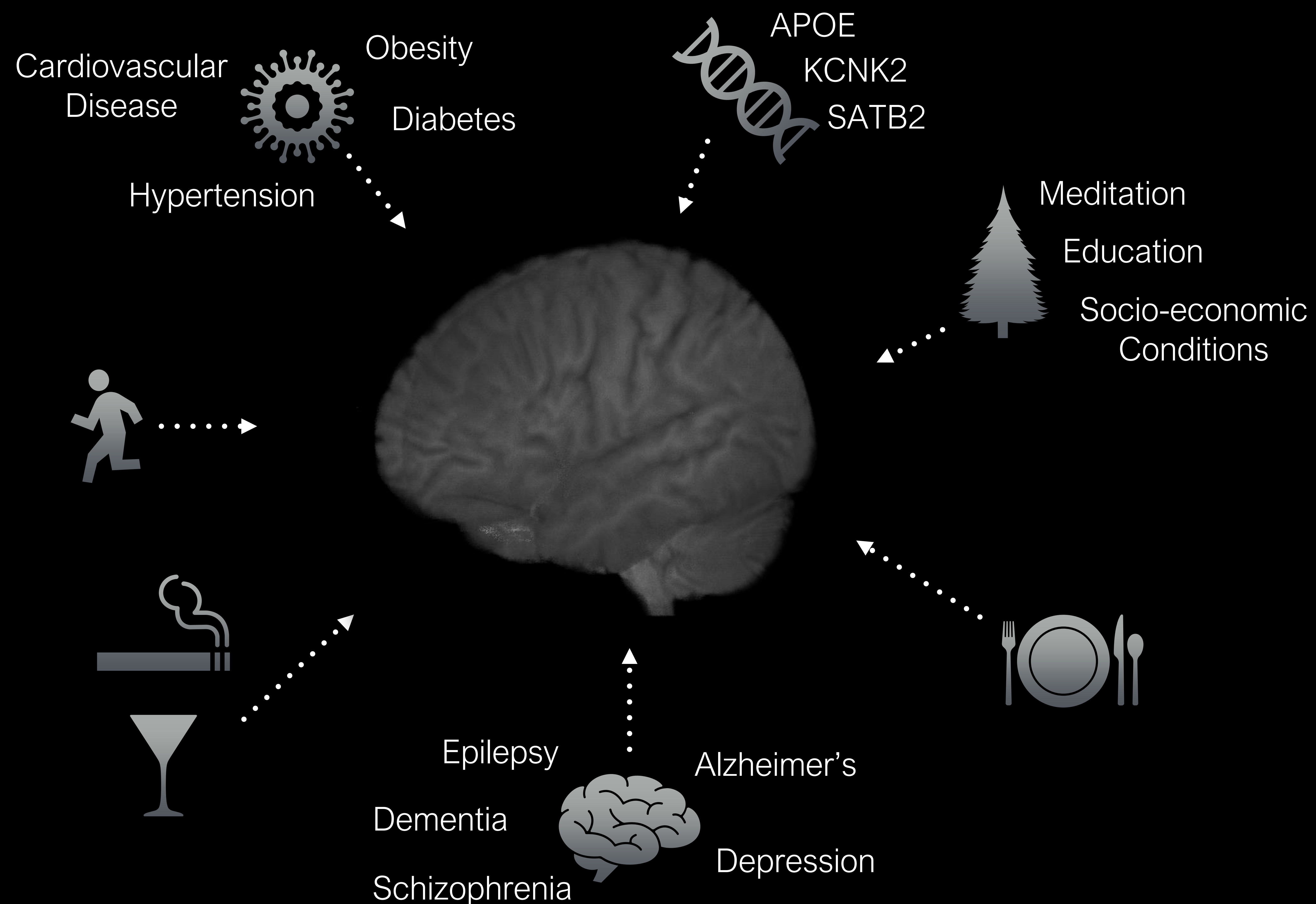


# Data Science Unmasks Brain Ageing: A Multimodal MRI Study

Andrei C. Roibu

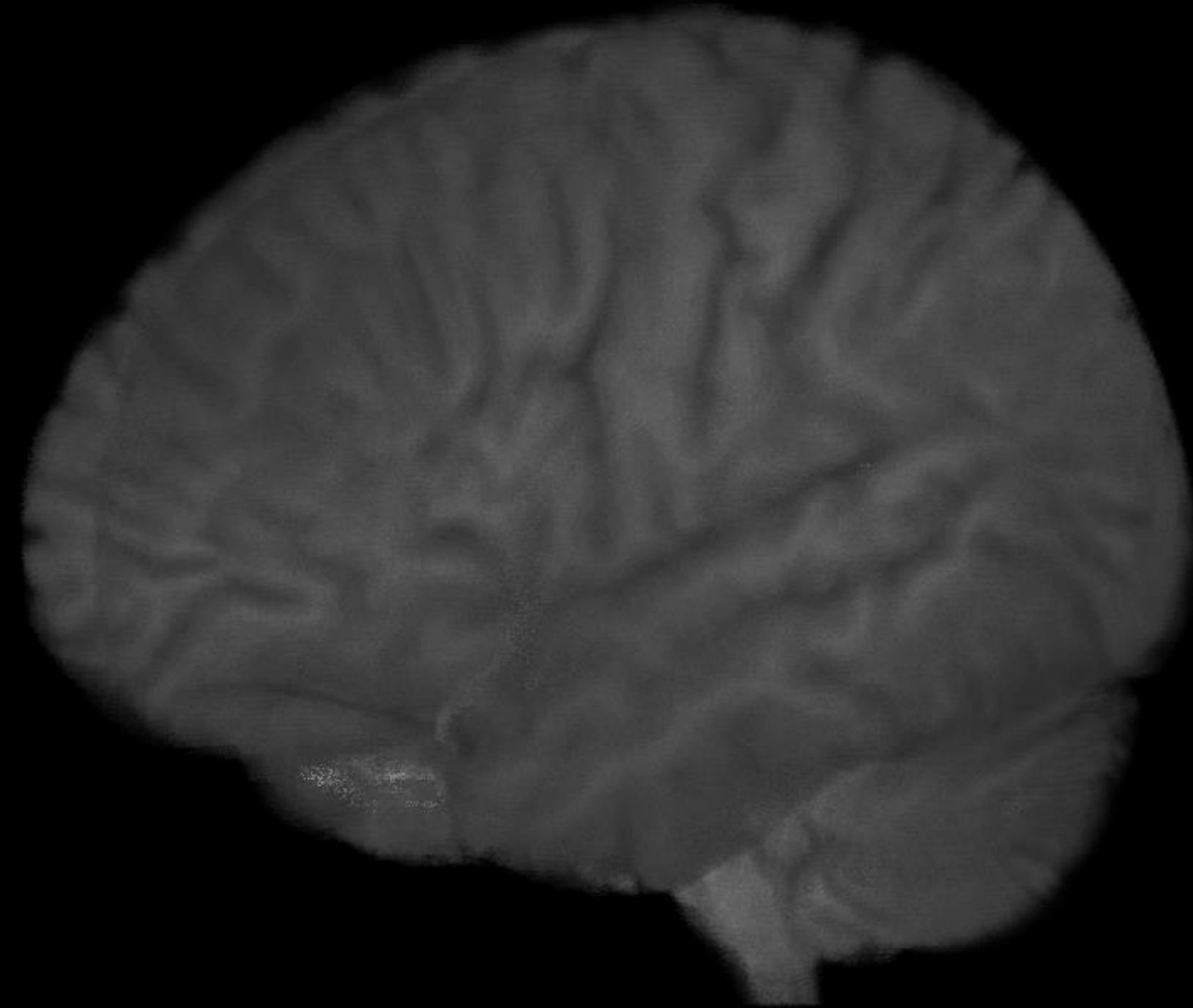
# The Mystery of Brain Ageing



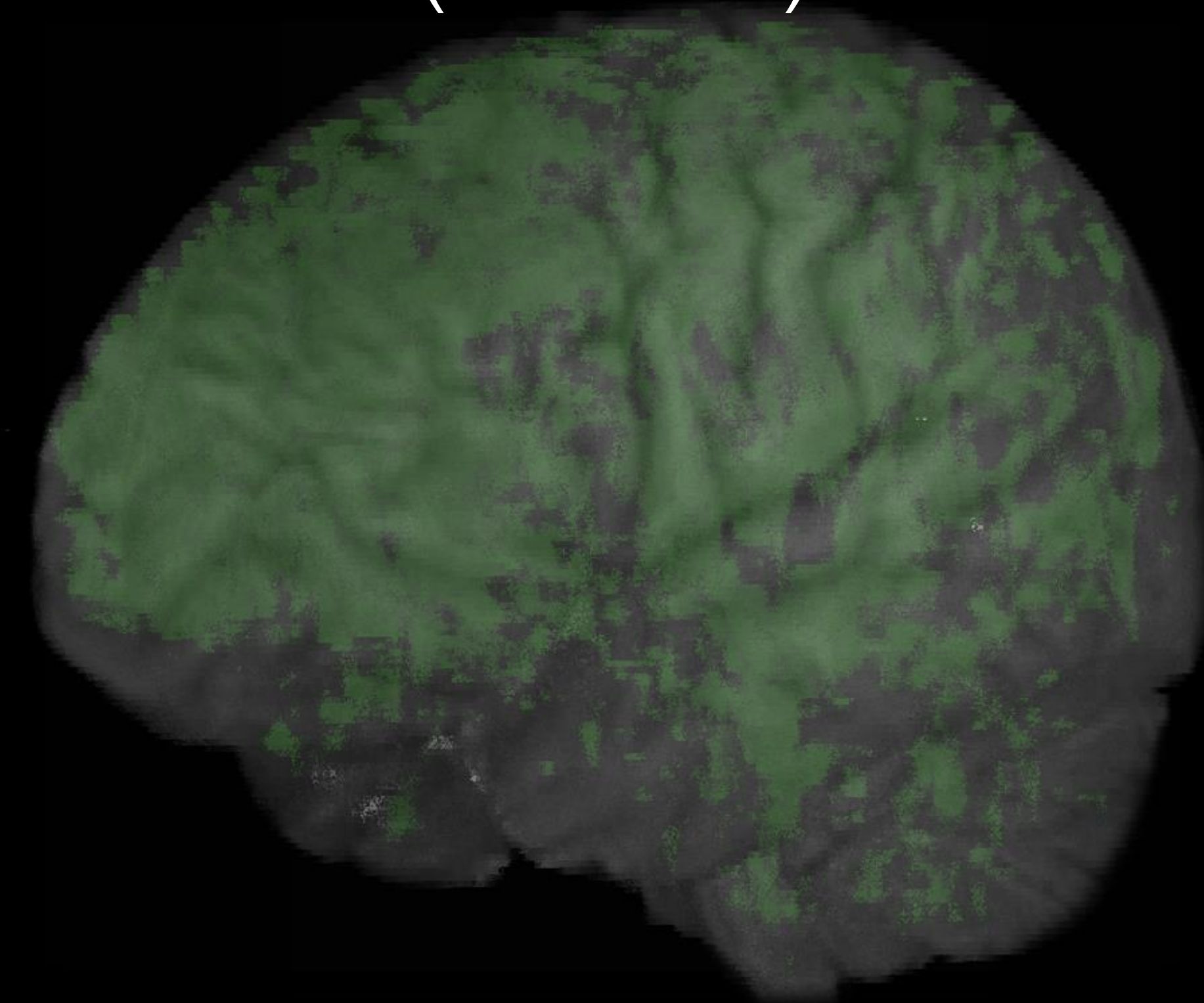


