

# BRAIN

A JOURNAL OF NEUROLOGY



**Cover image:** *Flaming June* (1895) by Frederic Leighton depicts a woman in slumber. Some have suggested that the (toxic) oleander branch to the top right might symbolize the fragile connection between sleep and death. There are several papers covering the topic of sleep in this issue of *Brain* including the Essay by Matthew Walker, which discusses why sleep is essential. Pp. 697–699. Public domain, via Wikimedia Commons.

## Contents

### Editorial

#### Sleep and neurodegenerative diseases

M. Husain  
695

### Essay

#### Sleep essentialism

M. P. Walker  
697

### Scientific Commentaries

#### A step forward in understanding the role of sleep and its link to neurodegeneration

A. Stefani and B. Högl  
700

#### DBS for refractory epilepsy: is closed-loop stimulation of the medial septum the way forward?

V. Magloire and G. Lignani  
702

#### Co-pathologies in Alzheimer's disease: just multiple pathologies or partners in crime?

S. O. Tomé and D. R. Thal  
706

#### Progression in Parkinson's disease: a potpourri of plots and probabilities

C. Le Heron, D. Myall and T. Anderson  
708

## Review Articles

### Deep brain stimulation of the brainstem

G. J. B. Elias, A. Loh, D. Gwun, A. Pancholi, A. Boutet, C. Neudorfer, J. Germann, A. Namasivayam, R. Gramer, M. Paff and A. M. Lozano  
712

### Glial cells and adaptive immunity in frontotemporal dementia with tau pathology

I. J. Hartnell, D. Blum, J. A. R. Nicoll, G. Dorothee and D. Boche

724

### Depression, dementia and immune dysregulation

S. Hayley, A. M. Hakim and P. R. Albert

746

## Reports

### Neurofilament light predicts neurological outcome after subarachnoid haemorrhage

P. Garland, M. Morton, A. Zolnourian, A. Durnford, B. Gaastra, J. Toombs, A. J. Heslegrave, J. More, H. Zetterberg, D. O. Bulters and I. Galea  
761

### Bi-allelic variants in HOPS complex subunit VPS41 cause cerebellar ataxia and abnormal membrane trafficking

L. E. Sanderson, K. Lanko, M. Alsagob, R. Almass, N. Al-Ahmadi, M. Najafi, M. A. Al-Muhaizea, H. Alzaidan, H. AlDhalaan, E. Perenthaler, H. C. van der Linde, A. Nikoncuk, N. A. Kühn, D. Antony, T. M. Owaidah, S. Raskin, L. G. D. R. Vieira, R. Mombach, N. Ahangari, T. R. D. Silveira, N. Ameziane, A. Rolfs, A. Alharbi, R. M. Sabagh, K. AlAhmadi, B. Alawam, H. Ghebeh, A. AlHargan, A. A. Albader, F. S. Binhumaid, E. Goljan, D. Monies, O. M. Mustafa, M. Aldosary, A. AlBakheet, B. Alyounes, F. Almutairi, A. Al-Odaib, D. B. Aksoy, A. N. Basak, R. Palvadeau, D. Trabzuni, J. A. Rosenfeld, E. G. Karimiani, B. F. Meyer, B. Karakas, F. Al-Mohanna, S. T. Aruld, D. Colak, R. Maroofian, H. Houlden, A. M. Bertoli-Avella, M. Schmidts, T. S. Barakat, T. J. van Ham and N. Kaya

769

### Cortical connectivity of the nucleus basalis of Meynert in Parkinson's disease and Lewy body dementias

A. Oswal, J. Gratwick, H. Akram, M. Jahanshahi, L. Zaborszky, P. Brown, M. Hariz, L. Zrinzo, T. Foltyne and V. Litvak  
781

