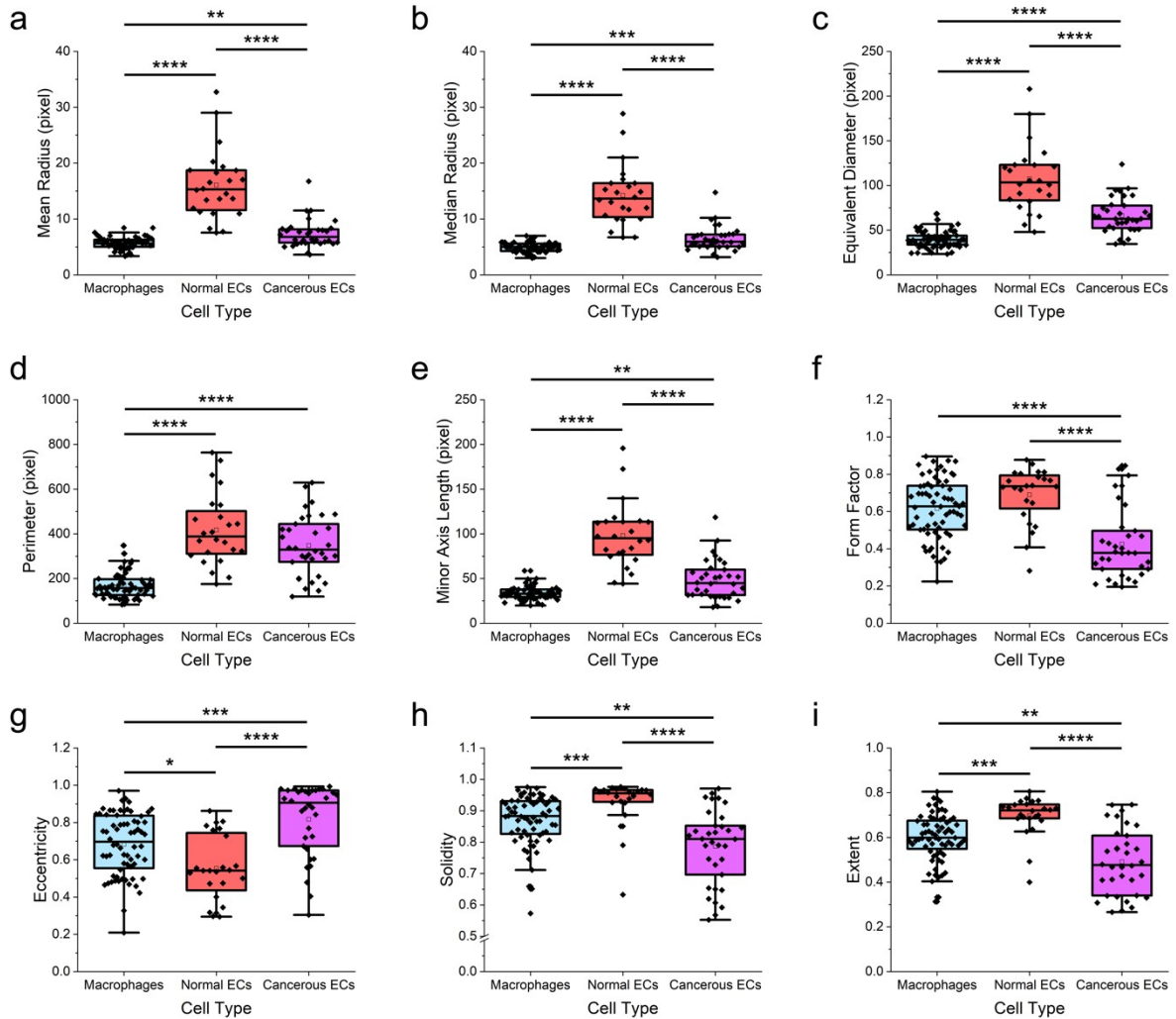
Supporting Figures

Figure S1. Morphological features of macrophages and epithelial cells: (a) mean radius, (b) median radius, (c) equivalent diameter, (d) perimeter, (e) minor axis length, (f) form factor, (g) eccentricity, (h) solidity, and (i) extent. n = 68 for RAW 264.7 macrophages, 24 for MCF-10A normal epithelial cells, and 34 for MDA-MB-231 cancerous epithelial cells. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, **** $p < 0.0001$ based on either Brown-Forsythe and Welch ANOVA test coupled with Dunnett's T3 multiple comparisons test or Kruskal-Wallis test coupled with Dunn's multiple comparisons test.
