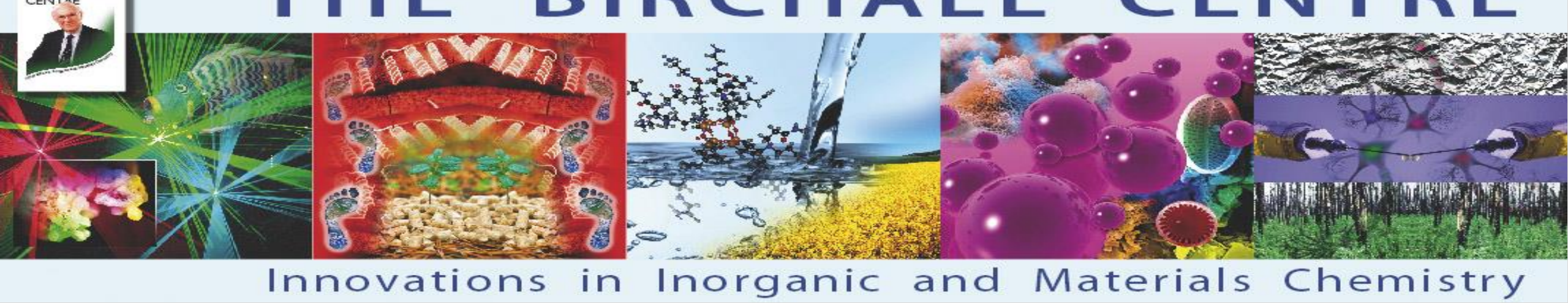

Ageing, Aluminium and Silicon

Christopher Exley PhD FRSB

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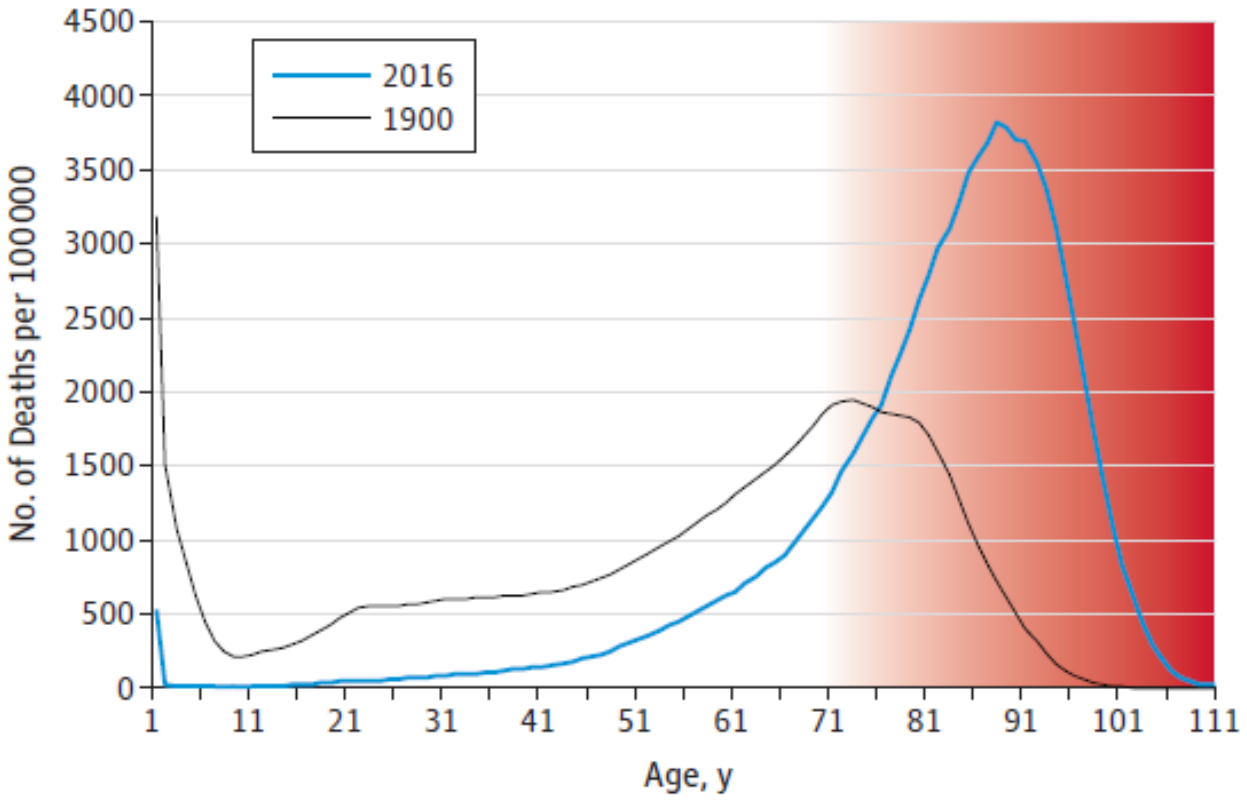
c.exley@keele.ac.uk

http://www.keele.ac.uk/aluminium/

https://www.hippocraticpost.com/?s=Exley

CMSRI

Figure. Age Distribution of Life Table Deaths for Women in the United States, per 100 000 People, 1900 and 2016



The red zone represents a period in life when the risk of frailty and disability begins to increase rapidly. The goal of aging science is to delay and compress the red zone, which may extend healthy life. Sources: 1900 data from Bell and Miller[1]; 2016 data from Human Mortality Database.[2]

Published Online: September 17, 2018.
doi:10.1001/jama.2018.12621

Neurones are the longest-lived cells of the human body and survive aging processes that ravage the remainder of the human body.

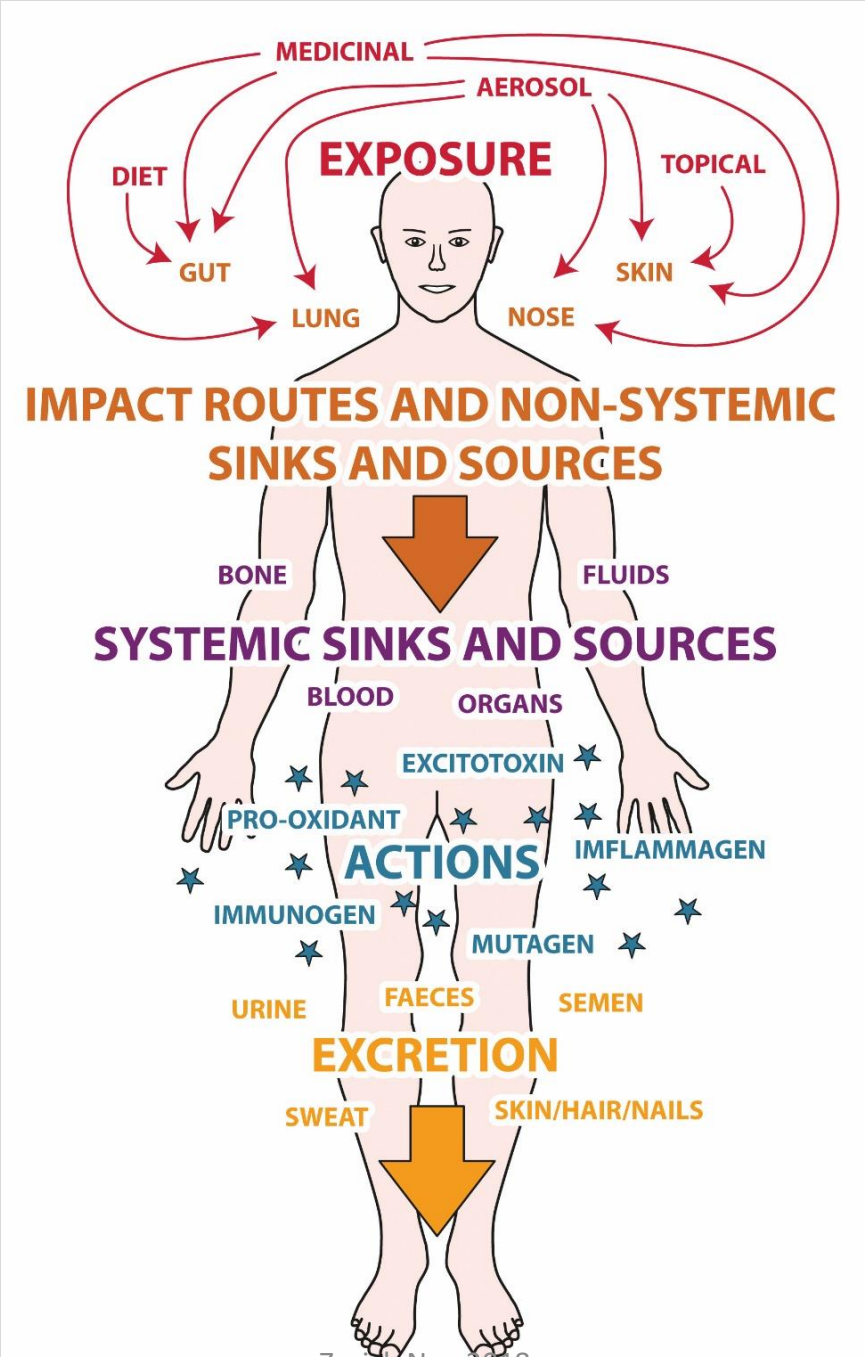
Evolution through natural selection has conferred biochemical advantages upon neurones and the neuronal microenvironment that have in turn enabled human beings to live for longer.

I would contend that the evolution of what is an ostensibly immortal cell line would not have occurred in the presence of biologically available aluminum.