# Understanding MRI Modalities

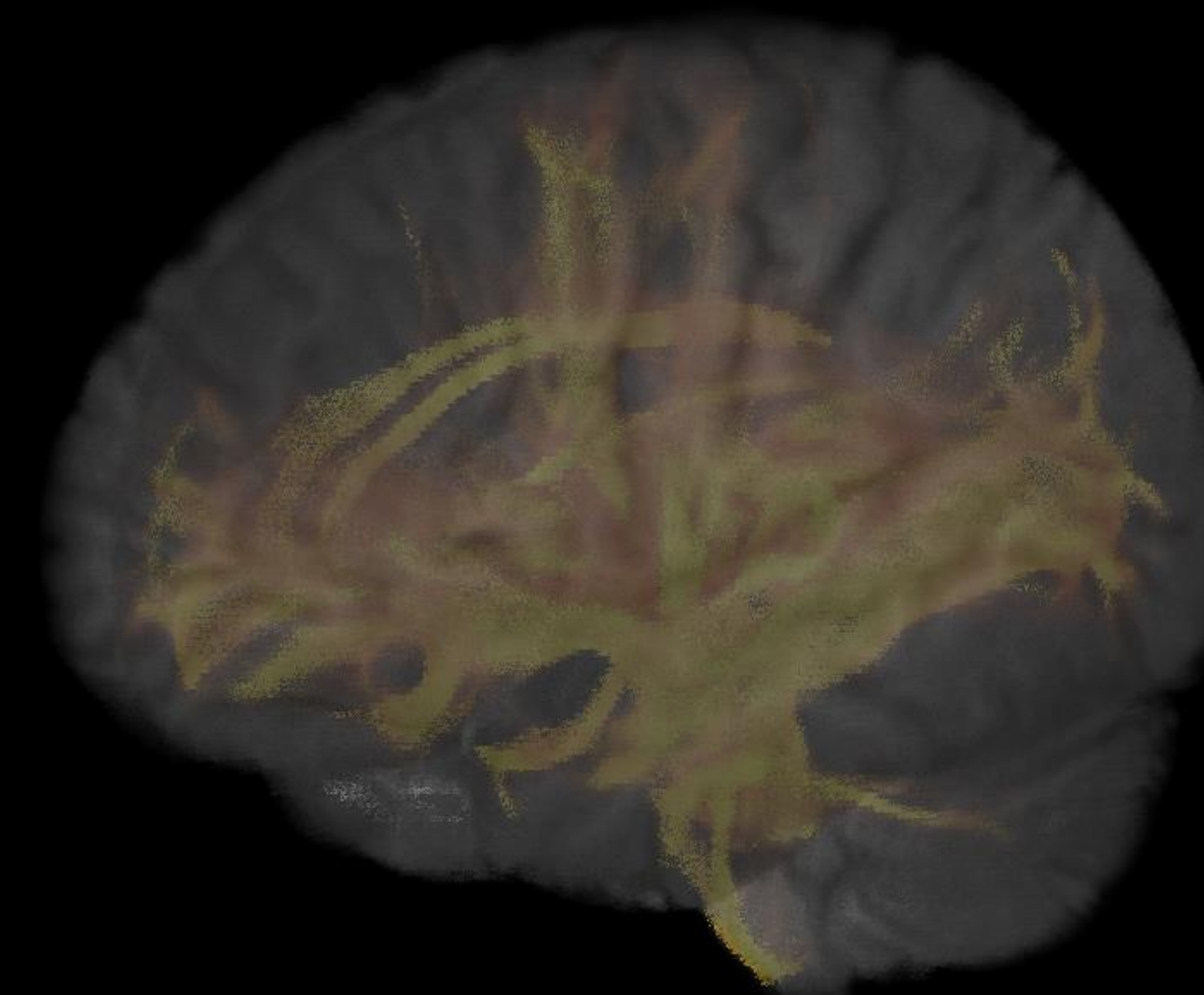
Structural MRI  
(sMRI)



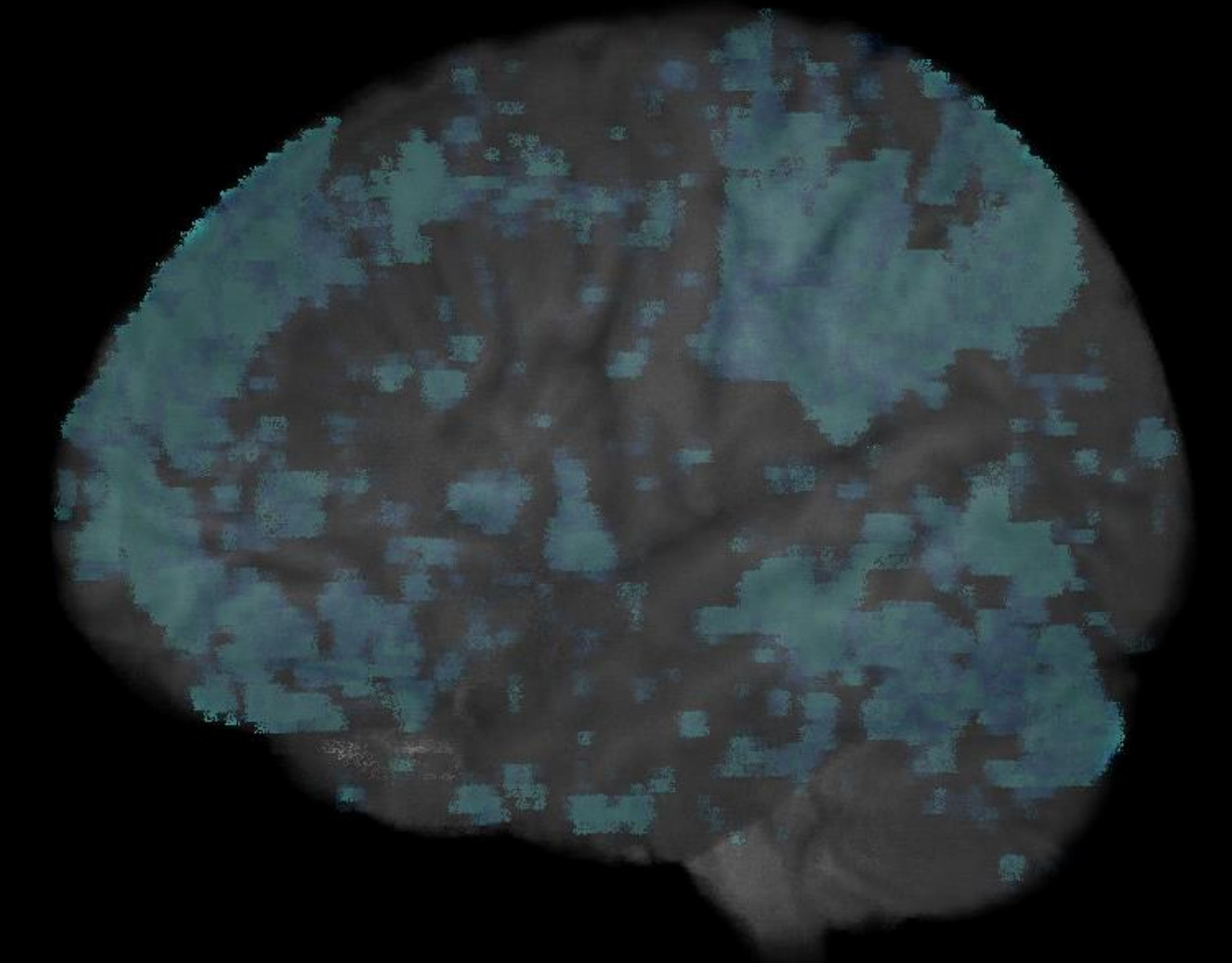
Susceptibility Weighted MRI  
(swMRI)



Diffusion MRI  
(dMRI)



Functional MRI  
(rsfMRI & tfMRI)