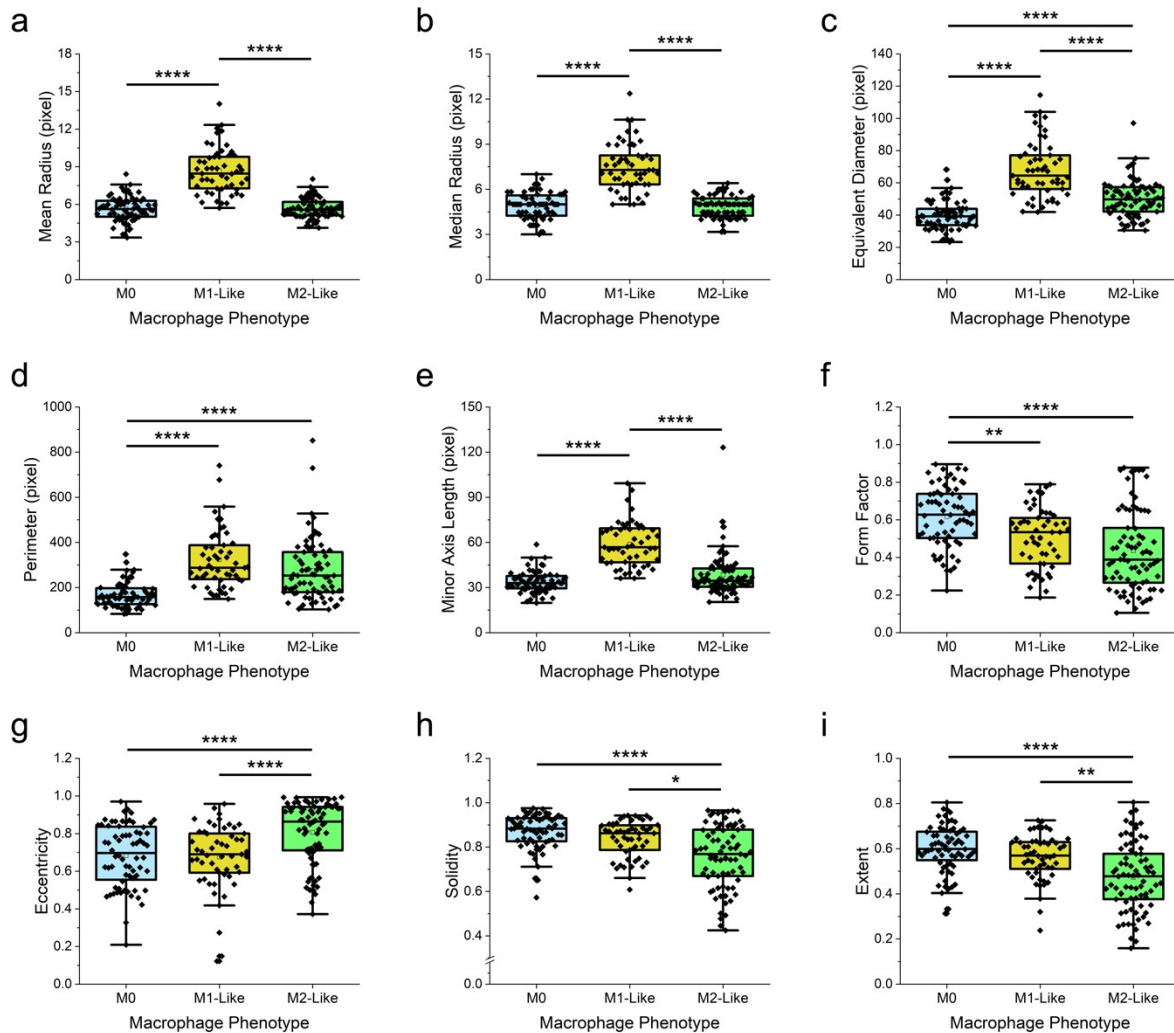
Figure S2. Morphological features of the different macrophage phenotypes: (a) mean radius, (b) median radius, (c) equivalent diameter, (d) perimeter, (e) minor axis length, (f) form factor, (g) eccentricity, (h) solidity, and (i) extent. *n* = 68 for M0, 53 for M1-like, and 77 for M2-like macrophages. * $p < 0.05$, ** $p < 0.01$, and **** $p < 0.0001$ based on either Brown-Forsythe and Welch ANOVA test coupled with Dunnett's T3 multiple comparisons test or Kruskal-Wallis test coupled with Dunn's multiple comparisons test.
