

Supplementary Information

Table S1. List of internal standards added during sample preparation.

| Lipid Class | Lipid Chemistry |
|----------------------------------|--|
| Cholesteryl ester | CE(18:0-d ₆) |
| Ceramide | C16-d ₃₁ Ceramide |
| Fatty acid | C15:0-d ₂₉ FA |
| Fatty acid | C17:0-d ₃₃ FA |
| Fatty acid | C20:0-d ₃₉ FA |
| <i>lyso</i> -Phosphatidylcholine | <i>lyso</i> PC(C14:0)-d ₄₂ |
| Phosphatidic acid | PA(C16:0-d ₃₁ /C18:1) Na ⁺ salt |
| Phosphatidylcholine | PC(C16:0-d ₃₁ /C18:1) |
| Phosphatidylethanolamine | PE(C16:0-d ₃₁ /C18:1) |
| Phosphatidylglycerol | PG(C16:0-d ₃₁ /C18:1) Na ⁺ salt |
| Phosphatidylinositol | PI(C16:0-d ₃₁ /C18:1) NH ₄ ⁺ salt |
| Phosphatidylserine | PS(C16:0-d ₆₂) Na ⁺ salt |
| Sphingomyelin | SM(C16:0-d ₃₁) |
| Triglyceride | TG(45:0-d ₂₉) |
| Triglyceride | TG(48:0-d ₃₁) |
| Triglyceride | TG(54:0-d ₃₅) |

Table S2. Univariate analysis of the abundance of the 10 most predictive variables for driving the random forest model used to predict BrainAGE.

| | BrainAGE (non-corrected) | BrainAGE (sex, age, BMI, HDL, Trig, apoe4) | Correlation coefficient |
|---------------------------------|-----------------------------|---|----------------------------|
| <i>lysoPC</i> (20:3) | 0.0069 | 0.003 | -0.270 |
| <i>lysoPC</i> -P(18:1) | 0.019 | 0.010 | -0.236 |
| PC(42:9) | 0.031 | 0.039 | -0.217 |
| <i>lysoPC</i> (20:4) | 0.270 | 0.135 | -0.112 |
| <i>lysoPC</i> (20:5) | 0.084 | 0.037 | -0.175 |
| <i>lysoPE</i> (21:0)/PC-O(18:0) | 0.104 | 0.044 | -0.164 |
| TG(58:6) | 0.274 | 0.164 | 0.111 |
| PE(36:1) | 0.291 | 0.288 | 0.107 |
| <i>lysoPC</i> -O(18:1) | 0.071 | 0.038 | -0.183 |
| BMI | 0.365 | N/A | -0.095 |

Corrected and non-corrected *p*-values and correlation coefficients for the association between the abundance of the 10 most predictive variables and BrainAGE. apoe4: apolipoprotein E4, BMI: body mass index, HDL: high density lipoprotein, *lysoPC*: lysophosphatidylcholine, *lysoPE*: lysophosphatidylethanolamine, PC: phosphatidylcholine, PE: phosphatidylethanolamine, TG: triglyceride.

Figure S1. Plots showing the performance and the lipids responsible for driving the random forest model of percent Stroop.

A) Scatter plot of actual Stroop performance against predicted Stroop performance in an independent test set. B) Variable importance plot of lipids responsible for driving the random forest model used to generate the predictions in plot A.