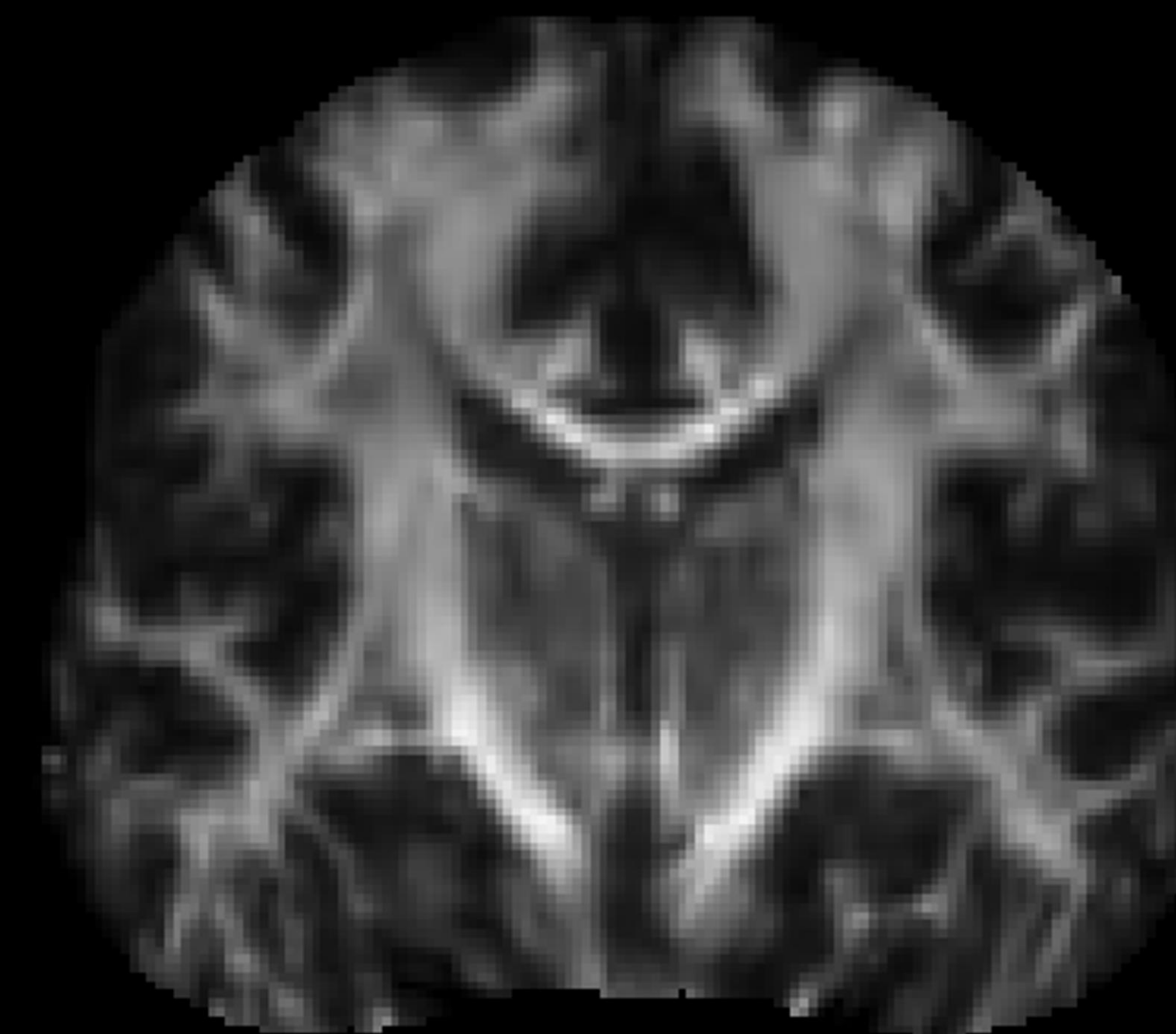


MODALITIES

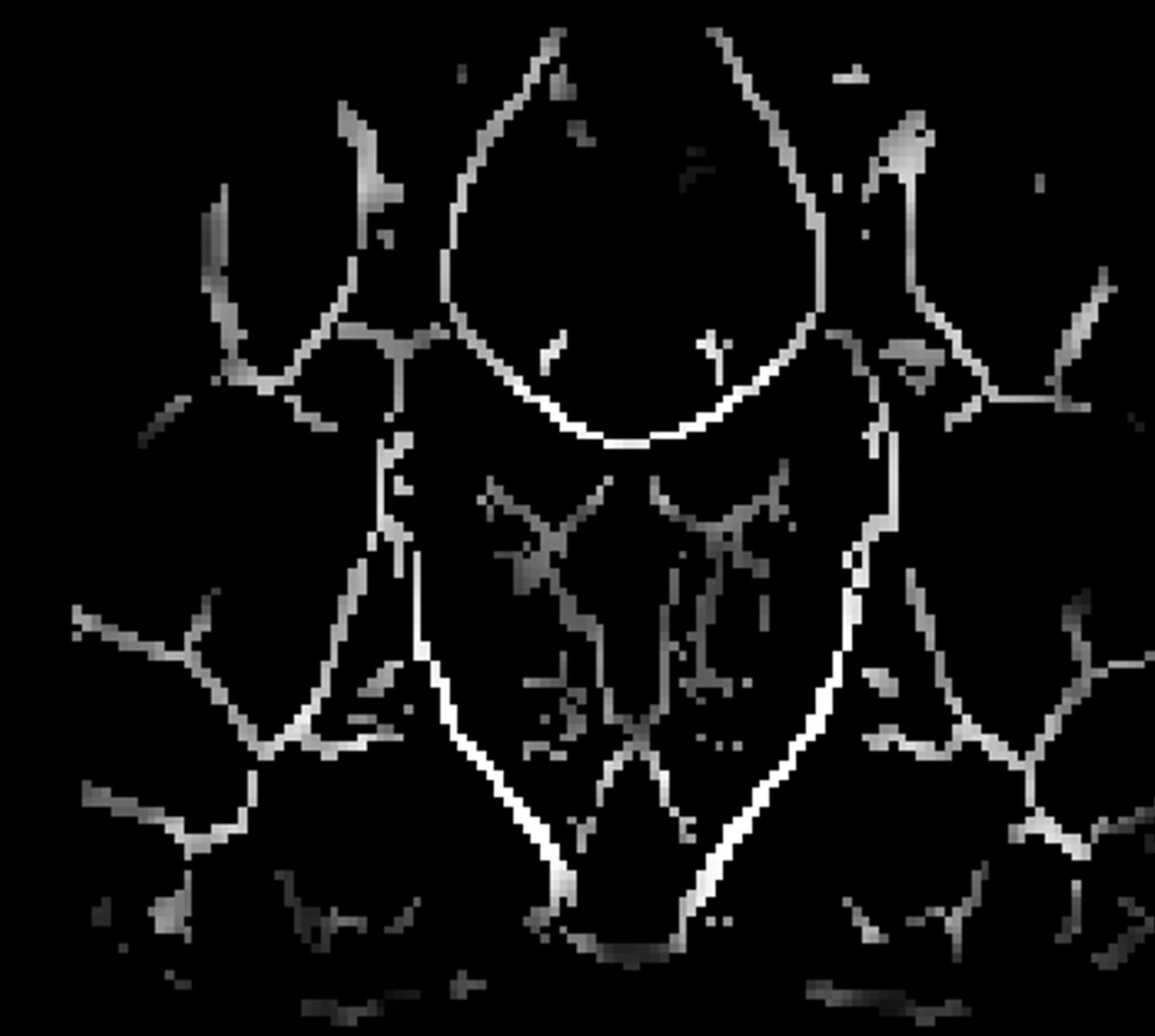
CONTRASTS



*Summed Probabilistic Tracts*



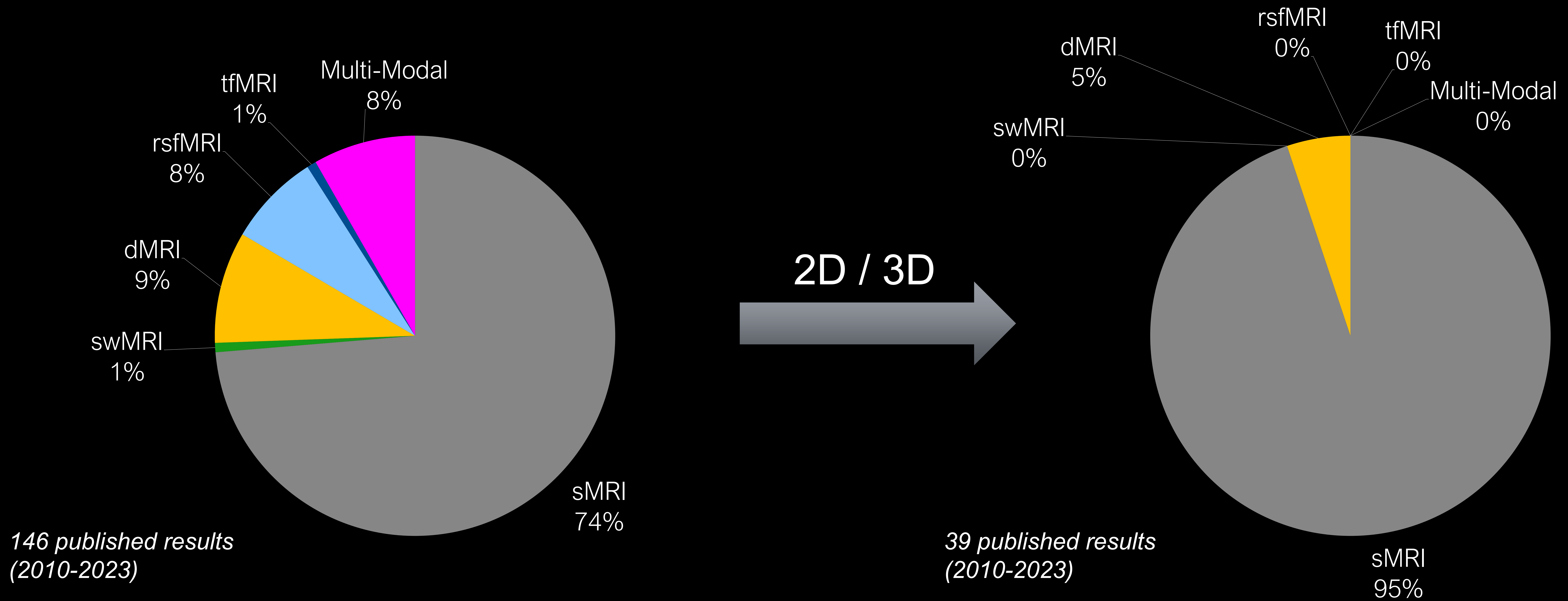
*Fractional Anisotropy (FA)*



*TBSS Skeletonised FA*

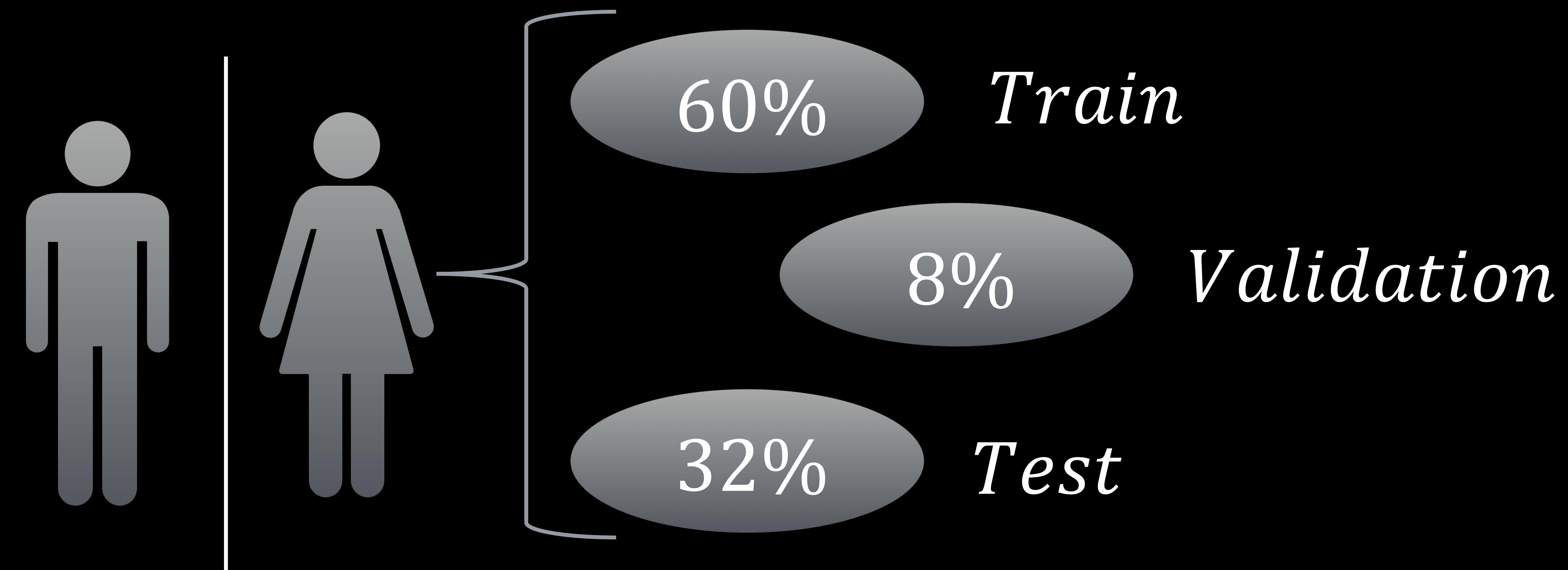