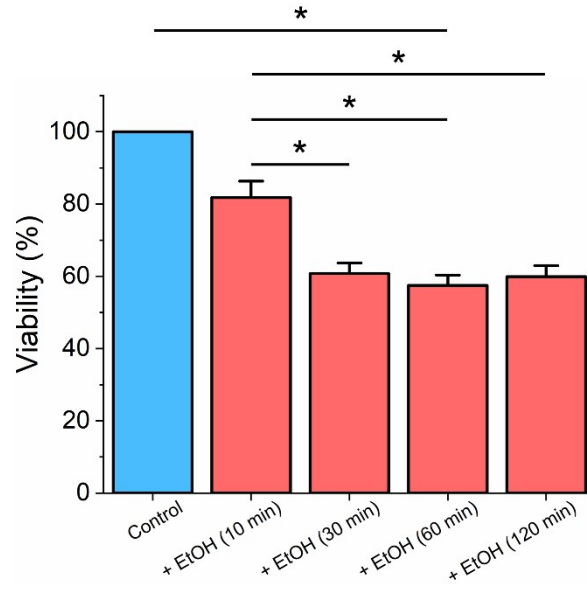
Figure S3. Semi-quantitative evaluation of the viability of macrophages treated with ethanol over time. * $p < 0.05$ based on Brown-Forsythe and Welch ANOVA test coupled with Dunnett's T3 multiple comparisons test.
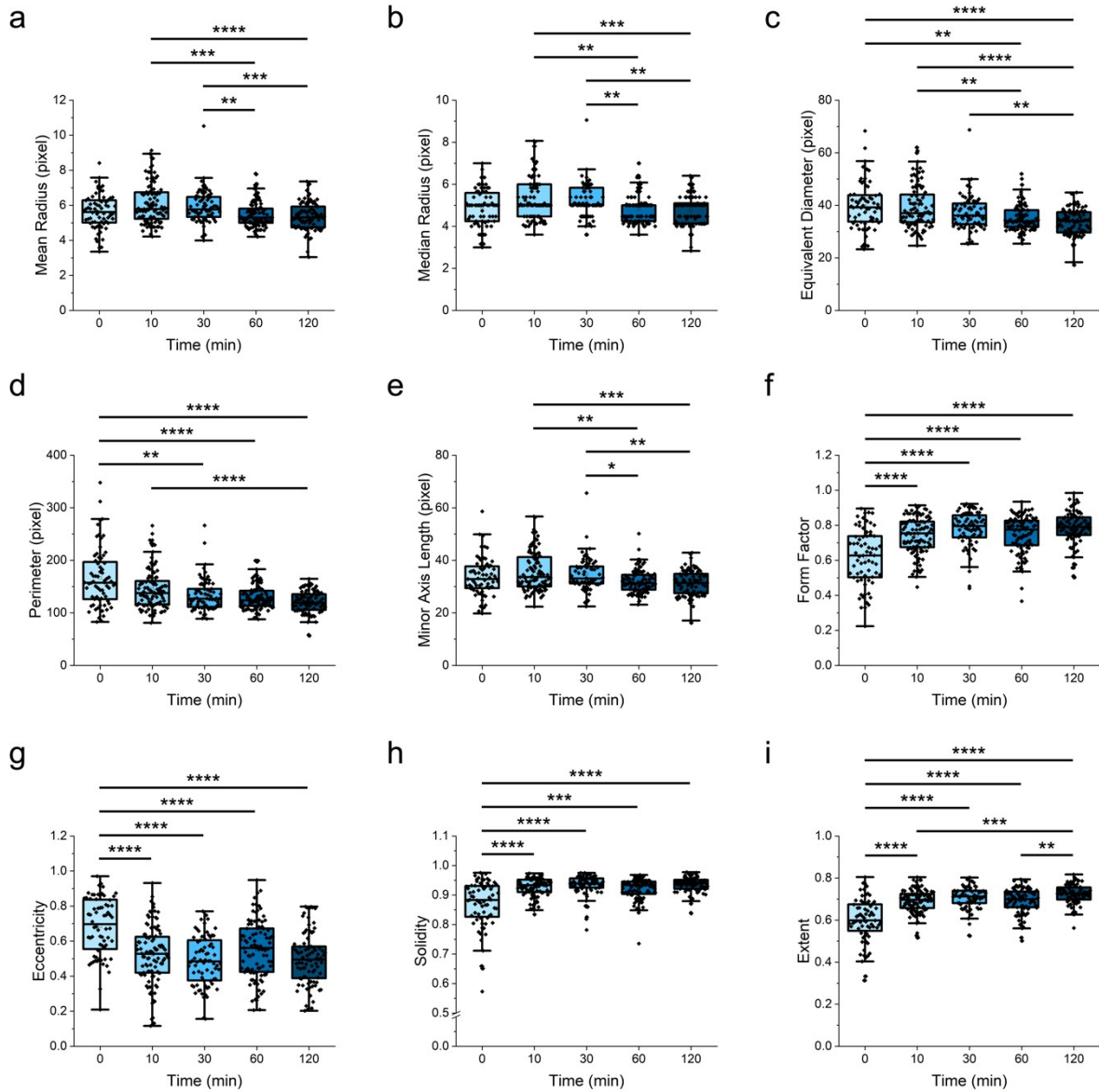
Figure S4. Morphological features of the different ethanol-treated macrophages with varying viability: (a) mean radius, (b) median radius, (c) equivalent diameter, (d) perimeter, (e) minor axis length, (f) form factor, (g) eccentricity, (h) solidity, and (i) extent. n = 68 for control 0 min, 101 for + EtOH 10 min, 74 for + EtOH 30 min, 97 for + EtOH 60 min, and 87 for + EtOH 120 min. * p < 0.05, ** p < 0.01, *** p < 0.001, and **** p < 0.0001 based on Kruskal-Wallis test coupled with Dunn's multiple comparisons test.
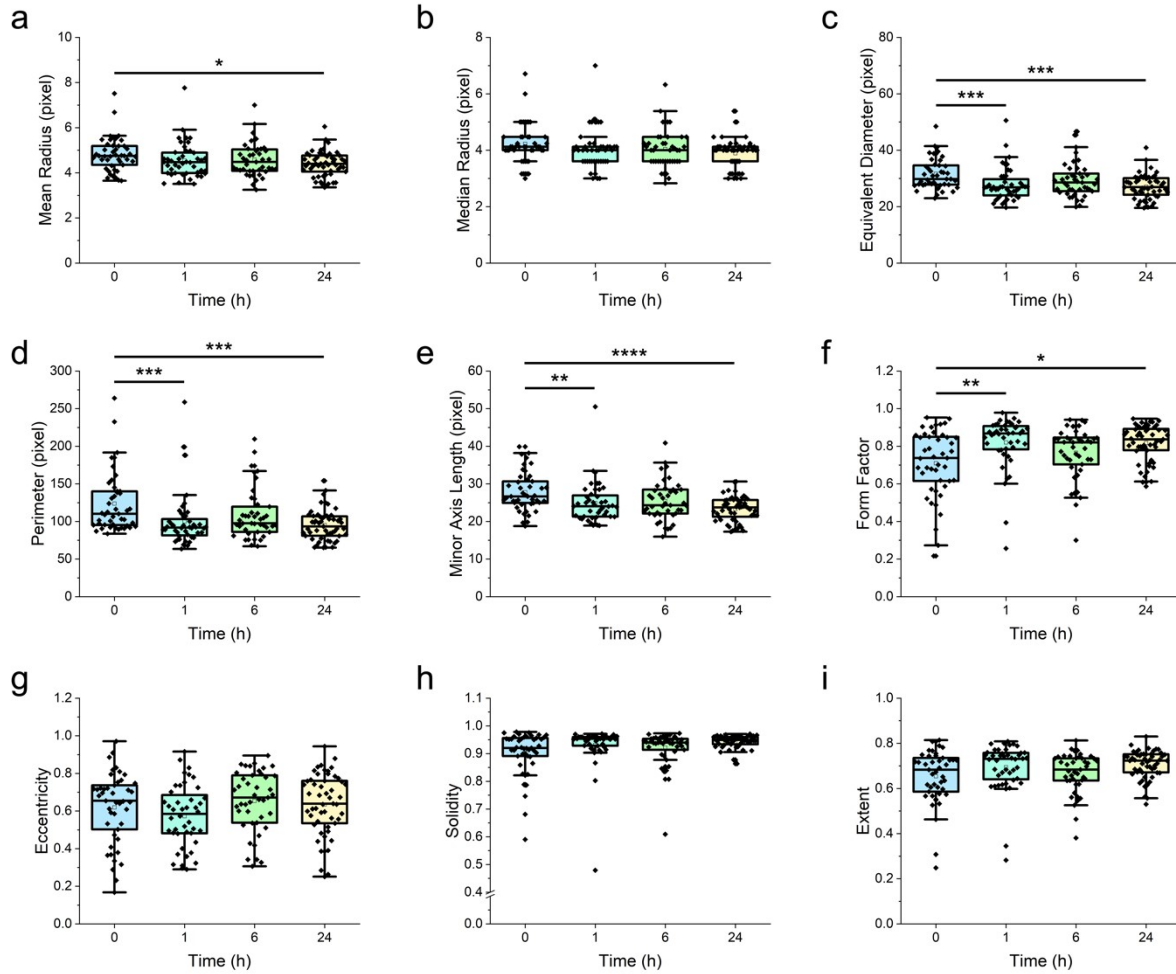
Figure S5. Morphological features of the different nanoparticle-treated macrophages: (a) mean radius, (b) median radius, (c) equivalent diameter, (d) perimeter, (e) minor axis length, (f) form