## Clinical Trial

### Randomized trial of granulocyte colony-stimulating factor for spinal cord injury

M. Koda, H. Hanaoka, Y. Fujii, M. Hanawa, Y. Kawasaki, Y. Ozawa, T. Fujiwara, T. Furuya, Y. Iijima, J. Saito, M. Kitamura, T. Miyamoto, S. Ohtori, Y. Matsumoto, T. Abe, H. Takahashi, K. Watanabe, T. Hirano, M. Ohashi, H. Shoji, T. Mizouchi, N. Kawahara, M. Kawaguchi, Y. Orita, T. Sasamoto, M. Yoshioka, M. Fujii, K. Yonezawa, D. Soma, H. Taneichi, D. Takeuchi, S. Inami, H. Moridaira, H. Ueda, F. Asano, Y. Shibao, I. Aita, Y. Takeuchi, M. Mimura, J. Shimbo, Y. Someya, S. Ikenoue, H. Sameda, K. Takase, Y. Ikeda, F. Nakajima, M. Hashimoto, F. Hasue, T. Fujiyoshi, K. Kamiya, M. Watanabe, H. Katoh, Y. Matsuyama, T. Hasegawa, G. Yoshida, H. Arima, Y. Yamato, S. Oe, D. Togawa, S. Kobayashi, K. Akeda, E. Kawamoto, H. Imai, T. Sakakibara, A. Sudo, Y. Ito, T. Kikuchi, T. Takigawa, T. Morita, N. Tanaka, K. Nakanishi, N. Kamei, S. Kotaka, H. Baba, T. Okudaira, H. Konishi, T. Yamaguchi, K. Ito, Y. Katayama, T. Matsumoto, T. Matsumoto, H. Kanno, T. Aizawa, K. Hashimoto, T. Eto, T. Sugaya, M. Matsuda, K. Fushimi, S. Nozawa, C. Iwai, T. Taguchi, T. Kanchiku, H. Suzuki, N. Nishida, M. Funaba, T. Sakai, Y. Imajo and M. Yamazaki

789

## Original Articles

### Diffuse axonal injury has a characteristic multidimensional MRI signature in the human brain

D. Benjamini, D. Iacono, M. E. Komlosh, D. P. Perl, D. L. Brody and P. J. Basser

800

### Damage to Broca's area does not contribute to long-term speech production outcome after stroke

A. Gajardo-Vidal, D. L. Lorca-Puig, PLORAS team, H. Warner, B. Pshdary, J. T. Crinion, A. P. Leff, T. M. H. Hope, S. Geva, M. L. Seghier, D. W. Green, H. Bowman and C. J. Price

817

### Long-term evolution of multiple sclerosis iron rim lesions in 7 T MRI

A. Dal-Bianco, G. Grabner, C. Kronnerwetter, M. Weber, B. Kornek, G. Kasprian, T. Berger, F. Leutmezer, P. S. Rommer, S. Trattnig, H. Lassmann and S. Hametner

833

### Subclinical anterior optic pathway involvement in early multiple sclerosis and clinically isolated syndromes

M. Pisa, T. Croese, G. Dalla Costa, S. Guerrieri, S. C. Huang, A. Finardi, L. Fabbella, F. Sangalli, B. Colombo, L. Moiola, V. Martinelli, G. Comi, R. Furlan and L. Leocani

848

### Sleep deprivation impairs molecular clearance from the human brain

P. K. Eide, V. Vinje, A. H. Pripp, K.-A. Mardal and G. Ringstad

863

### Repeated traumatic brain injury and risk of epilepsy: a Danish nationwide cohort study

K. Lolk, J. W. Dreier and J. Christensen

875

### Closed-loop stimulation of the medial septum terminates epileptic seizures

Y. Takeuchi, M. Harangozo, L. Pedraza, T. Földi, G. Kozák, Q. Li and A. Berényi

885

### Striatal and cerebellar vesicular acetylcholine transporter expression is disrupted in human DYT1 dystonia

J. Mazere, B. Dilharreguy, G. Catheline, M. Vidailhet, M. Deffains, D. Vimont, B. Ribot, E. Barse, L. Cif, B. Mazoyer, N. Langbour, A. Pisani, M. Allard, F. Lamare, D. Guehl, P. Fernandez and P. Burbaud

909

**Prediction of Alzheimer's disease using multi-variants from a Chinese genome-wide association study**  
L. Jia, F. Li, C. Wei, M. Zhu, Q. Qu, W. Qin, Y. Tang, L. Shen, Y. Wang, L. Shen, H. Li, D. Peng, L. Tan, B. Luo, Q. Guo, M. Tang, Y. Du, J. Zhang, J. Zhang, J. Lyu, Y. Li, A. Zhou, F. Wang, C. Chu, H. Song, L. Wu, X. Zuo, Y. Han, J. Liang, Q. Wang, H. Jin, W. Wang, Y. Lü, F. Li, Y. Zhou, W. Zhang, Z. Liao, Q. Qiu, Y. Li, C. Kong, Y. Li, H. Jiao, J. Lu and J. Jia

**924**

**The interplay of emotional and social conceptual processes during moral reasoning in frontotemporal dementia**  
C. Strikwerda-Brown, S. Ramanan, Z.-L. Goldberg, A. Mothakunnel, J. R. Hodges, R. M. Ahmed, O. Piguet and M. Irish