# A Glimpse into the Past: Previous Brain Ageing Studies



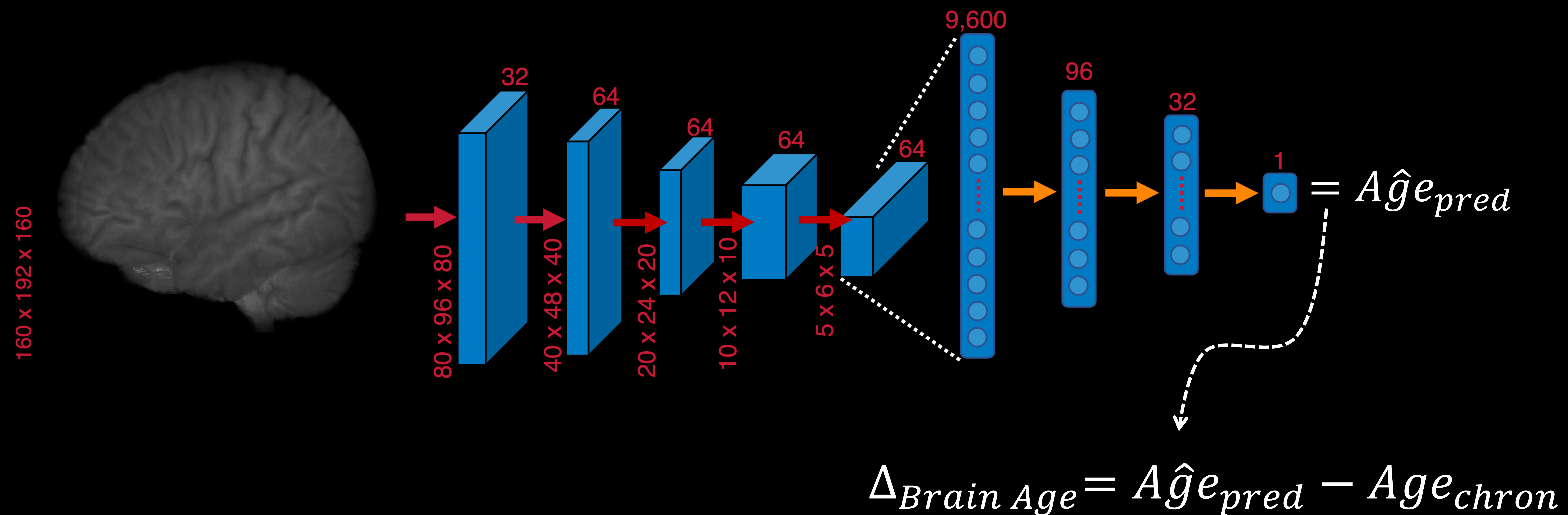


# The Building Blocks: Harnessing Multimodal MRI Data



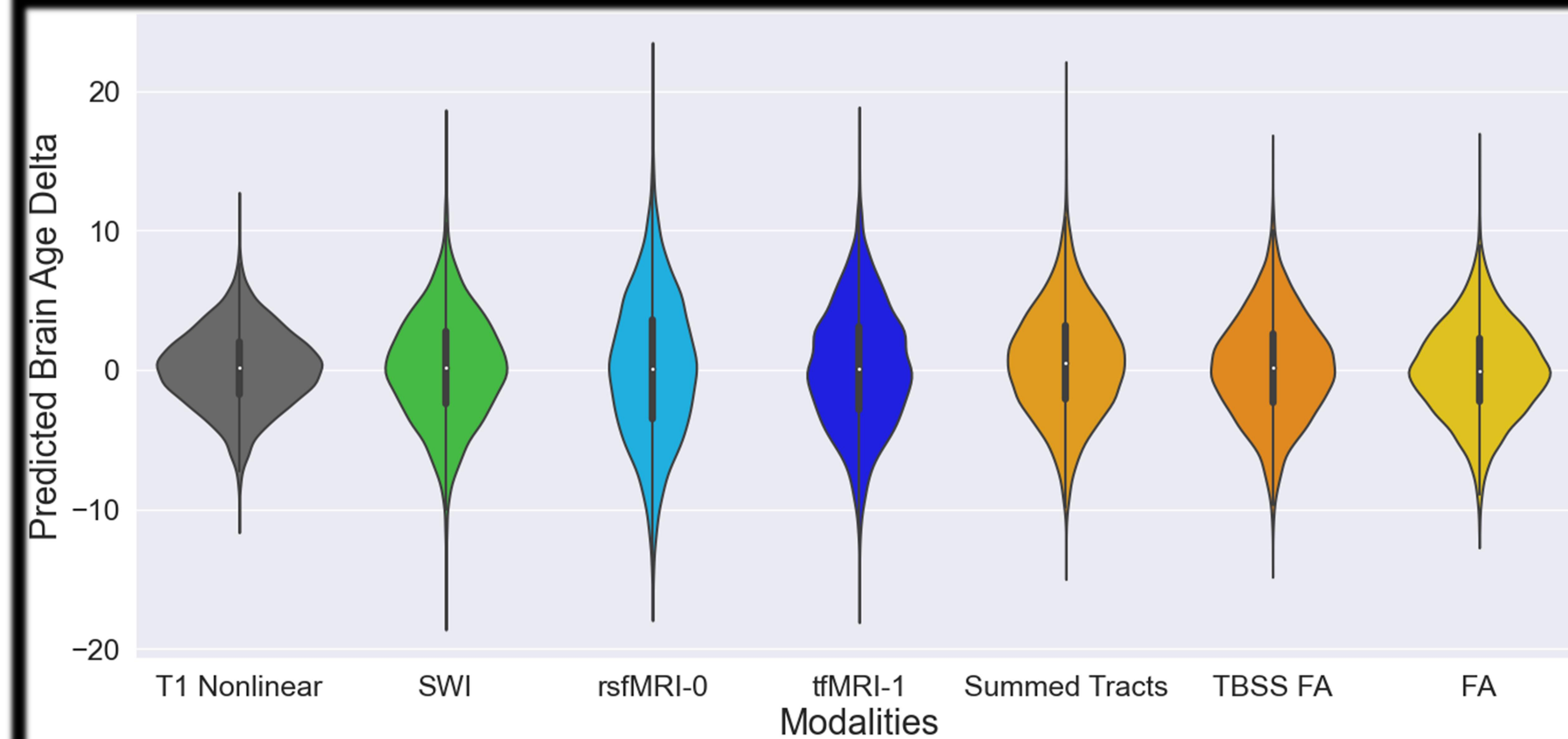
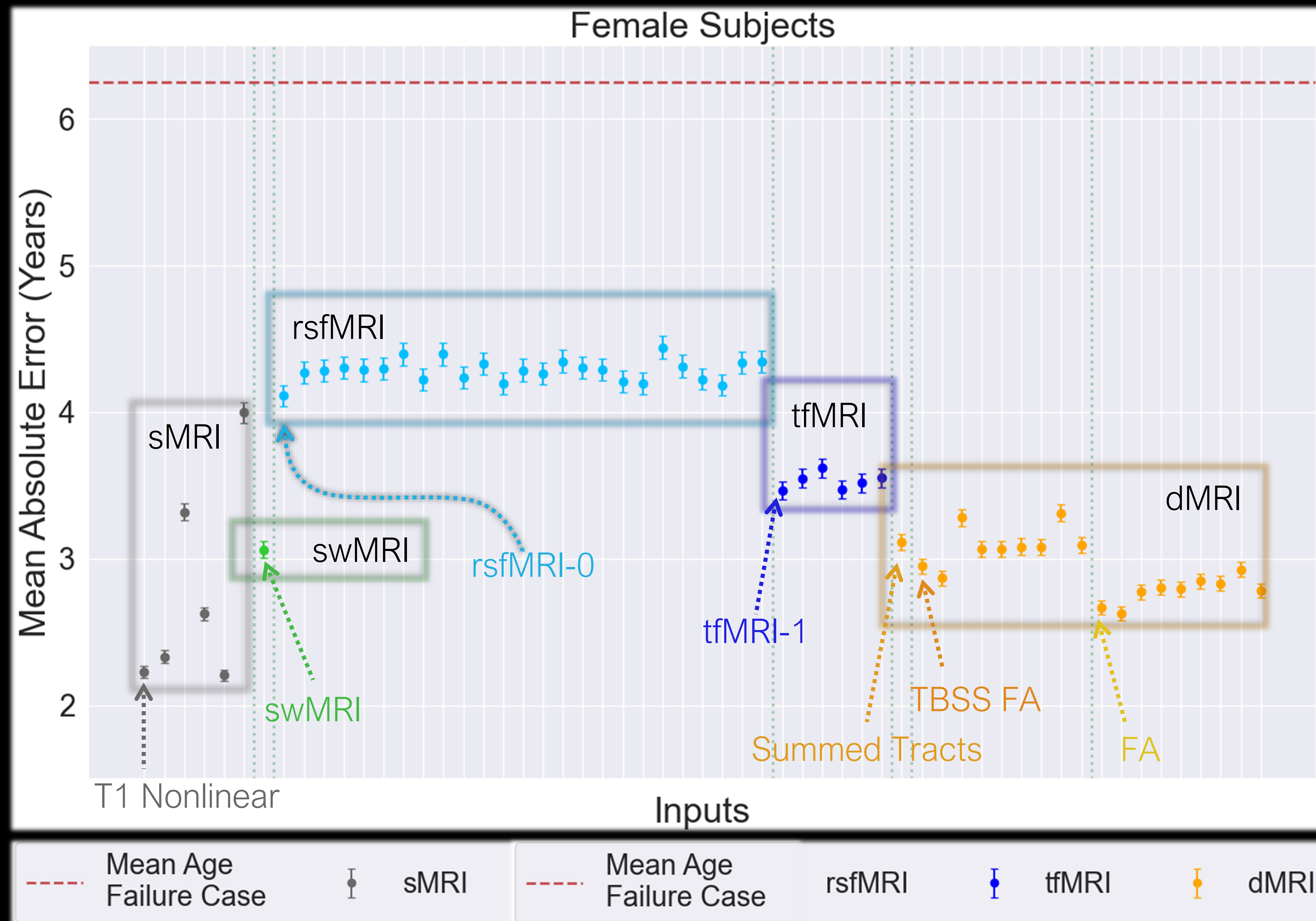