factor, (g) eccentricity, (h) solidity, and (i) extent. n = 45 for control 0 h, 44 for + Nanoparticles 1 h, 43 for + Nanoparticles 6 h, and 53 for + Nanoparticles 24 h. * p < 0.05, ** p < 0.01, and *** p < 0.001 based on Kruskal-Wallis test coupled with Dunn's multiple comparisons test.
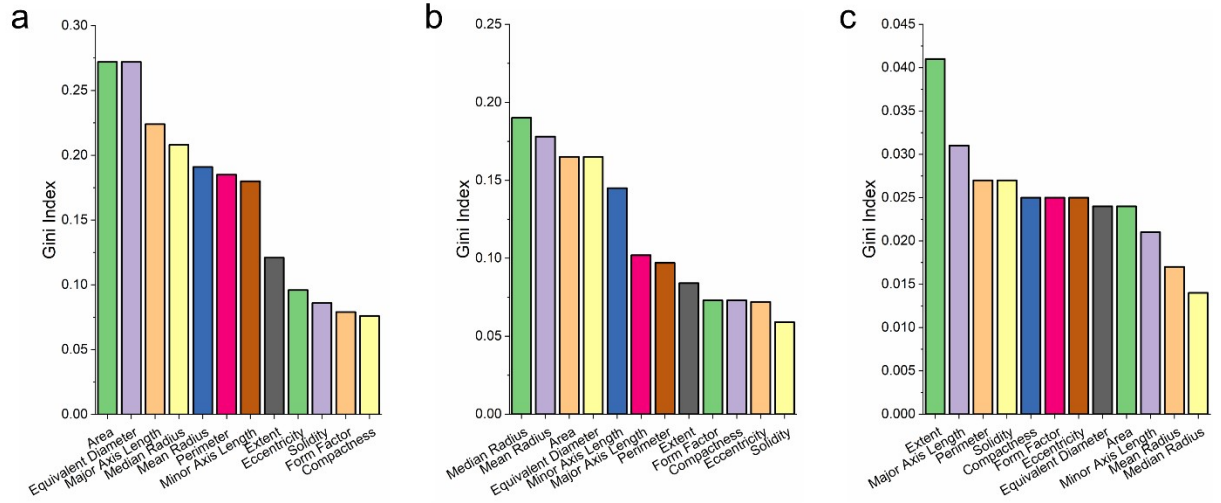
Figure S6. Gini index of various morphological features of (a) macrophages and normal and cancerous epithelial cells, (b) different macrophage phenotypes, and (c) ethanol-treated macrophages with varying viability.