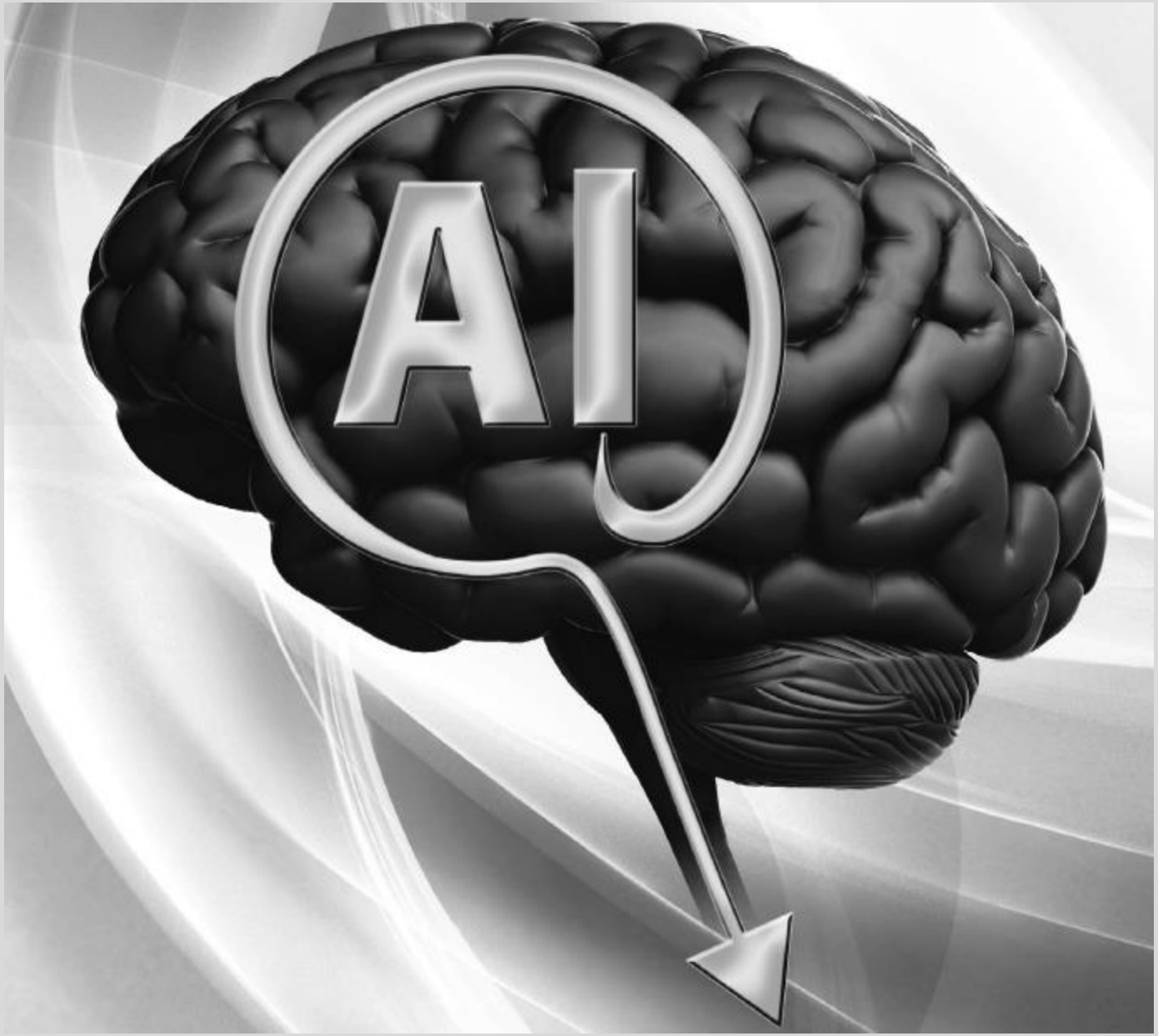
Indeed, the advent of the aluminum age must now have serious consequences for the health and longevity of such a cell line.

The lifespan of neurones predisposes them to a lifetime accumulation of aluminium.

https://www.frontiersin.org/articles/10.3389/fneur.2014.00212/full



https://pubs.rsc.org/en/content/articlelanding/2013/em/c3em00374d#!divAbstract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Metallomics

Dynamic Article Links

Cite this: *Metallomics*, 2012, **4**, 56–65

www.rsc.org/metallomics

PAPER

Aluminium, iron and copper in human brain tissues donated to the medical research council's cognitive function and ageing study

Emily House,[a] Margaret Esiri,[b] Gill Forster,[c] Paul G Ince[c] and Christopher Exley*[a]

The median Al content of tissues from all **60 brains** (n=713) is 1 μg/g dry wt.

In 52 out of 60 individuals at least one tissue sample exceeded 2 μg Al/g dry wt.

In 41 out of 60 individuals at least one tissue sample exceeded 3.5 μg Al/g dry wt.

Approximately 70% of individuals aged 70 – 103 years had at least one tissue Al content which should be considered as pathological

Journal of Alzheimer's Disease 54 (2016) 1333–1338
DOI 10.3233/JAD-160648
IOS Press

The Identification of Aluminum in Human Brain Tissue Using Lumogallion and Fluorescence Microscopy

Ambreen Mirza[a], Andrew King[b,c], Claire Troakes[c] and Christopher Exley[a,*]
[a]*The Birchall Centre, Lennard-Jones Laboratories, Keele University, Staffordshire, UK*
[b]*Department of Clinical Neuropathology, King's College Hospital, London, UK*
[c]*MRC London Neurodegenerative Diseases Brain Bank, Institute of Psychiatry, Psychology and Neuroscience, King's College, London, UK*

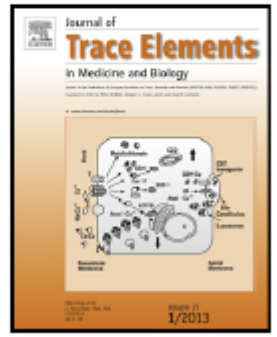
https://content.iospress.com/articles/journal-of-alzheimers-disease/jad160648

Journal of Trace Elements in Medicine and Biology 40 (2017) 30–36

Contents lists available at ScienceDirect

Journal of Trace Elements in Medicine and Biology

journal homepage: www.elsevier.com/locate/jtemb



Toxicology

Aluminium in brain tissue in familial Alzheimer's disease

Ambreen Mirza[a], Andrew King[b,c], Claire Troakes[c], Christopher Exley[a,*]

[a] The Birchall Centre, Lennard-Jones Laboratories, Keele University, Staffordshire, ST5 5BG, United Kingdom
[b] Department Of Clinical Neuropathology, King's College Hospital, London, SE5 9RS, United Kingdom
[c] MRC London Neurodegenerative Diseases Brain Bank, Institute of Psychiatry, Psychology and Neuroscience, King's College, London, SE5 8AF, United Kingdom

https://www.sciencedirect.com/science/article/pii/S0946672X16303777?via%3Dihub

45000 Views on the Publisher's Website

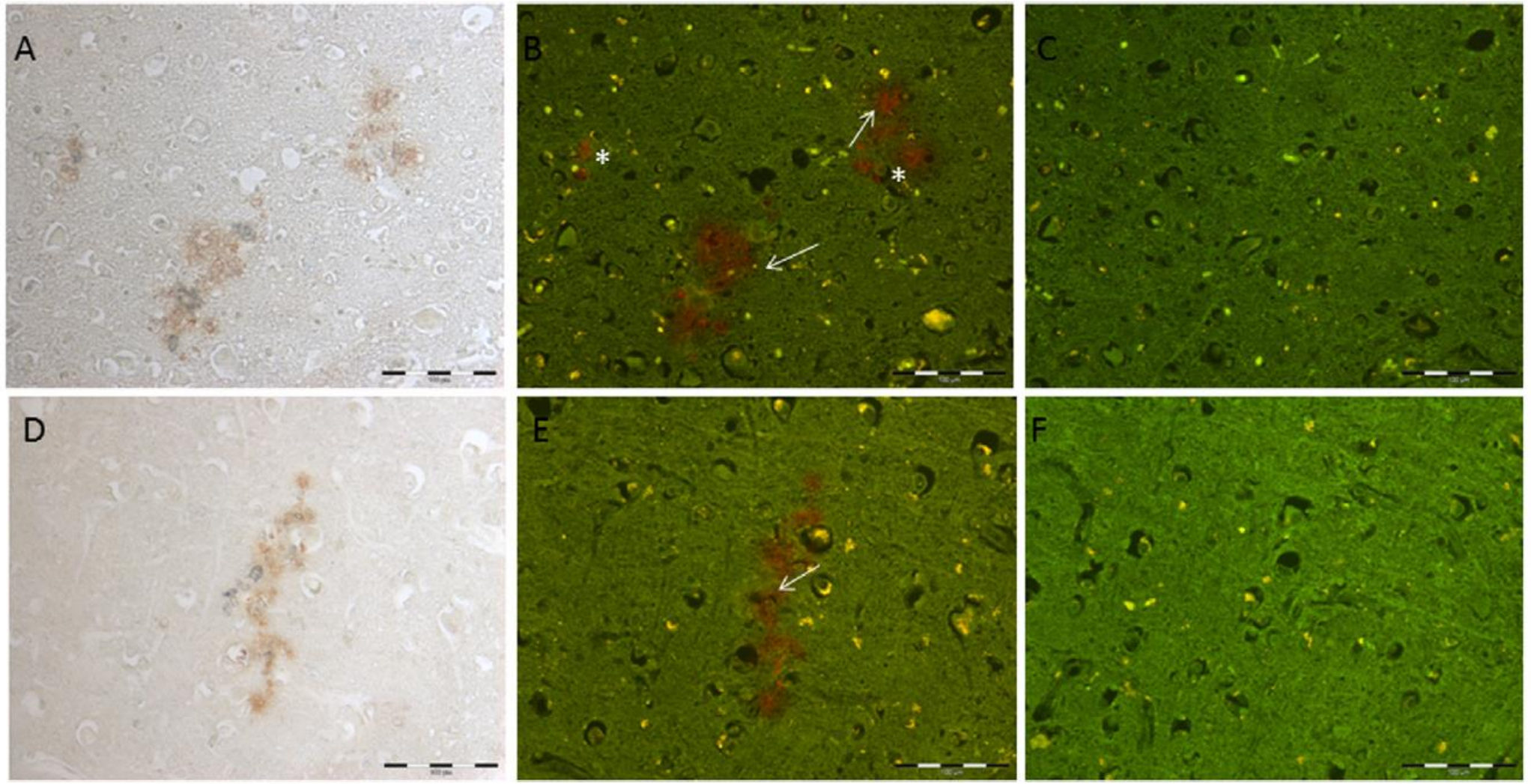


Fig. 1. Representative images of aluminium in frontal cortex. Light (A&D) and fluorescence (B&E) microscopy images of lumogallion-stained sections of frontal cortex. Asterisk label suggested intracellular deposits while arrows show diffuse deposits. Fluorescence microscopy of un-stained adjacent tissue sections (C&F) show autofluorescence. Scale bars are all 100 μm.

