Project Details	
Project Code	NMH27Ba Walton
Title	Combining epigenetics and neuroimaging to predict mental health traits across child development
Research Theme	Neuroscience & Mental Health
Project Type	Dry lab
Summary	Epigenetic and structural brain alterations have been separately linked to neurodevelopmental and psychiatric conditions, but little is known about their combined impact on health and how this association changes from infancy to adulthood. The student will lead a set of multi-cohort studies within the international MIND consortium to systematically characterize associations between epigenetic patterns, structural brain variation and mental health outcomes across development.
Description	Background Many brain-associated disorders have a developmental origin (Solmi et al., 2022). Finding biological markers that can help predict risk for poor mental health early on is needed to inform translatable risk prediction and early intervention efforts. Two systems have emerged that could harbour such predictive biological markers: epigenetics and brain imaging, with promising findings emerging that suggest epigenetic or brain scores (e.g. for age acceleration, inflammation, cognition) could associate with neurodevelopmental conditions such as anxiety, depression and ADHD (Walton et al., 2023, Schuurmans et al., 2026). However, so far results have been typically based on single, cross-sectional studies with small sample sizes (n<100) – which raises issues of statistical power, low reproducibility and unclear direction of effects. Furthermore, mental health studies have also almost exclusively focussed on either epigenetics (e.g., DNA methylation) or brain imaging as predictors, but not both. This project is uniquely embedded within the global MIND consortium, which aims to shed light on the relationship between DNA methylation patterns, brain structure and mental health across development. We have previously characterised the developmental links between DNA methylation and brain traits (Staginnus et al., 2026) - this PhD project will take our previous work to the next level by including mental health phenotypes. Originality: The student will work with the MIND consortium (co-led by the supervisors), which comprises a global set of researchers and datasets (sample n>5000), including groups from the USA, UK, South Africa, Finland, Brazil, the Netherlands and more (Schuurmans et al., 2026). The MIND consortium was specifically established to advance the new field of Neuroimaging Epigenetics by (i) promoting collaborative science via multi-cohort analyses; (ii) increasing scientific rigor through data harmonization and the establishment of shared practices; and (iii) elucidating directionality of associations between methylation, brain and mental health via the use of prospective, longitudinal studies across development. Approach: The student will combine information on DNA methylation (e.g. methylation profile scores for age or inflammation) with neuroimaging phenotypes (e.g. brain age, brain structure) to predict a

	range of health outcomes (e.g., anxiety, depression, ADHD). Cohorts span pregnancy to adulthood. Through a meta-analytic approach, they will then pool results from individual studies to describe changing associations across development. Project Objectives: Assess which epigenetic and brain imaging scores are most predictive of anxiety, depression and ADHD Assess whether combining epigenetic and brain imaging scores in one model can improve mental health risk prediction Assess whether the strength of associations change throughout development Student Ownership: This project offers a wide scope for intellectual and methodological ownership. The student will have flexibility in shaping the direction of the analyses based on their interests and is encouraged to explore their own ideas in pursuing each of the objectives. E.g., they can: a) choose between various epigenetic and neuroimaging scores (e.g., scores for age, inflammation, cognition) b) select which developmental time points to focus on (e.g., neonatal, childhood, adolescence). d) explore suitable ways to analyse longitudinal trends. While the core objectives provide a structured framework, the student is encouraged to propose new research questions, develop independent hypotheses, and pursue follow-up analyses based on initial findings. There is also the opportunity to contribute to other publications in the team, attend international conferences, and engage with our international collaborators (e.g., at Erasmus MC in the Netherlands). Feasibility: The project relies on data that has already been collected, measures that are largely already derived and a network that is already set up.
Can be completed part time?	No
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