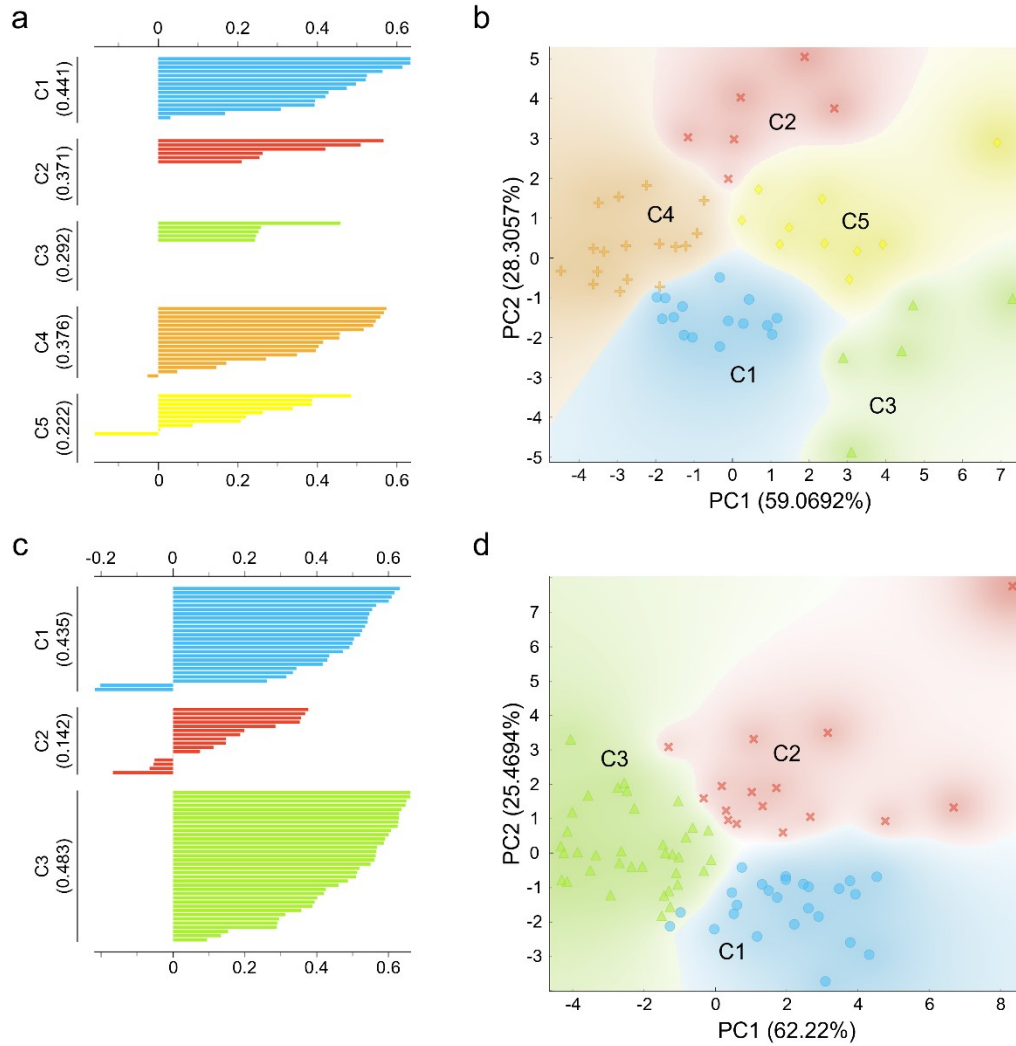
Figure S7. Unsupervised *k*-means clustering of the different macrophage phenotypes: (a, b) M1-like and (c, d) M2-like macrophages. (a, c) Silhouette plots and (b, d) scattering plots of the different macrophage clusters of the respective groups as identified through the unsupervised *k*-means clustering.