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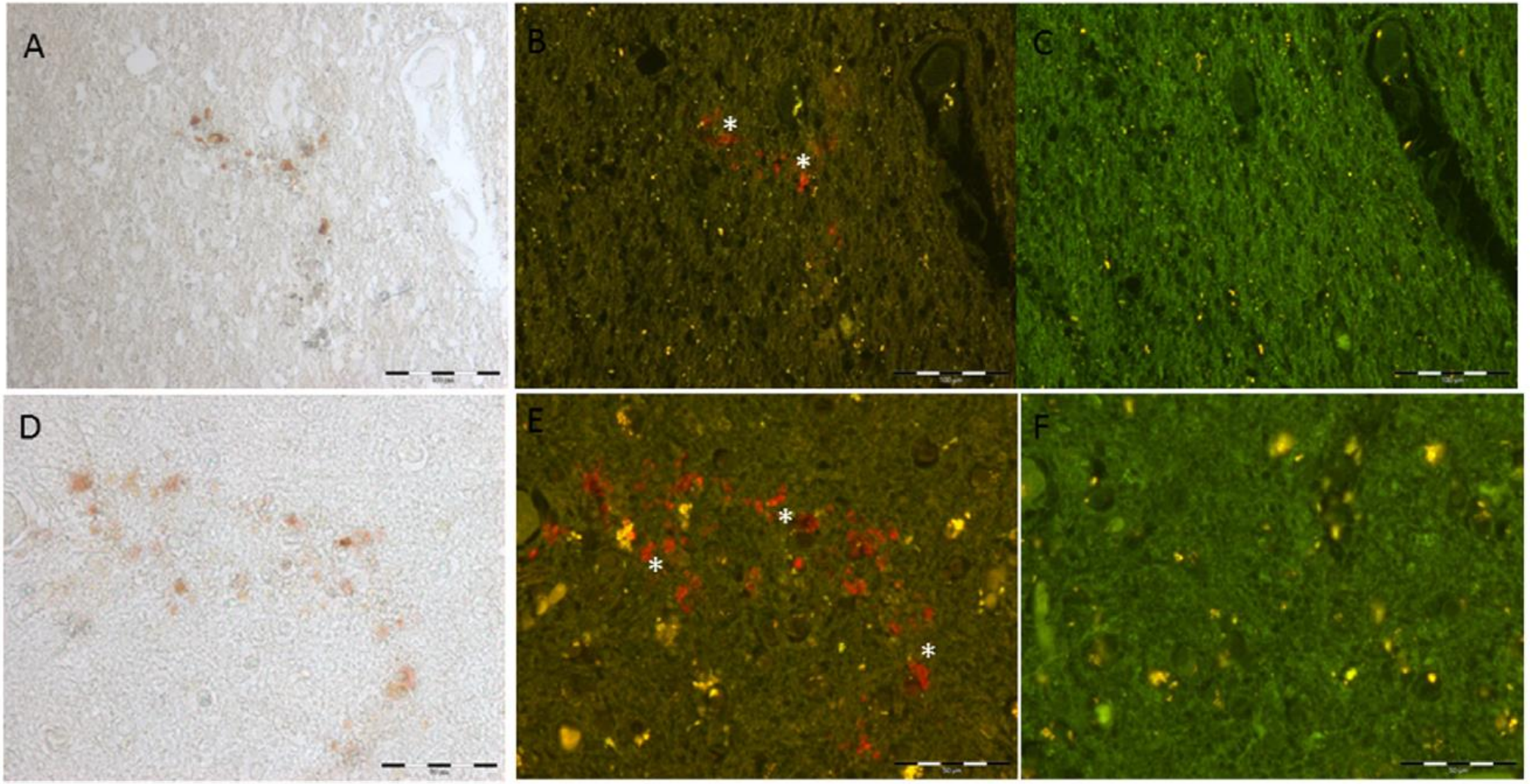

Fig. 2. Representative images of aluminium in parietal cortex. Light (A&D) and fluorescence (B&E) microscopy images of lumogallion-stained sections of frontal cortex. Asterisk label suggested intracellular deposits associated with both living and dead cells. Fluorescence microscopy of un-stained adjacent tissue sections (C&F) show autofluorescence. Scale bars are 100 μm (A–C) and 50 μm (D–F).

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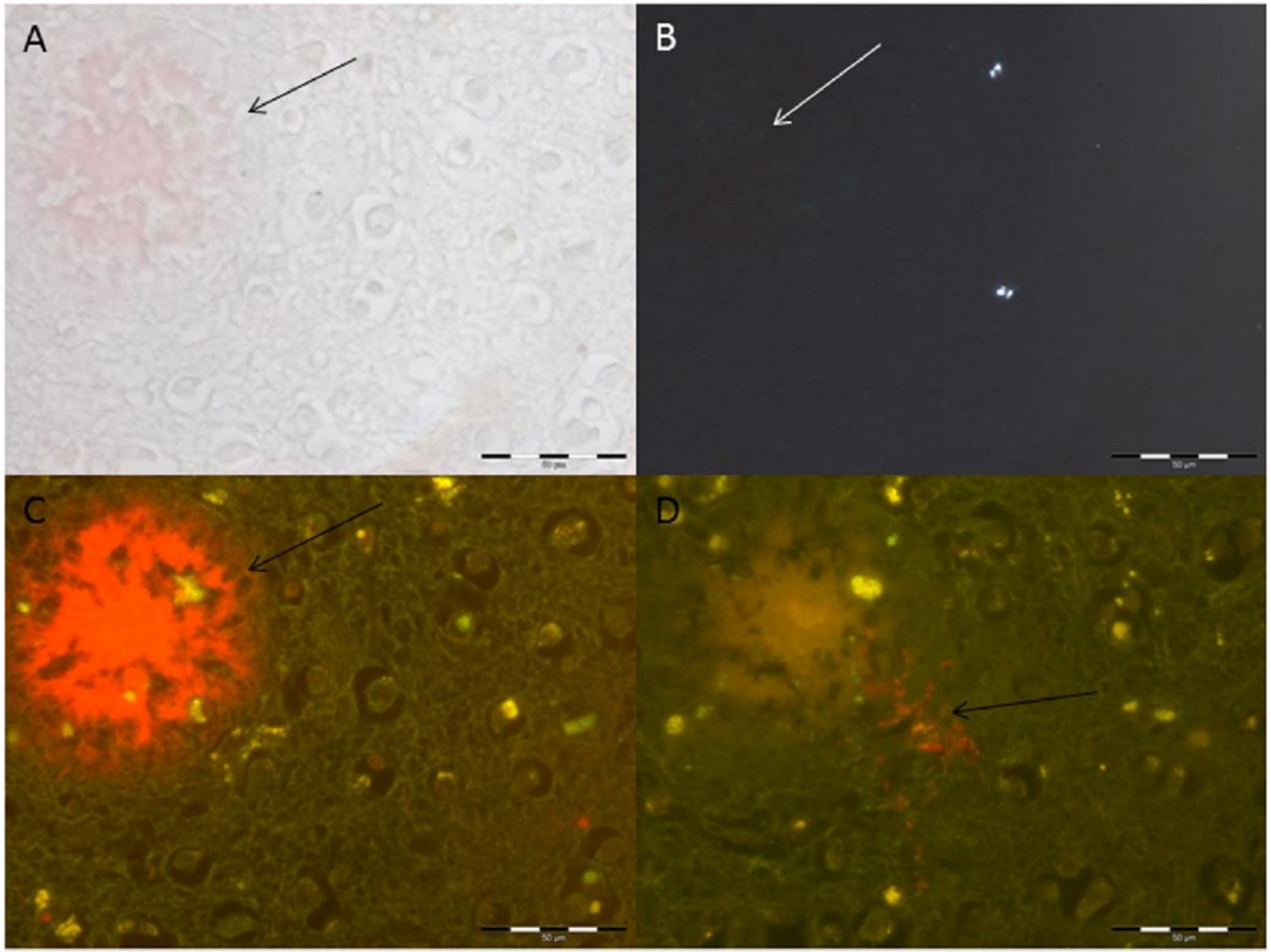

Fig. 4. Co-localisation of amyloid and aluminium in occipital cortex. (A) Light microscopy image of Congo red-stained tissue showing (arrow) senile plaque-like amyloid deposit. (B) Polarising microscopy image of Congo red-stained image showing (arrow) apple-green birefringence characteristic of amyloid in β sheet conformation. (C) Fluorescence microscopy image of Congo red-stained tissue showing (arrow) senile plaque-like amyloid deposit. (D) Fluorescence microscopy image of adjacent section of tissue stained with lumogallion and showing (arrow) significant deposits of aluminium. Scale bars are all 50 μm.

https://www.sciencedirect.com/science/article/pii/S0946672X16303777?via%3Dihub

Journal of Trace Elements in Medicine and Biology 46 (2018) 76–82

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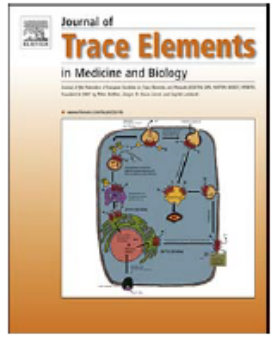

Aluminium in brain tissue in autism

Matthew Mold[a], Dorcas Umar[b], Andrew King[c], Christopher Exley[a,*]

[a] The Birchall Centre, Lennard-Jones Laboratories, Keele University, Staffordshire, ST5 5BG, United Kingdom
[b] Life Sciences, Keele University, Staffordshire, ST5 5BG, United Kingdom
[c] Department of Clinical Neuropathology, Kings College Hospital, London, SE5 9RS, United Kingdom