**938**

**The development and convergence of co-pathologies in Alzheimer's disease**

J. L. Robinson, H. Richardson, S. X. Xie, E. Suh, V. M. Van Deerlin, B. Alfaro, N. Loh, M. Porras-Paniagua, J. J. Nirschl, D. Wolk, V. M.-Y. Lee, E. B. Lee and J. Q. Trojanowski

**953**

**Severe oligomeric tau toxicity can be reversed without long-term sequelae**

A. Martinisi, M. Flach, F. Sprenger, S. Frank, M. Tolnay and D. T. Winkler

**963**

**Sequence of clinical and neurodegeneration events in Parkinson's disease progression**

N. P. Oxtoby, L.-A. Leyland, L. M. Aksman, G. E. C. Thomas, E. L. Bunting, P. A. Wijeratne, A. L. Young, A. Zarkali, M. M. X. Tan, F. D. Bremner, P. A. Keane, H. R. Morris, A. E. Schrag, D. C. Alexander and R. S. Weil

**975**

**Cognitive decline heralds onset of symptomatic inherited prion disease**

J. Mole, S. Mead, P. Rudge, A. Nihat, T. Mok, J. Collinge and D. Caine

**989**

**Psychosis in neurodegenerative disease: differential patterns of hallucination and delusion symptoms**

G. Naasan, S. M. Shdo, E. M. Rodriguez, S. Spina, L. Grinberg, L. Lopez, A. Karydas, W. W. Seeley, B. L. Miller and K. P. Rankin

**999**

**All or nothing belief updating in patients with schizophrenia reduces precision and flexibility of beliefs**

M. R. Nassar, J. A. Waltz, M. A. Albrecht, J. M. Gold and M. J. Frank

**1013**

#### **Letters to the Editor**

**PSAP variants in Parkinson's disease: a large cohort study in Chinese mainland population**

Y.-w. Zhao, H.-x. Pan, Q. Zeng, Z.-h. Fang, Z.-h. Liu, Y. Wang, L. Jiang, R. He, X. Zhou, Y.-j. Zhou, Q. Xu, Q.-y. Sun, B. Li, G. Zhao, Y. Yang, Y.-c. Hu, Y.-s. Chen, J. Du, L.-f. Lei, H.-n. Zhang, C.-y. Wang, X.-x. Yan, L. Shen, H. Jiang, J.-c. Li, B.-s. Tang, J.-q. Tan and J.-f. Guo

**e25**

**Reply: PSAP variants in Parkinson's disease: a large cohort study in Chinese mainland population**

Y. Oji, T. Hatano, M. Funayama and N. Hattori

**e26**

**Two heterozygous progranulin mutations in progressive supranuclear palsy**

W. Yang, B. Deng, Y. Huang, J. Liu, Z. Huang, Z. Chang, S. Zhu, L.-L. Chan, K. R. Chaudhuri, E.-K. Tan and Q. Wang

**e27**

**Reply: Two heterozygous progranulin mutations in progressive supranuclear palsy**

V. Huin, M. Barbier, A. Durr and I. Le Ber

**e28**

**Neurological complications in COVID-19 patients from Latin America**

S. M. D. Brucki, L. A. Corazza, A. P. de Queiroz, M. P. Barros, J. F. S. Tatsch, I. L. Riso, N. A. Batista, G. Manfroi, L. A. Sawada, L. L. R. Batista, M. A. Baldocchi, J. L. de Freitas, M. B. Aidar and M. S. G. Rocha

**e29**

**Defective phosphatidylethanolamine biosynthesis leads to a broad ataxia-spasticity spectrum**

R. Kaiyrzhanov, S. Wortmann, T. Reid, M. Dehghani, M. Y. Vahidi Mehrjardi, B. Alhaddad, M. Wagner, M. Deschauer, I. Cordts, J. P. Fernandez-Murray, V. Treffer, Z. Metanat, A. Pitman, H. Houlden, T. Meitinger, C. Carroll, C. R. McMaster and R. Maroofian

**e30**

**From 'loose fitting' to high-performance, uncertainty-aware brain-age modelling**

T. Hahn, L. Fisch, J. Ernsting, N. R. Winter, R. Leenings, K. Sarink, D. Emden, T. Kircher, K. Berger and U. Dannowski

**e31**

**Reply: From 'loose fitting' to high-performance, uncertainty-aware brain-age modelling**

V. Bashyam, H. Shou and C. Davatzikos

**e32**

**Corrigenda**

**e33**