# Advancing Forward: Deep Learning in Brain Ageing Research



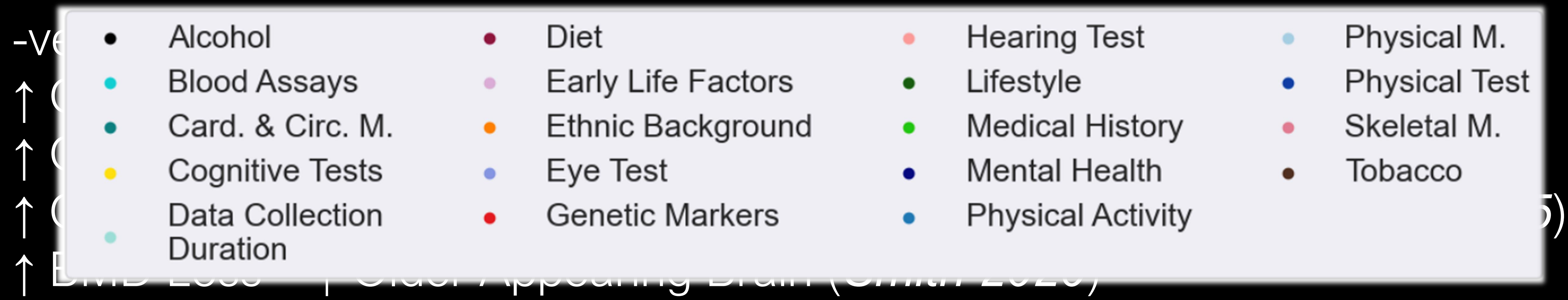
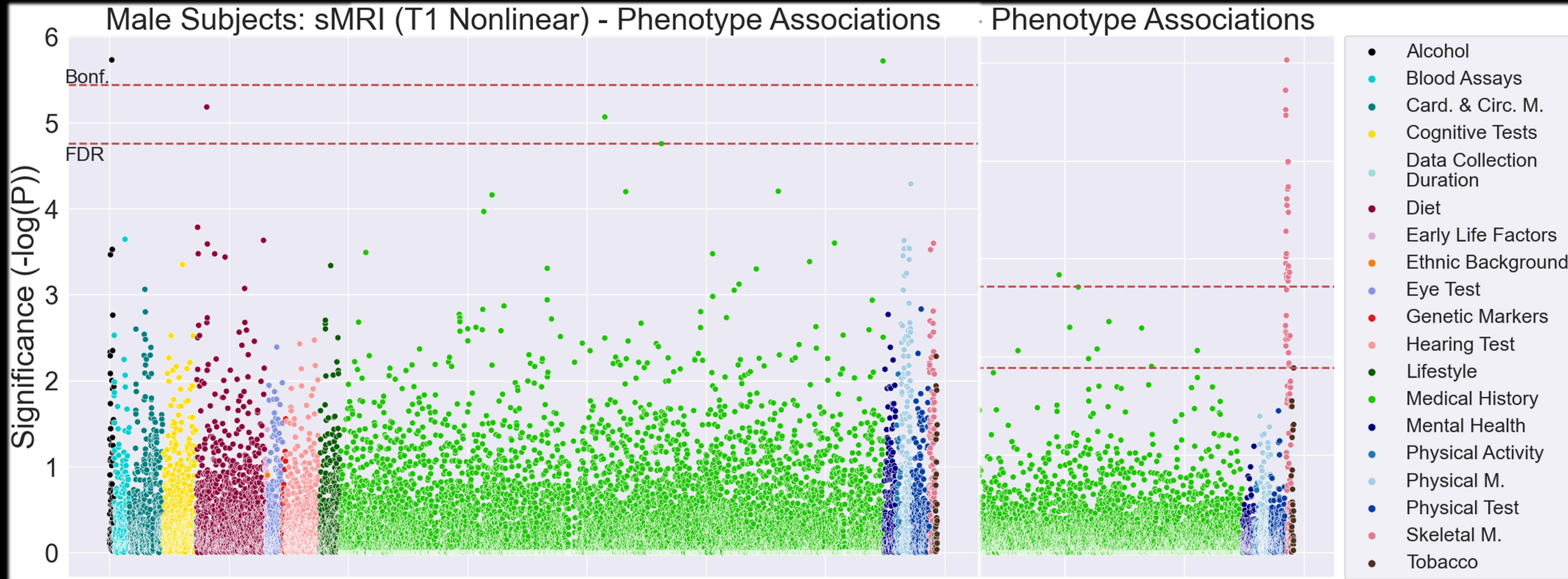


# The Power of 57 Contrasts





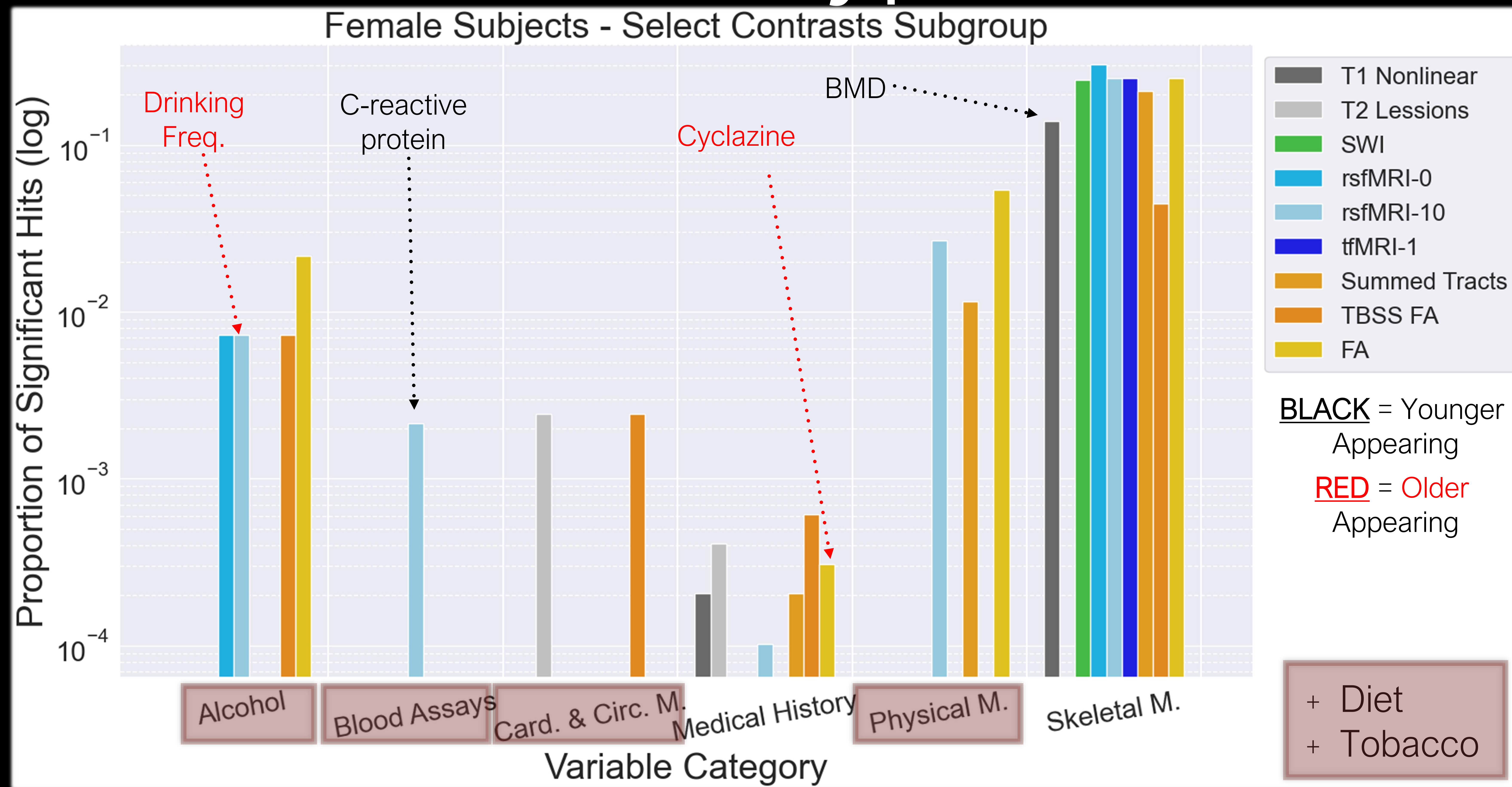
# Connecting with Phenotypes



↑ (1) ↑ (2) ↑ (3) ↑ (4) ↑ (5) ↑ (6) ↑ (7) ↑ (8) ↑ (9) ↑ (10) ↑ (11) ↑ (12) ↑ (13) ↑ (14) ↑ (15) ↑ (16) ↑ (17) ↑ (18) ↑ (19) ↑ (20) ↑ (21) ↑ (22) ↑ (23) ↑ (24) ↑ (25) ↑ (26) ↑ (27) ↑ (28) ↑ (29) ↑ (30) ↑ (31) ↑ (32) ↑ (33) ↑ (34) ↑ (35) ↑ (36) ↑ (37) ↑ (38) ↑ (39) ↑ (40) ↑ (41) ↑ (42) ↑ (43) ↑ (44) ↑ (45) ↑ (46) ↑ (47) ↑ (48) ↑ (49) ↑ (50) ↑ (51) ↑ (52) ↑ (53) ↑ (54) ↑ (55) ↑ (56) ↑ (57) ↑ (58) ↑ (59) ↑ (60) ↑ (61) ↑ (62) ↑ (63) ↑ (64) ↑ (65) ↑ (66) ↑ (67) ↑ (68) ↑ (69) ↑ (70) ↑ (71) ↑ (72) ↑ (73) ↑ (74) ↑ (75) ↑ (76) ↑ (77) ↑ (78) ↑ (79) ↑ (80) ↑ (81) ↑ (82) ↑ (83) ↑ (84) ↑ (85) ↑ (86) ↑ (87) ↑ (88) ↑ (89) ↑ (90) ↑ (91) ↑ (92) ↑ (93) ↑ (94) ↑ (95) ↑ (96) ↑ (97) ↑ (98) ↑ (99) ↑ (100)

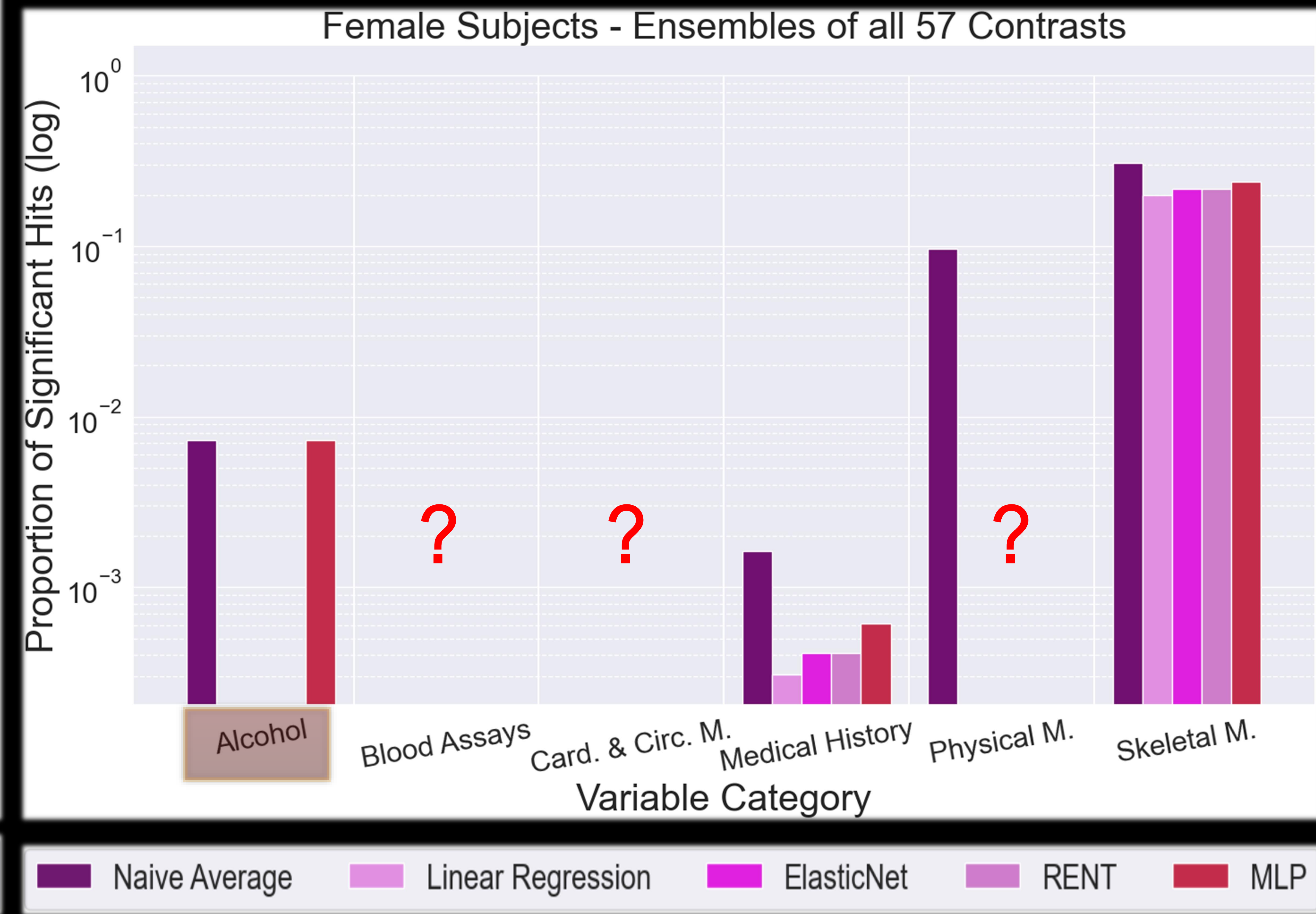
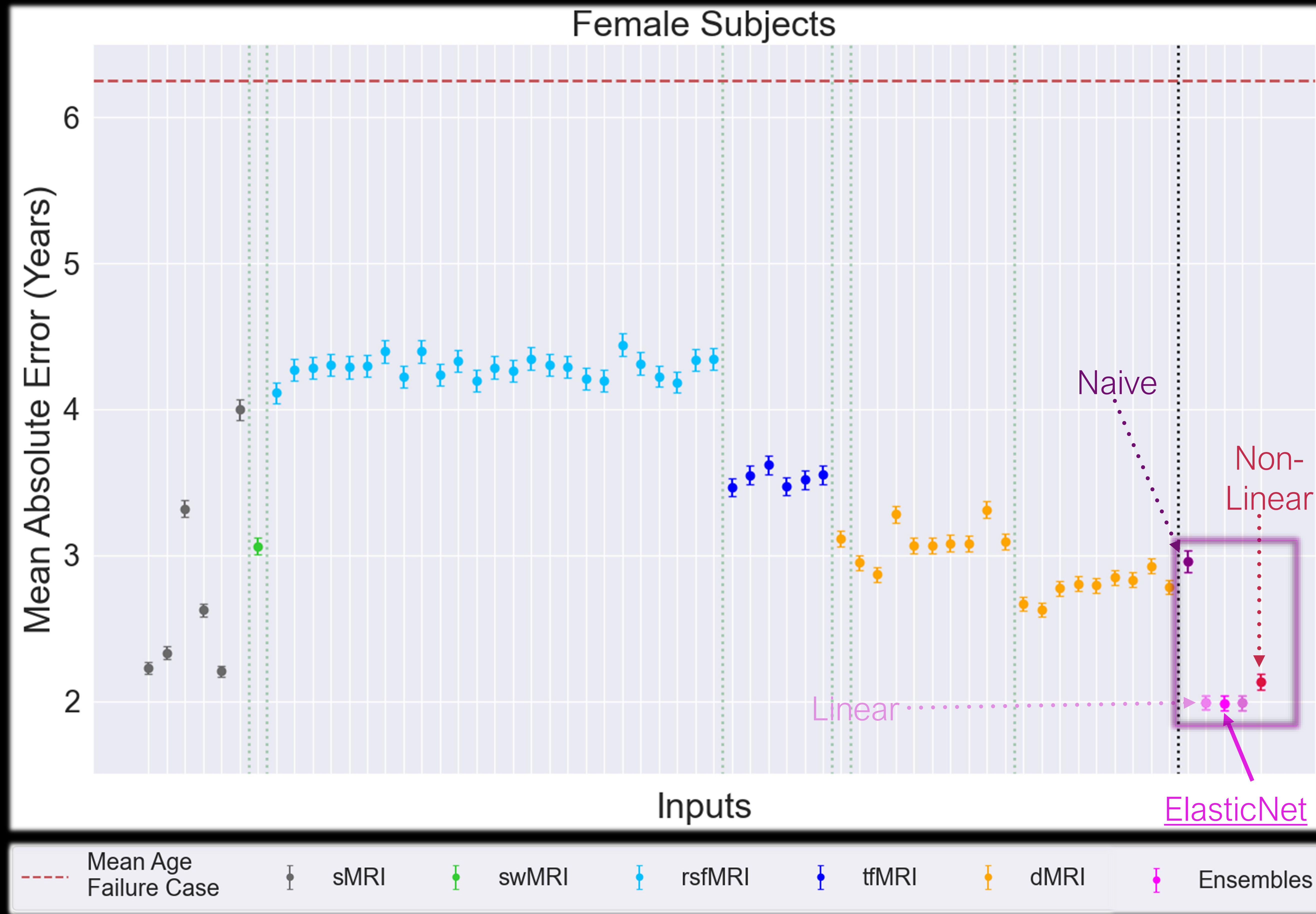


# Connecting with Non-Imaging Phenotypes



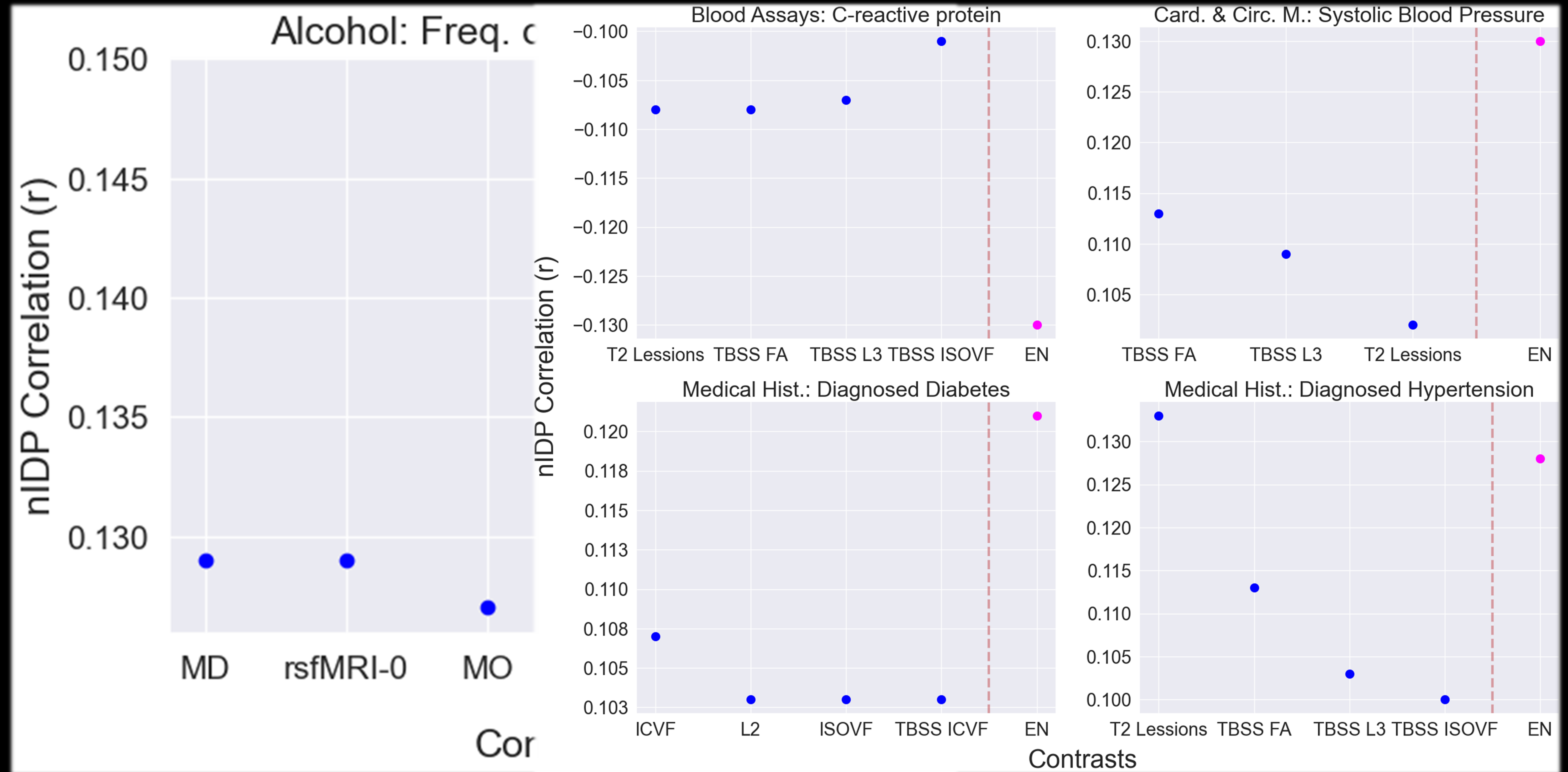


# The Ensemble Effect





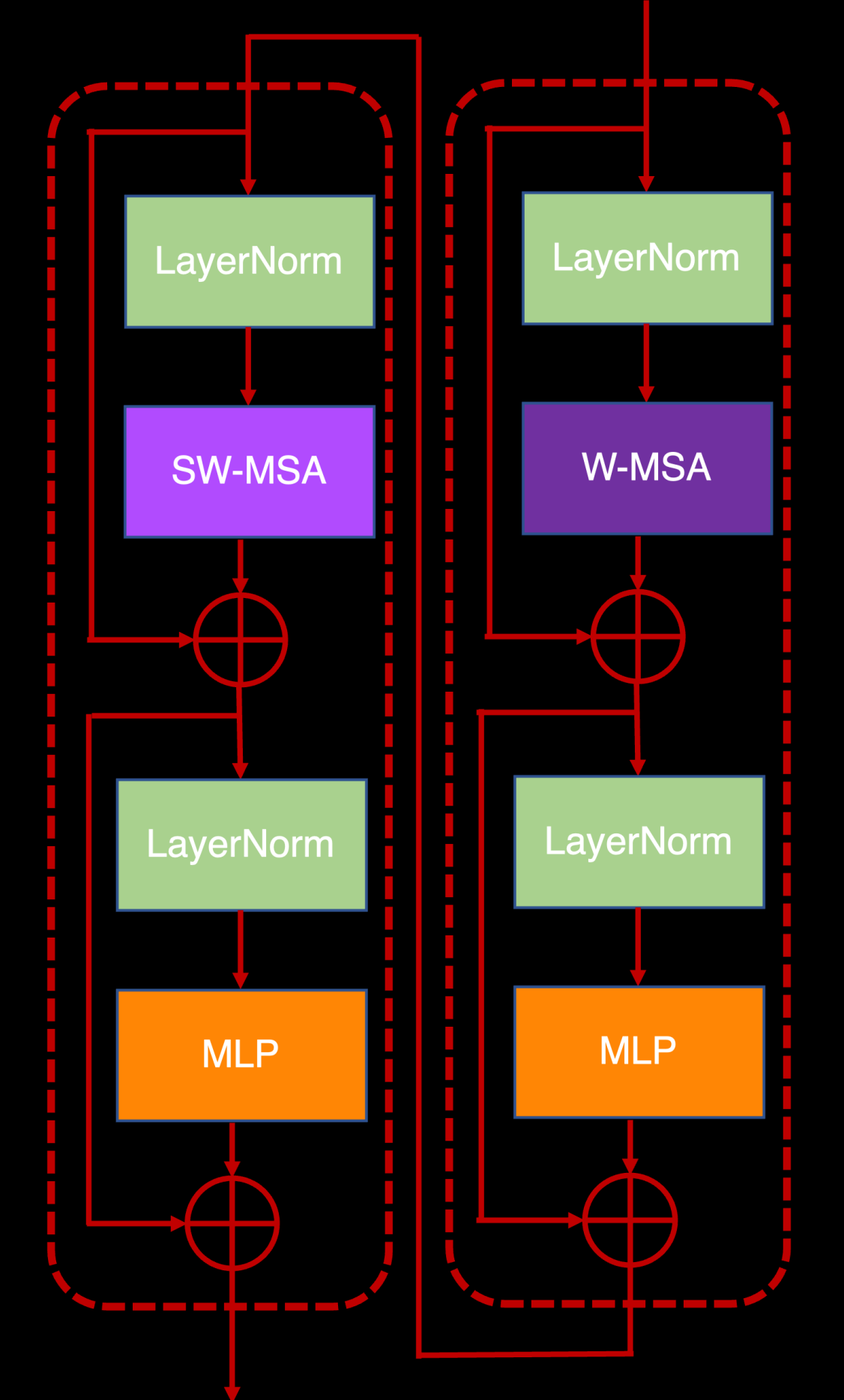
# The Ensemble Effect



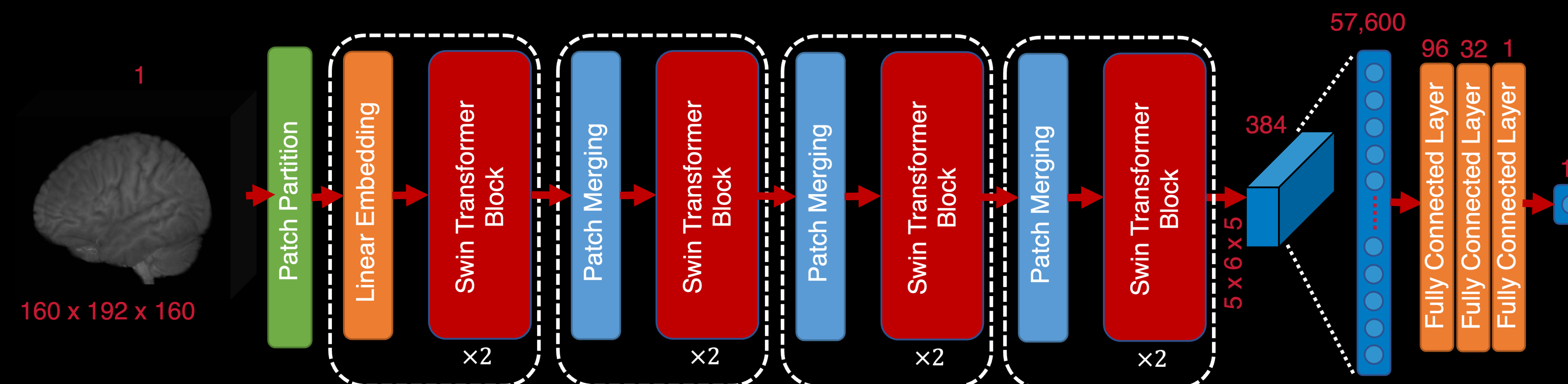


# Pushing the Boundary: Deep Fusion and Swin Transformers

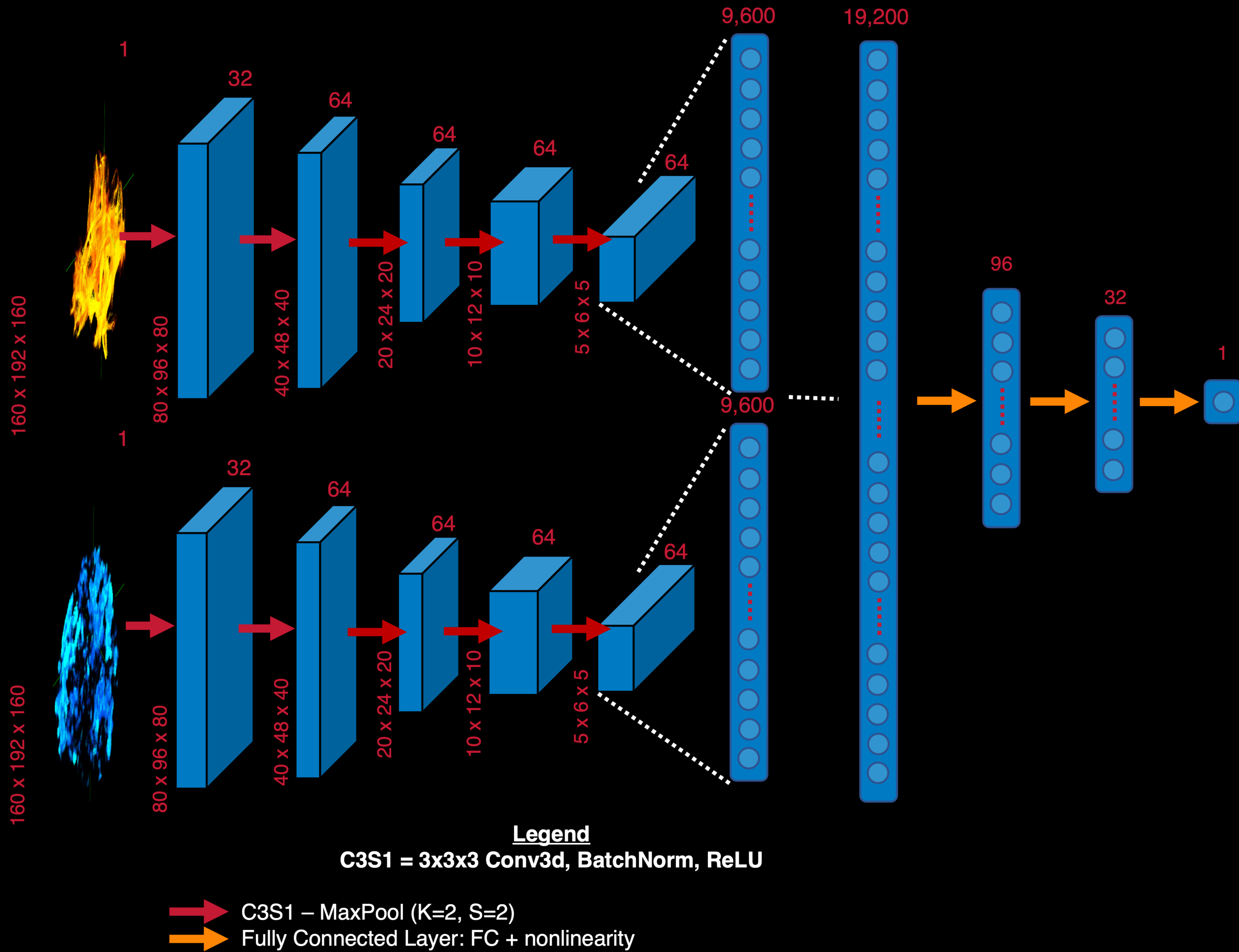
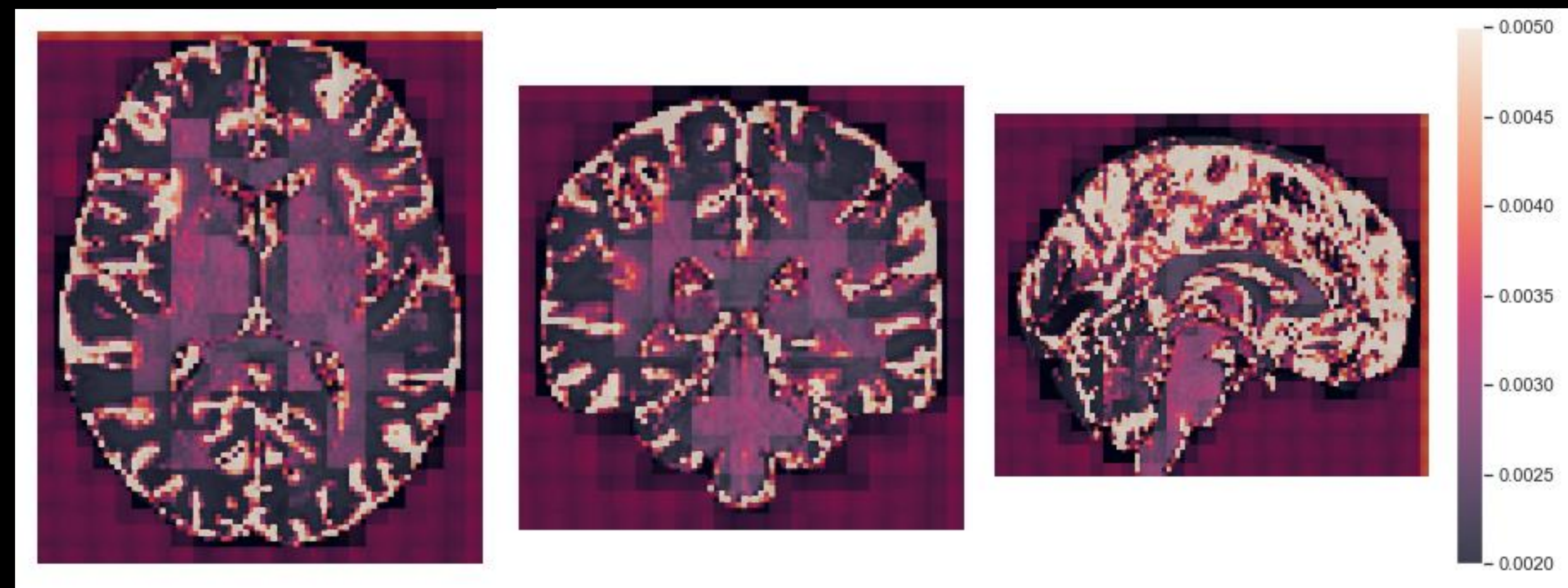
Swin Transformer Block



Swin Architecture



Attention Activations





# Wrapping up the Journey

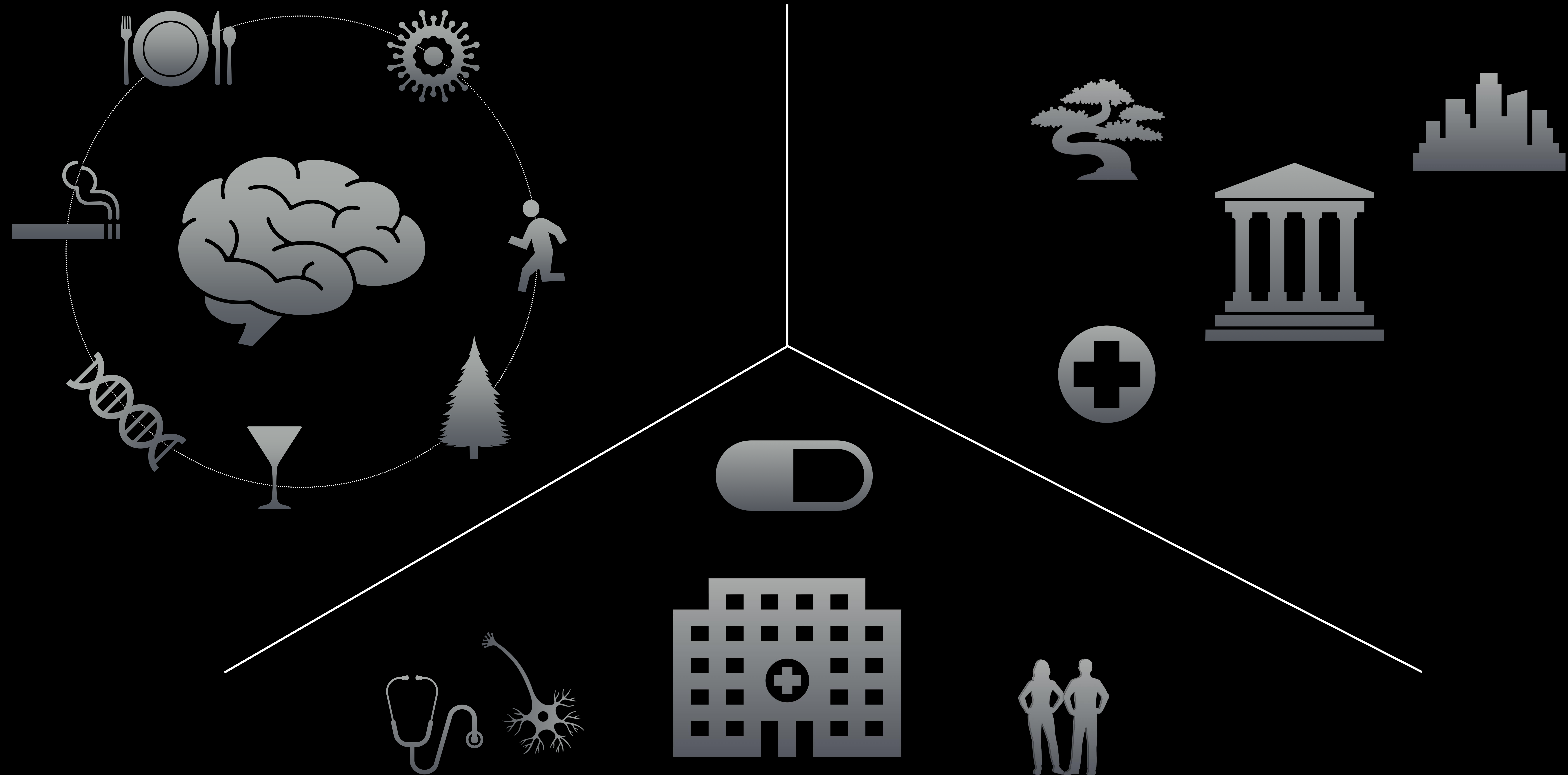
Different MRI contrasts encode bespoke information about the ageing brain

191 statistically significant associations were found between brain age deltas and biomedical phenotypes

Ensembling brain age predictions results in improved predictions and stronger biomedical phenotype correlations



# Shaping the Future of Brain Ageing





# *“It take a village to raise a child researcher”*

Prof Stephen Smith



Dr Frederik Lange



Prof Ana Namburete



Dr Torsten Schindler



Dr Stanisław Adaszewski



Oxford Machine Learning in NeuroImaging Lab



Engineering and Physical Sciences Research Council



# Thank you for your attention!

Any Questions?



Contact Details

Email: [andrei-claudiu.roibu@dtc.ox.ac.uk](mailto:andrei-claudiu.roibu@dtc.ox.ac.uk)

LinkedIn: [linkedin.com/in/andreiroibu](https://www.linkedin.com/in/andreiroibu)



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