https://www.sciencedirect.com/science/article/pii/S0946672X17308763

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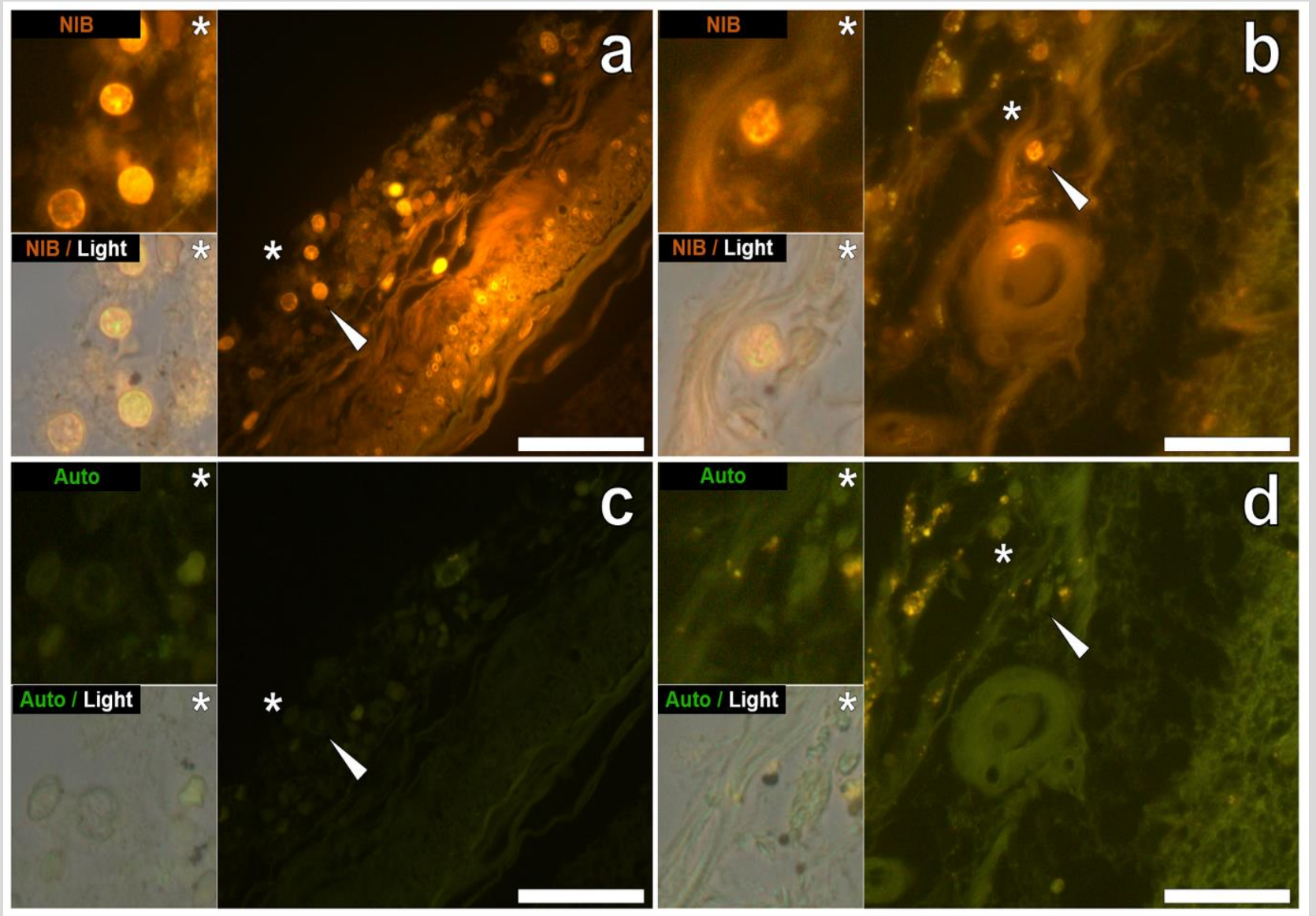
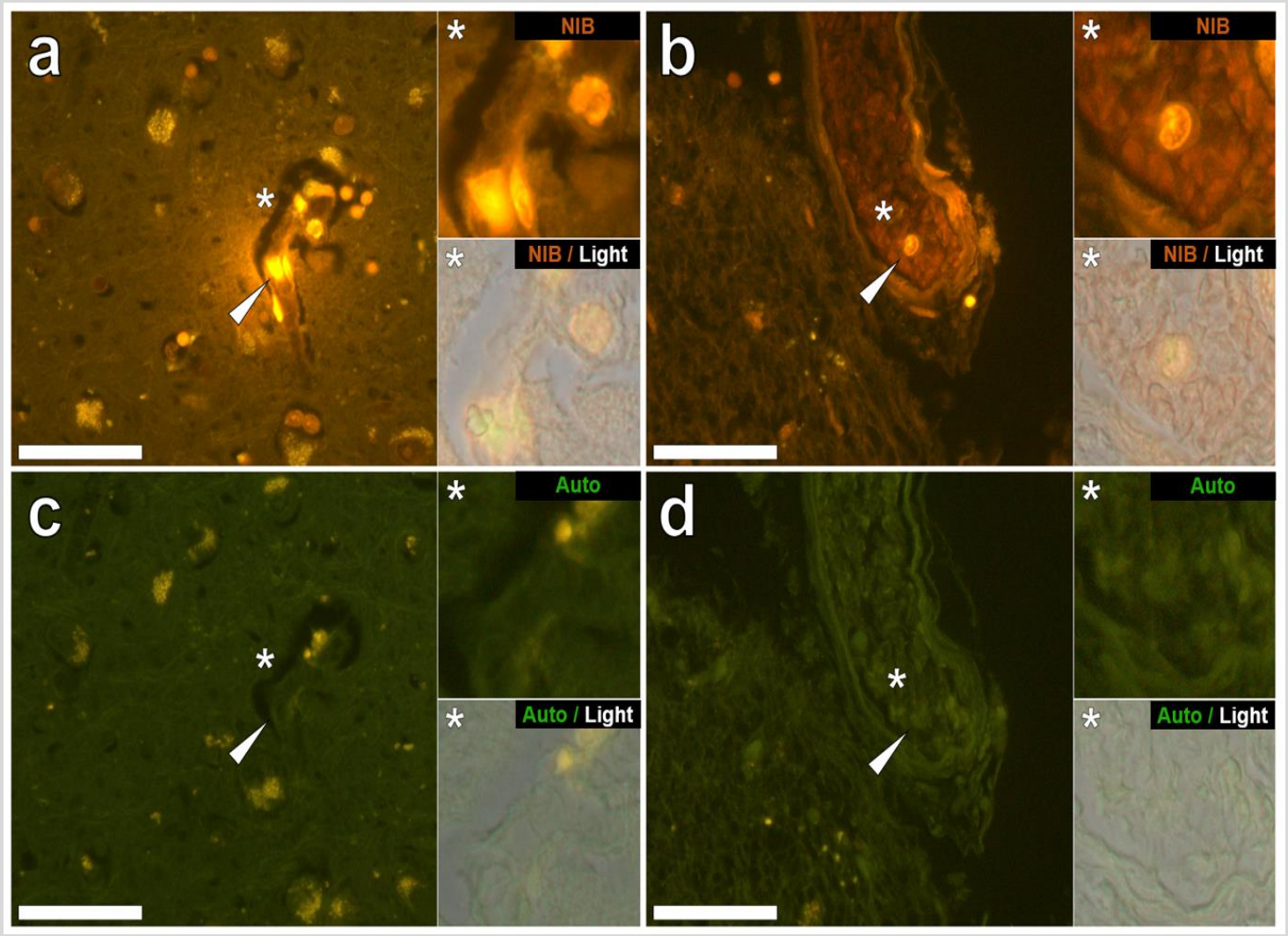


Intrameningeal lumogallion-reactive aluminium identified in the hippocampus **(a & c)** and frontal lobe **(b & d)** of a 50-year-old male donor diagnosed with autism.

https://www.sciencedirect.com/science/article/pii/S0946672X17308763



Intravasculature lumogallion-reactive aluminium identified in the hippocampus **(a – d)** of a 50-year-old male donor diagnosed with autism.

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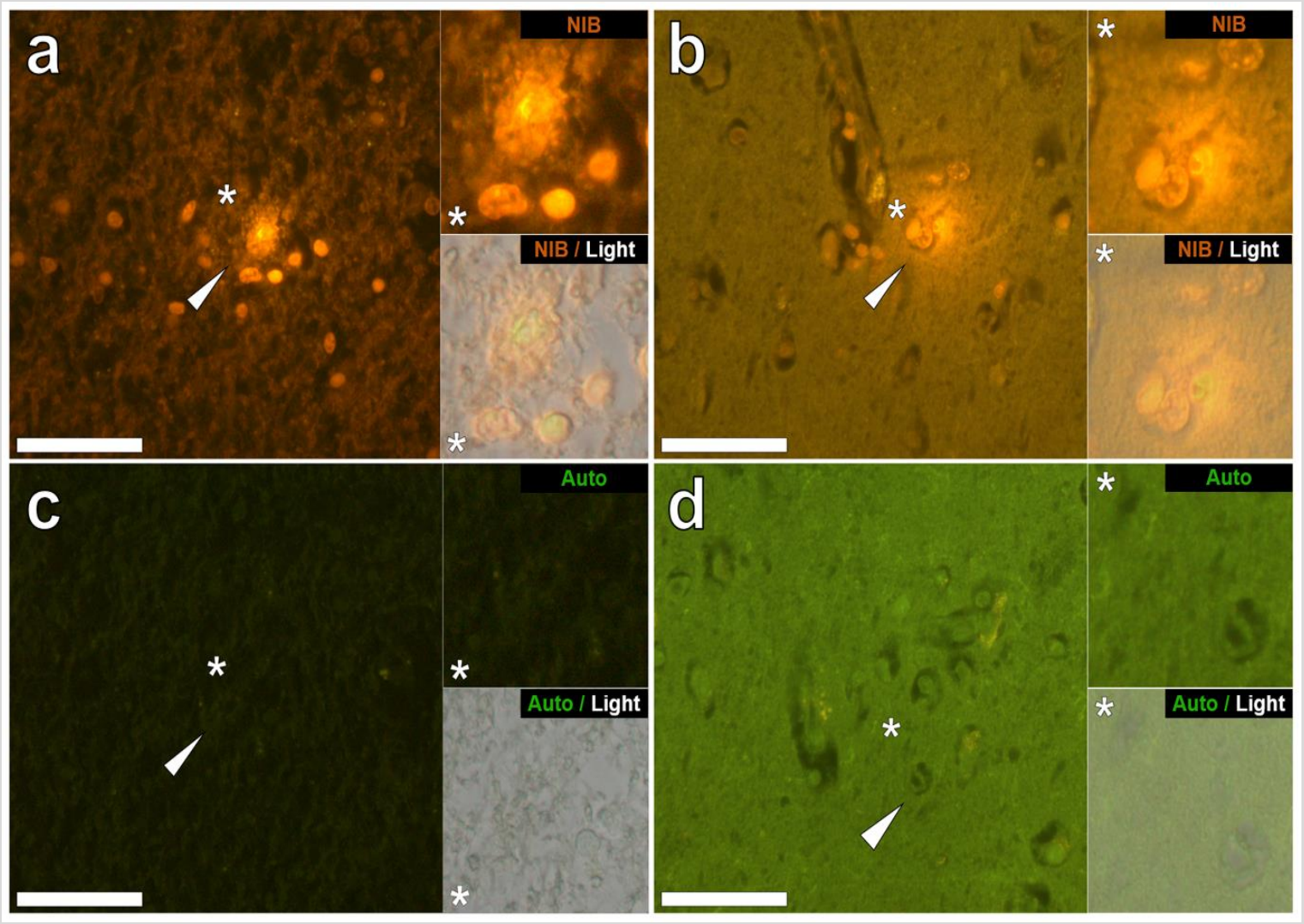


Lumogallion-reactive aluminium identified in the hippocampus **(a & c)** and parietal **(b & d)** lobe of a 15-year-old male donor diagnosed with autism.

https://www.sciencedirect.com/science/article/pii/S0946672X17308763

International Journal of
Environmental Research and Public Health

MDPI

Article

Aluminium in Brain Tissue in Multiple Sclerosis

Matthew Mold [1], Agata Chmielecka [2], Maria Raquel Ramirez Rodriguez [1], Femia Thom [2], Caroline Linhart [3], Andrew King [4] and Christopher Exley [1,*]

https://www.mdpi.com/1660-4601/15/8/1777

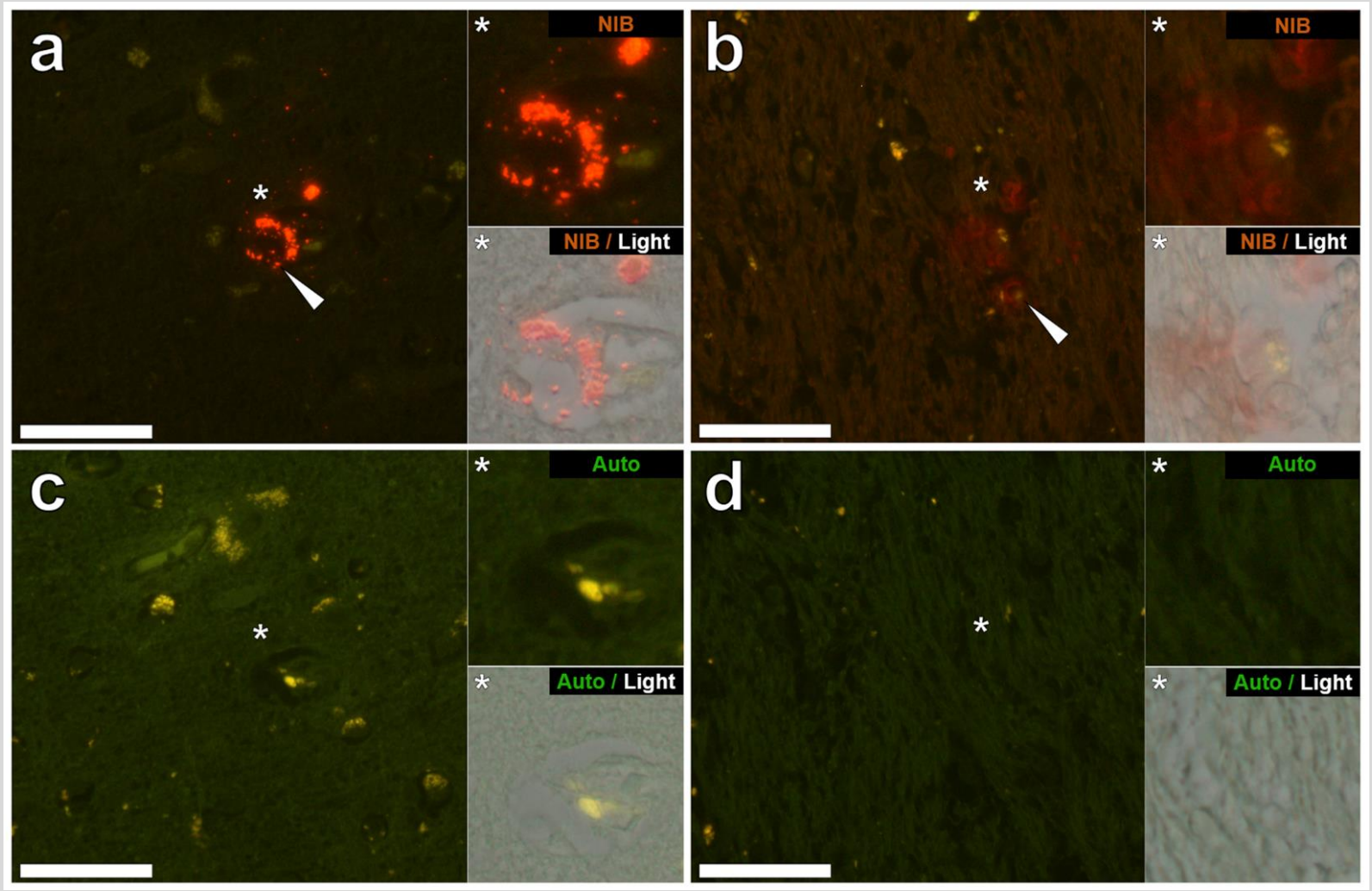


Figure 1. Extracellular aluminium in the frontal lobe and hippocampus of a 56-year-old male donor (MS274), diagnosed with RRMS. (**a**) Intense orange fluorescence (white arrow) indicating punctate deposits of aluminium was observed in the perivascular region of a small blood vessel in the white matter of the frontal lobe, in close proximity to lipofuscin, identified by yellow fluorescence. (**b**) Extracellular deposits of aluminium, identified as diffuse orange-red fluorescence, appear co-deposited with lipofuscin (white arrow) in white matter adjacent to the parahippocampal gyrus. (**c**,**d**) Autofluorescence of serial sections confirms the identity of aluminium in (**a**,**b**) respectively. Upper and lower panels depict magnified inserts of the fluorescence channel and bright field overlay. Magnification x400, scale bar 50 μm.

https://www.mdpi.com/1660-4601/15/8/1777

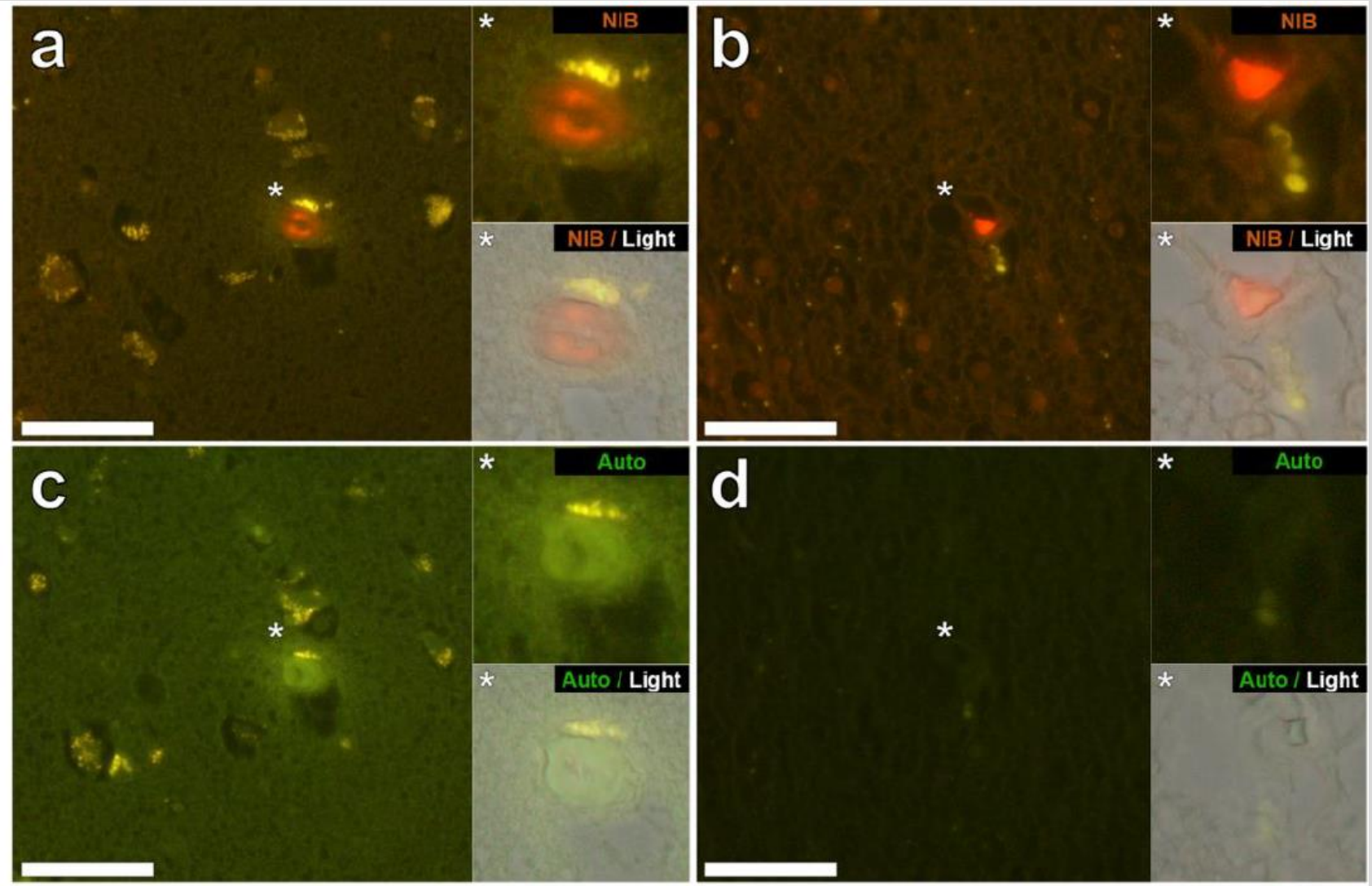
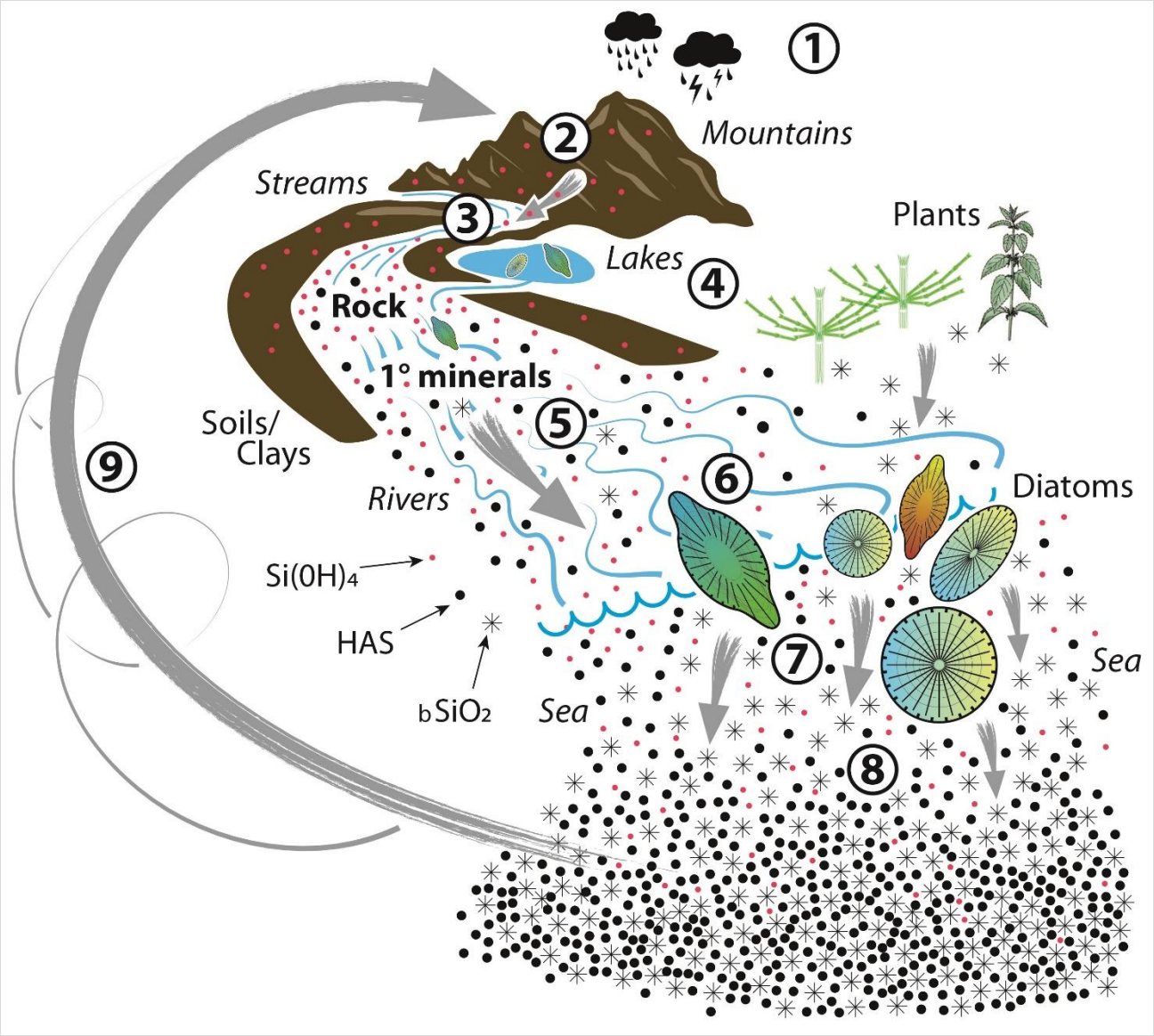


Figure 3. Aluminium in the frontal lobe and hippocampus of a 48-year-old female donor (MS317), diagnosed with SPMS. (**a**) Intense orange aluminium fluorescence was identified in refractile corpora amylacea (or mineralised deposits) in the frontal cortex grey matter). (**b**) Intracellular aluminium was also observed in occasional glial-like cells in the parahippocampal gyrus (white matter). Autofluorescence of serial sections (**c,d**) confirms the identity of aluminium in (**a**,**b**) respectively. Upper and lower panels depict magnified inserts of the fluorescence channel and bright field overlay. Magnification x400, scale bars: 50 μm.

https://www.mdpi.com/1660-4601/15/8/1777

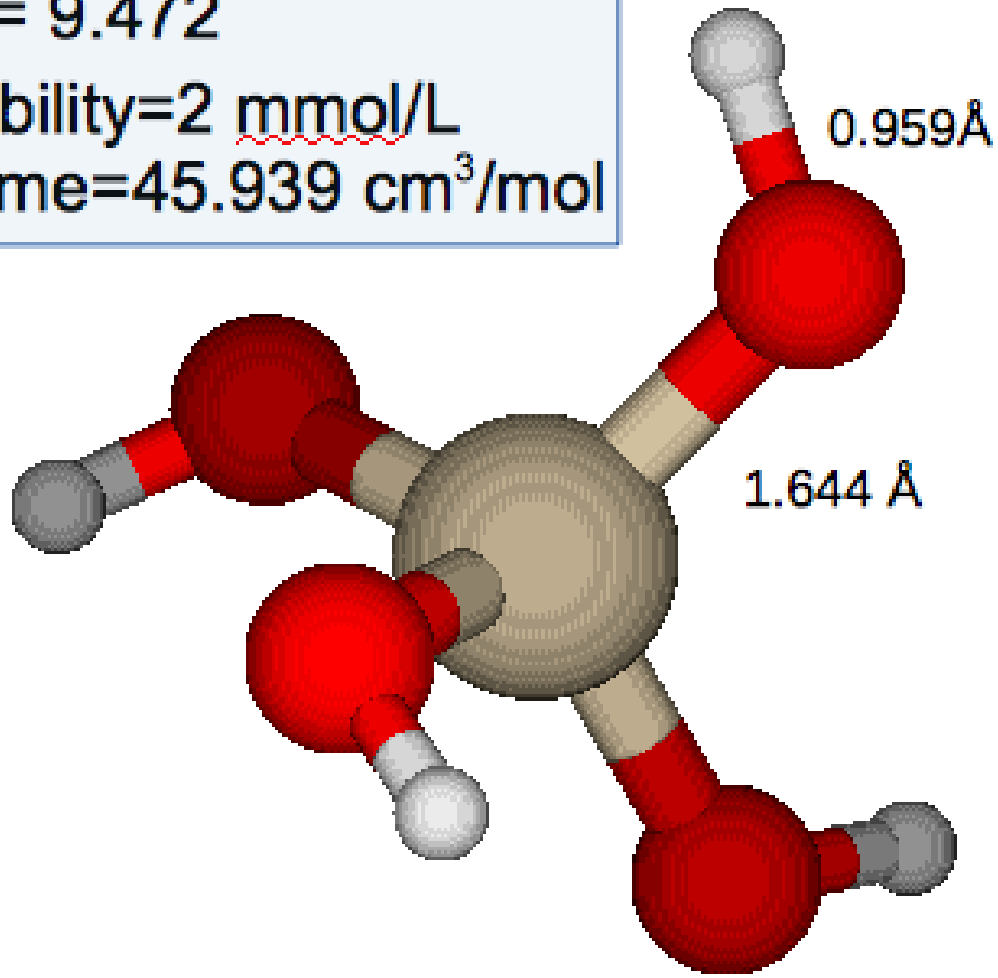
THE SILICIC ACID CYCLE

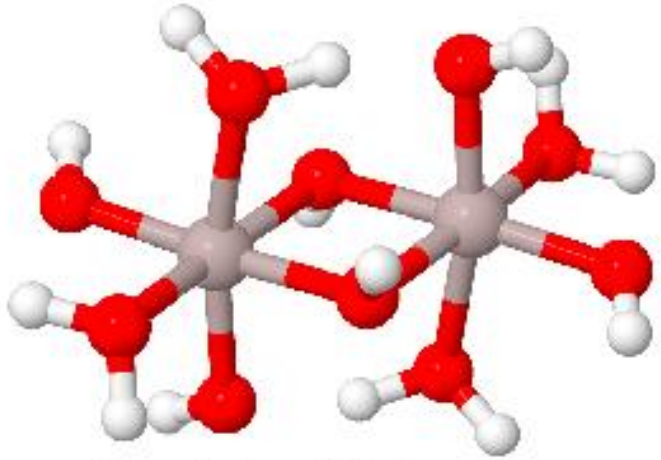
The clue to Earth's (healthy) ageing strategy?



Silicic Acid

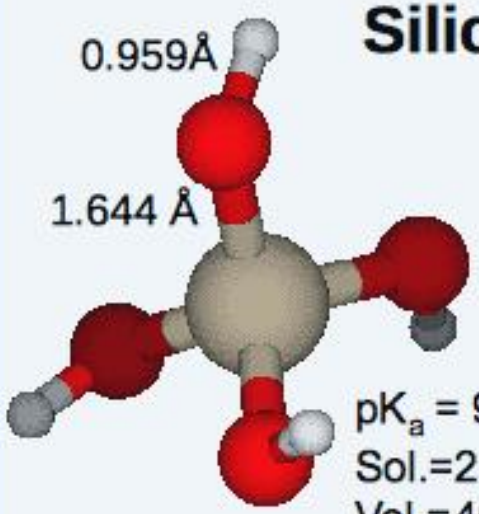
pK_a = 9.472
Solubility=2 mmol/L
Volume=45.939 cm^3/mol



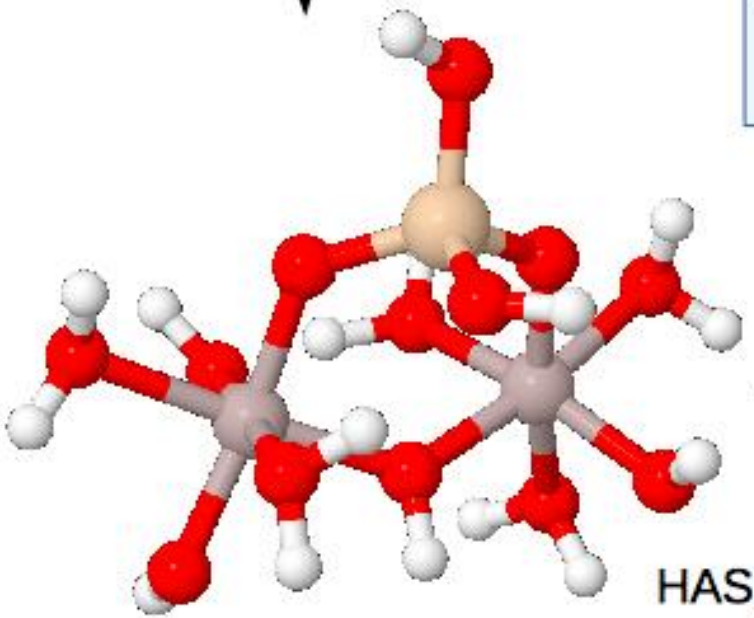


Aluminium Hydroxide

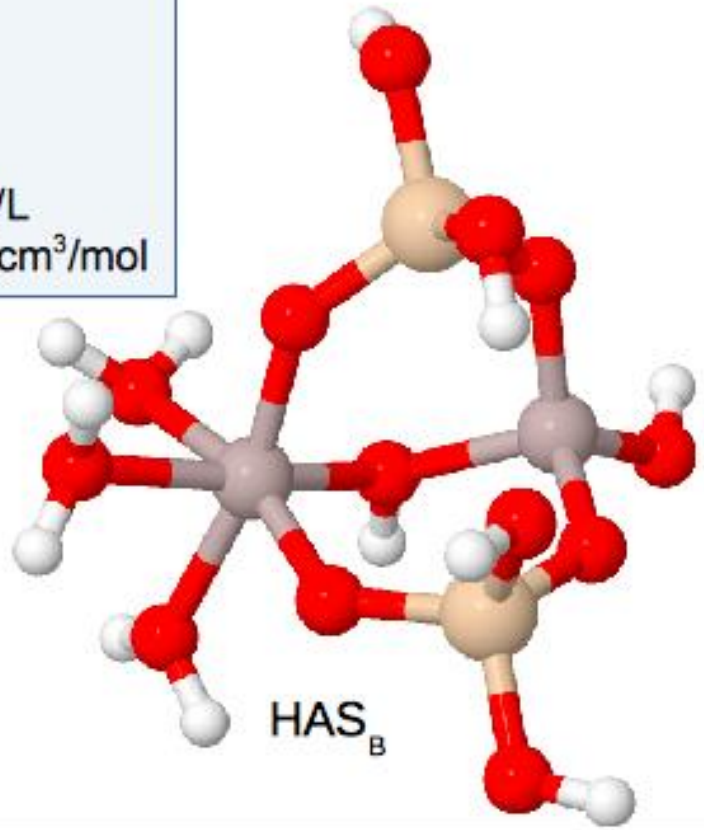
Silicic Acid



pK_a = 9.472
Sol.=2 mmol/L
Vol.=45.939 cm^3/mol

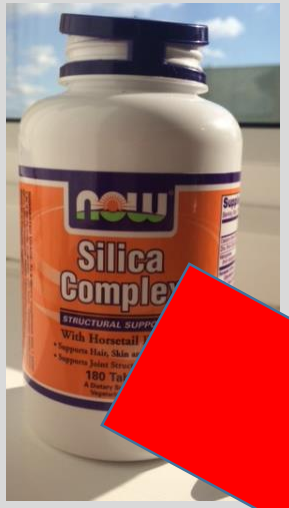


HAS_A



HAS_B

SILICON/SILICA SUPPLEMENTS



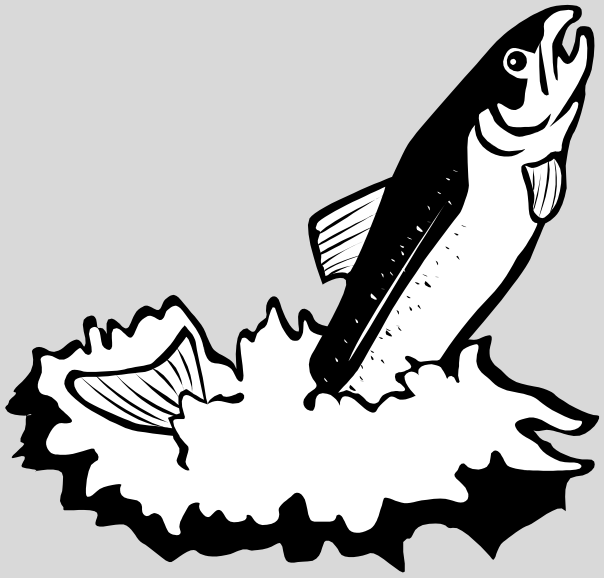
A Bioinorganic Solution to Aluminium-Related Disease?

1989

Acute toxicity of aluminium to fish eliminated in silicon-rich acid waters

J. D. BIRCHALL, C. EXLEY,
J.S. CHAPPELL & M. J. PHILLIPS

***Nature* 338, 146 - 148 (09 March 1989); doi:10.1038/338146a0**

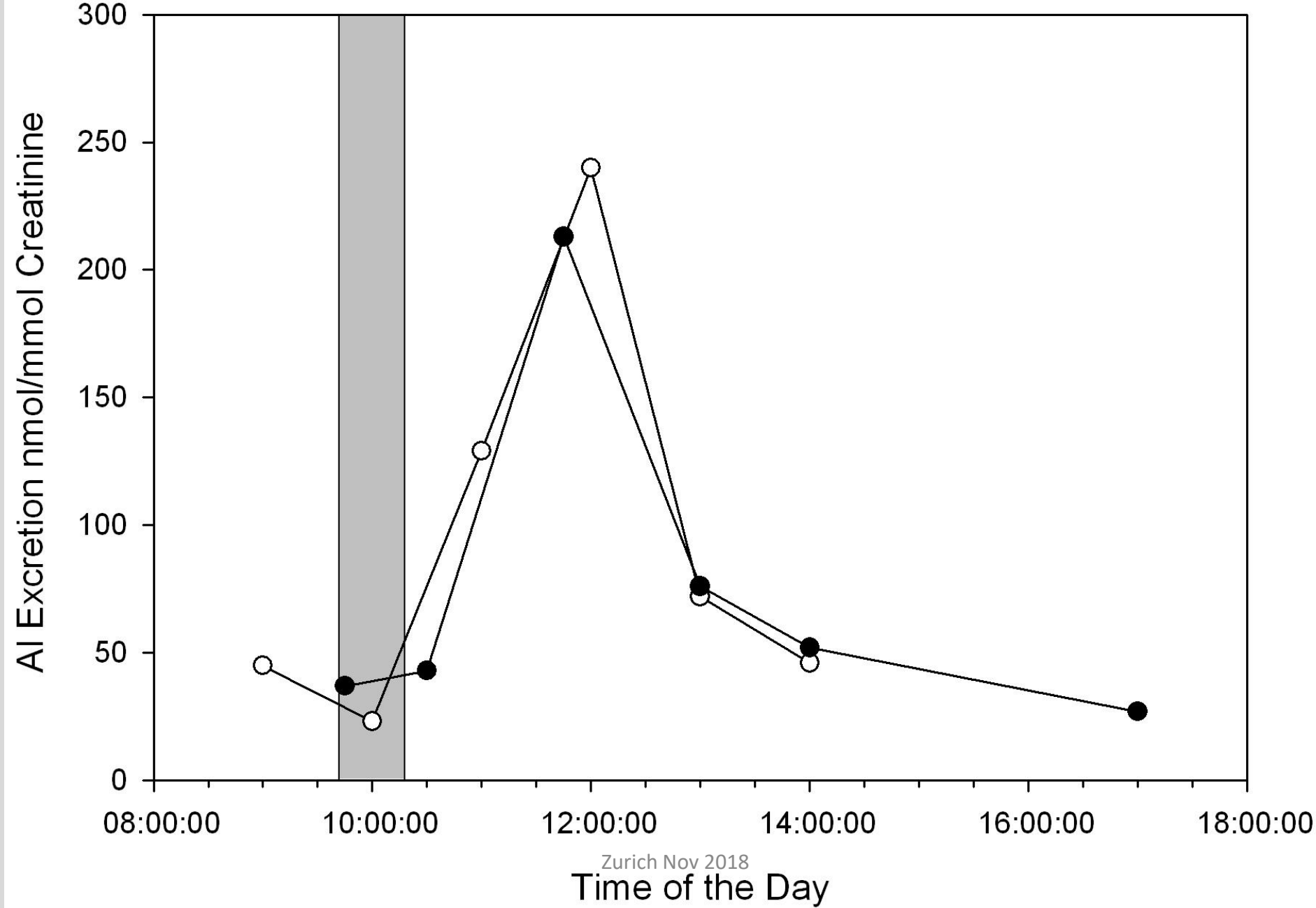


2006

Non-invasive therapy to reduce the body burden of aluminium in Alzheimer's disease

Christopher Exley, Olga Korchazhkina, Deborah Job, Stanislav Strekopytov, Anthony Polwart and Peter Crome

Journal of Alzheimer's Disease 10 (2006) 17–24


300
250
200
150
100
50
0
AI Excretion nmol/mmol Creatinine
08:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
Time of the Day

Journal of Alzheimer's Disease 10 (2006) 17–24
IOS Press

Non-invasive therapy to reduce the body burden of aluminium in Alzheimer's disease

Christopher Exley[a,*], Olga Korchazhkina[b], Deborah Job[c], Stanislav Strekopytov[a], Anthony Polwart[d] and Peter Crome[c,e]
[a]*Birchall Centre for Inorganic Chemistry and Materials Science, Keele University, Staffordshire, UK*
[b]*Institute for Science and Technology in Medicine, Keele University, Staffordshire, UK*
[c]*Department of Gerontology, University Hospital of North Staffordshire, Staffordshire, UK*
[d]*Life Sciences, Keele University, Staffordshire, UK*
[e]*School of Medicine, Keele University, Staffordshire, UK*

The first 'test' (over only 5 days) of an 'aluminium hypothesis of Alzheimer's disease with a silicon-rich mineral water showed that silicon-rich mineral waters could be an effective and non-invasive method to lower the body burden of aluminium.

Journal of Alzheimer's Disease 33 (2013) 423–430
DOI 10.3233/JAD-2012-121231
IOS Press

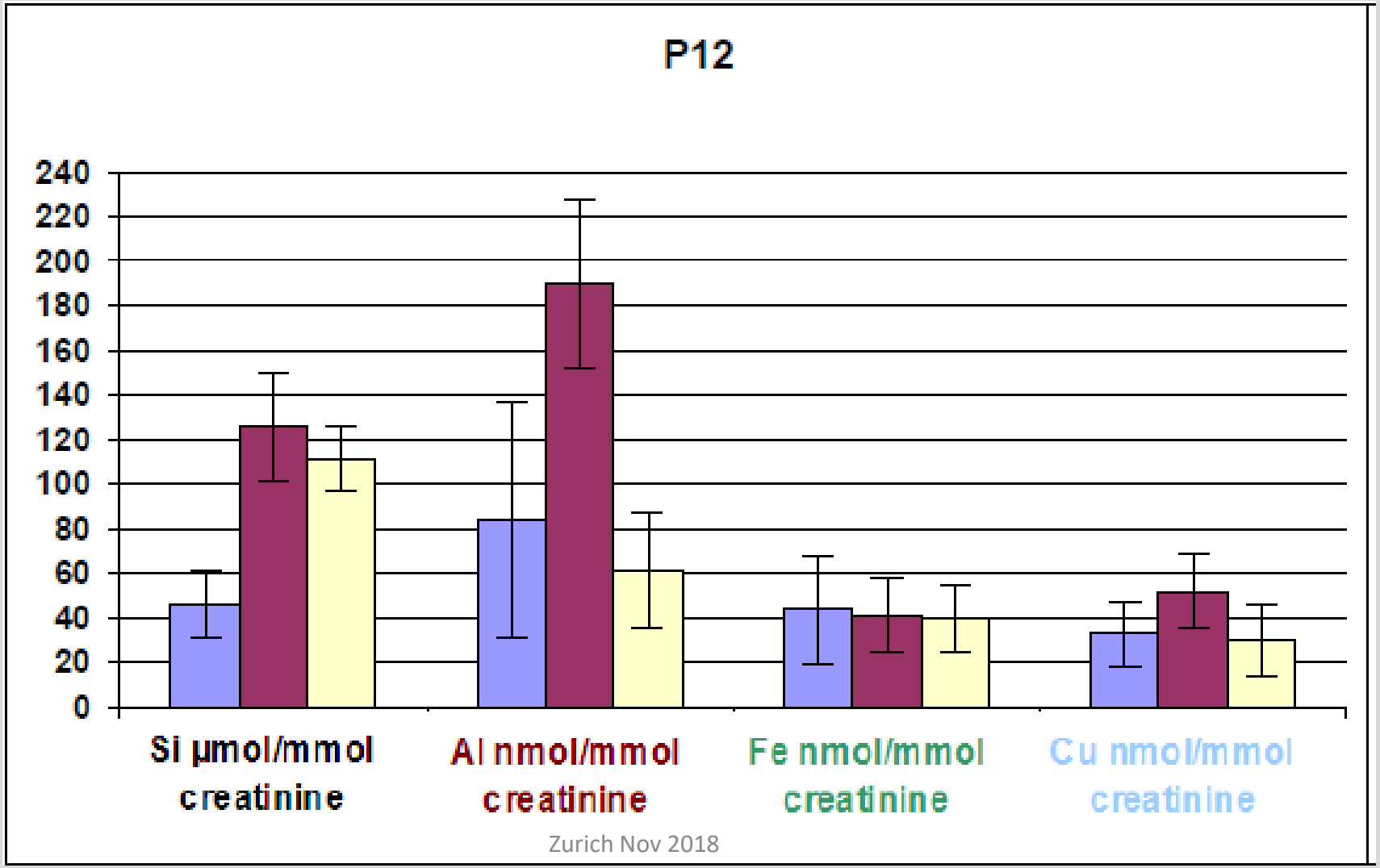
The Second Test!

Silicon-Rich Mineral Water as a Non-Invasive Test of the 'Aluminum Hypothesis' in Alzheimer's Disease

Samantha Davenward[a], Peter Bentham[b], Jan Wright[b], Peter Crome[c], Deborah Job[c], Anthony Polwart[d] and Christopher Exley[a,*]
[a]*The Birchall Centre, Lennard-Jones Laboratories, Keele University, Stoke-on-Trent, Staffordshire, UK*
[b]*Birmingham and Solihull Mental Health NHS Foundation Trust, The Barberry Centre, Birmingham, UK*
[c]*North Staffordshire Combined Healthcare NHS Trust, Harplands Hospital, Stoke-on-Trent, UK*
[d]*Life Sciences, Keele University, Stoke-on-Trent, Staffordshire, UK*

We have provided preliminary evidence that over 12 weeks of silicon-rich mineral water therapy the body burden of aluminium fell significantly in individuals with Alzheimer's disease and, concomitantly, cognitive performance showed clinically relevant improvements in at least 3 out of 15 individuals.

Alzheimer's Disease



Healthy Volunteers

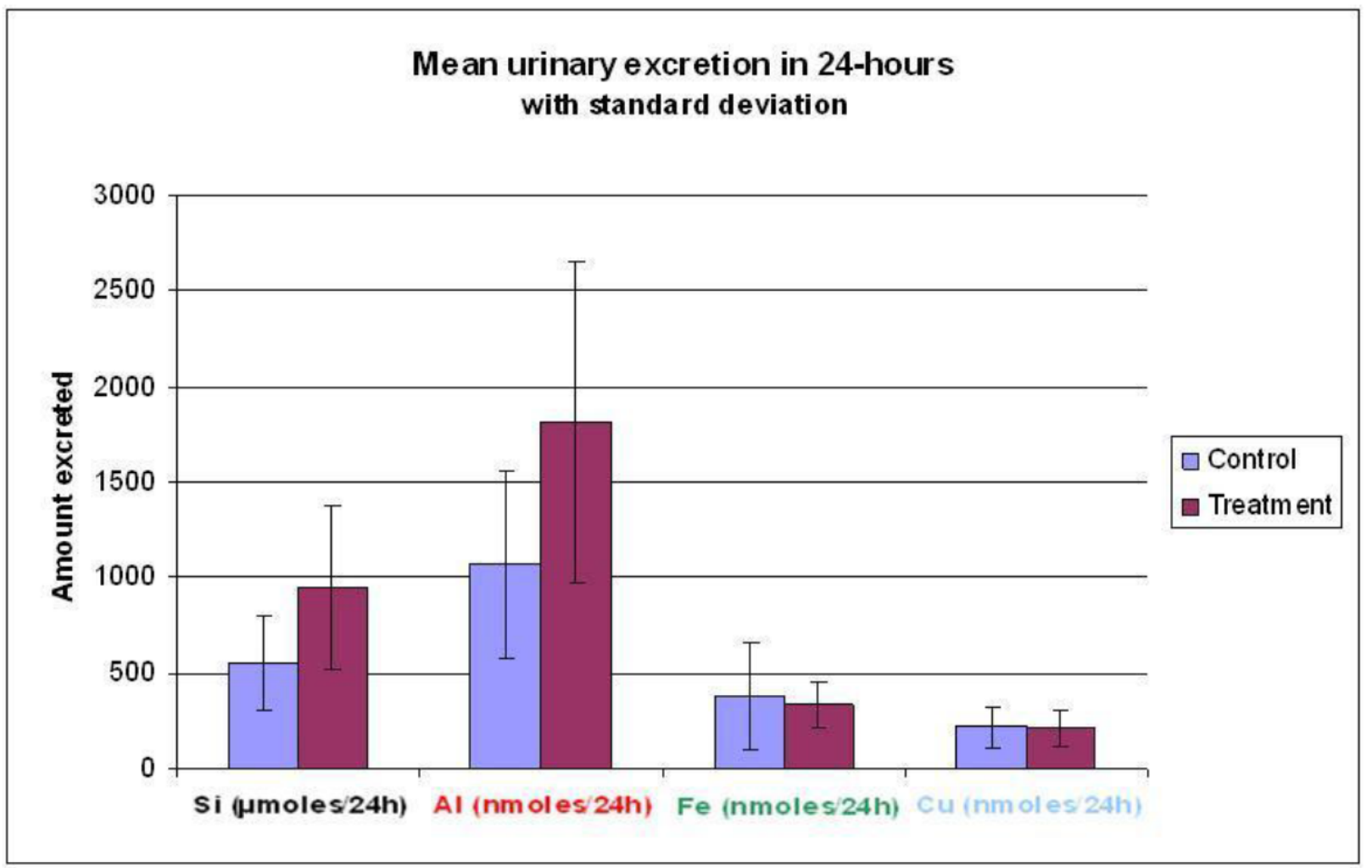


*Figure 3.1.4.2: **Mean** amounts and standard deviation bars of excreted Si (µmoles/24h), Al, Fe and Cu (nmoles/24h) in the control and treatment samples.*

EBioMedicine 26 (2017) 60–67

Contents lists available at ScienceDirect

EBioMedicine

journal homepage: www.ebiomedicine.com

Research Paper

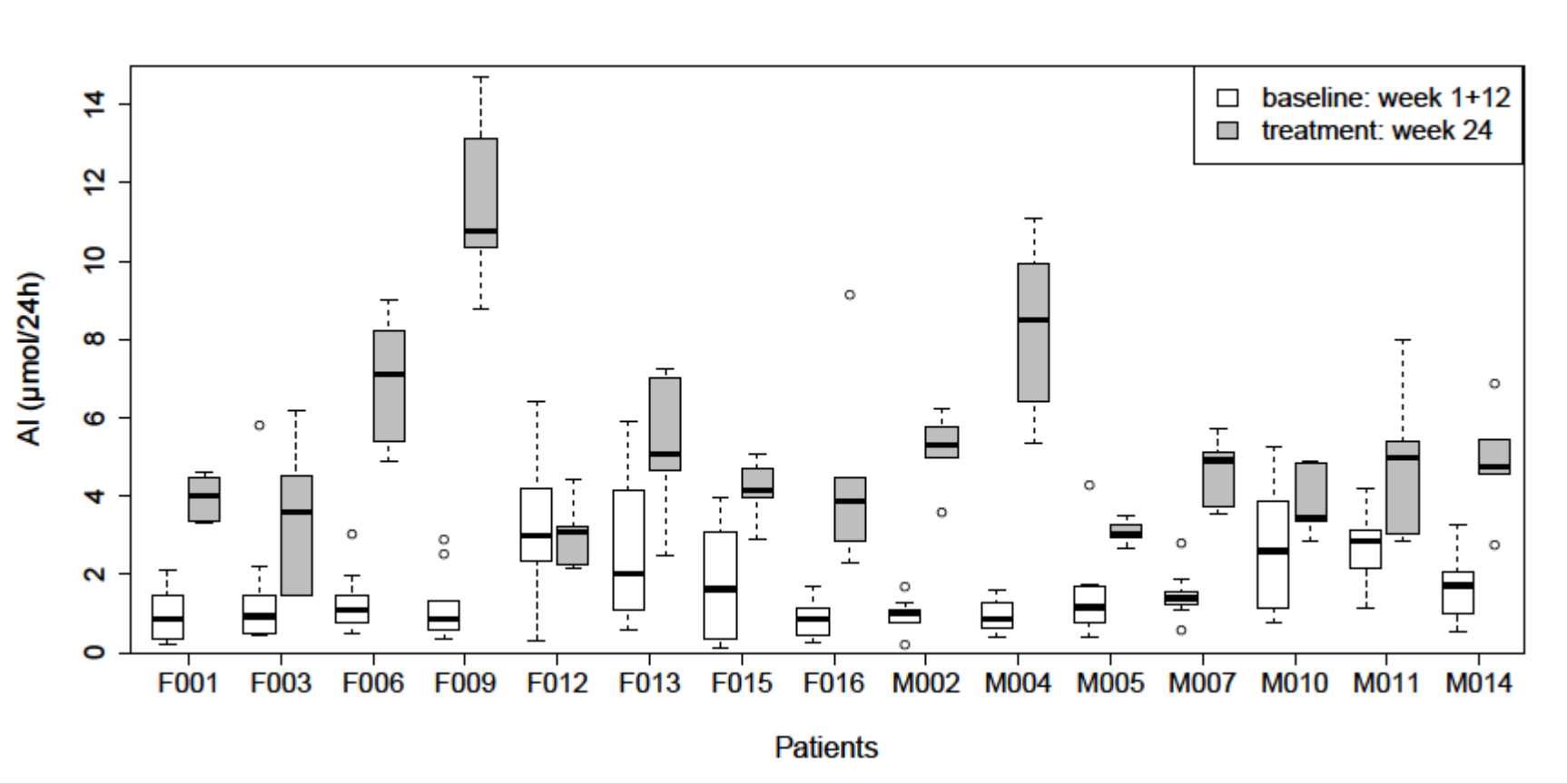
Urinary Excretion of Aluminium and Silicon in Secondary Progressive Multiple Sclerosis

Krista Jones [a], Caroline Linhart [b], Clive Hawkins [c], Christopher Exley [a,*]

[a] The Birchall Centre, Lennard-Jones Laboratories, Keele University, United Kingdom
[b] