

1 An interactive meta-analysis of MRI biomarkers of myelin

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11 Summary

12 In this work, we explore important aspect of quantitative magnetic resonance imaging (qMRI):
13 validation ([Cohen-Adad, 2018](#)). Focusing specifically on myelin measures, we show the results
14 of our meta-analysis comparing quantitative MRI with histology.

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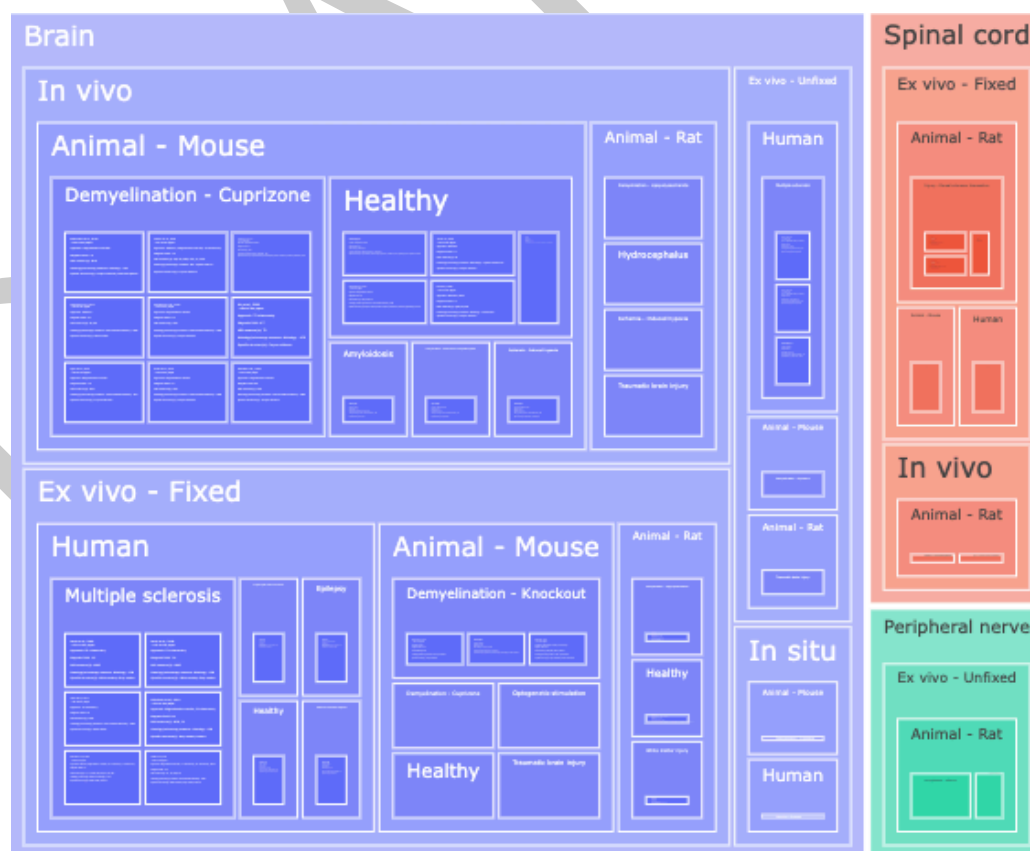


Figure 1: Treemap chart of the studies considered for the meta-analysis, organized by MRI measure. The color of each box represents the reported R2 value while the size box is proportional to the sample size.

15 **Why myelin?:** Myelin is a key component of the central nervous system. The myelin sheaths
16 insulate axons with a triple effect: allowing fast electrical conduction, protecting the axon,
17 and providing trophic support. The conduction velocity regulation has become an important
18 research topic, with evidence of activity-dependent myelination as an additional mechanism
19 of plasticity. Myelin is also relevant from a clinical perspective, given that demyelination is
20 often observed in several neurological diseases such as multiple sclerosis.

21 **How qMRI measures validated?:** Similarly to other qMRI biomarkers, MRI-based myelin
22 measurements are noisy, indirect, and might be affected by other microstructural features.
23 Assessing the accuracy of such measurements, as well as their sensitivity to change, is essential
24 for their translation into clinical practice. That is why histological validation is necessary. The
25 most common validation approach is based on acquiring MR data from in vivo or ex vivo
26 tissue and then comparing those data with the related samples analysed using histological
27 techniques.

28 **Why meta analysis?:** So far, a long list of studies have looked at MRI-histology comparisons,
29 each of them focusing on a specific pathology and a few MRI measures. Despite these
30 numerous studies, there is still an ongoing debate on what MRI measure should be used to
31 quantify myelin and as a consequence there is a constant methodological effort to propose
32 new measures. We believe that this debate would benefit from a quantitative analysis of all
33 the findings published so far, specifically addressing inter-study variations and prospects for
34 future studies, something that is currently missing from the literature.

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38 References

39 Cohen-Adad, J. (2018). Microstructural imaging in the spinal cord and validation strategies.
40 *NeuroImage*, 182, 169–183. <https://doi.org/10.1016/j.neuroimage.2018.04.009>