

# The Brain Functional Neural Organisation of Apathy and Depression in Amyotrophic Lateral Sclerosis: A Connectome-Based Study

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**Disclosure:** Canu and Basaia have received research support for the present manuscript from the Italian Ministry of Health (IMH). Verde is an Associate Editor for the Journal of Alzheimer's Disease. Poletti has received compensation from Liquidweb S.r.l.; and is an Associate Editor for Frontiers in Neuroscience. Silani has received compensation from AveXis (now acquired by Novartis), Cytokinetics, Italfarmaco, Liquidweb S.r.l., Novartis Pharma AG, Amylyx Pharmaceuticals, Biogen, and Zambon Biotech SA; support from IMH, AriSLA, and E-Rare Joint Transnational Call (JTC); and is on the Editorial Board for ALS/FTD, European Neurology, American Journal of Neurodegenerative Diseases (AJND), Frontiers in Neurology, and Exploration of Neuroprotective Therapy.

This study received support from the European Research Council (ERC; StG-2016\_714388\_NeuroTRACK) and Next Generation EU, in the context of the National Recovery and Resilience Plan, Investment PE8 - Project Age-It: "Ageing Well in an Ageing Society." Agosta has received speaker

honoraria from Biogen Idec, Roche, Eli Lilly, and GE Healthcare; and research support from IMH, Italian Ministry of University and Research (IMUR), AriSLA, ERC, EU Joint Programme - Neurodegenerative Disease Research (JPND), and Foundation Research on AD (France). Filippi has received research support from Biogen Idec, Merck-Serono, Novartis, Roche, IMH, IMUR, and Fondazione Italiana Sclerosi Multipla; compensation from Alexion, Almirall, Bayer, Biogen, Celgene, Chiesi Italia SpA, Eli Lilly, Genzyme, Janssen, Merck-Serono, Neopharmed Gentili, Novartis, Novo Nordisk, Roche, Sanofi Takeda, and TEVA; payment for speaking activities from Bayer, Biogen, Celgene, Chiesi Italia SpA, Eli Lilly, Genzyme, Janssen, Merck-Serono, Neopharmed Gentili, Novartis, Novo Nordisk, Roche, Sanofi, Takeda, and TEVA; payment for scientific direction of events for Biogen, Merck, Roche, Celgene, Bristol-Myers Squibb, Lilly, Novartis, and Sanofi-Genzyme; serves on Advisory Boards for Alexion, Biogen, Bristol-Myers Squibb, Merck, Novartis, Roche, Sanofi, Sanofi-Aventis, Sanofi-Genzyme, and Takeda; is the Editor-in-Chief of the Journal of Neurology; and is an Associate Editor of Human Brain Mapping, Neurological Sciences, and Radiology. The other authors have declared no conflicts of interest.

**Keywords:** Amyotrophic lateral sclerosis (ALS), apathy, depression, functional connectivity, graph analysis.

**Citation:** EMJ Neurol. 2025;13[1]:47-48.  
<https://doi.org/10.33590/emjneuro/QNBF5153>

## BACKGROUND AND AIMS

Apathy and depression are the most prevalent neuropsychiatric symptoms in amyotrophic lateral sclerosis (ALS).<sup>1-3</sup> Although insufficiently investigated, their distinction holds important clinical relevance for the accurate diagnosis of ALS with behavioural impairment,<sup>4</sup> and for patients' prognosis and management.<sup>2</sup> In the present study, the authors aimed to assess both apathy and depressive symptoms in patients with ALS, and whether they have similar or different functional neural correlates.

## METHODS

Using graph analysis and connectomics, global and lobar nodal properties, as well as regional functional brain connectivity, were assessed in patients with ALS without apathy/depression (ALSn; n=42), with apathy and without depression (ALSa; n=14), with depressive symptoms and without apathy (ALSd; n=20), and those with both apathy and depressive symptoms (ALSad; n=6), as well as 46 healthy controls. Correlations between brain functional properties, apathy, and depressive symptoms were performed in all patients.

## RESULTS

Depressive symptoms were related with reduced path length within the bilateral basal ganglia (BG) network, while apathy was related with increased path length, decreased nodal strength, and local efficiency within the left BG network. Patients in the ALSa group showed altered functional nodal properties within the BG network compared to the ALSn and ALSd groups. Compared to healthy controls and all patients who were non-apathetic (ALSn and ALSd), all patients who were apathetic (ALSa and ALSad) exhibited altered functional nodal properties within parietal, occipital, and frontal networks. Patients who were non-apathetic showed

relatively preserved functional nodal properties in the BG network compared to those who were apathetic.

## CONCLUSION

The author's findings indicate differences in brain functional neural organisation associated with apathy and depression, underscoring the importance of distinguishing these symptoms in ALS and highlighting the need for targeted interventions.<sup>5</sup>

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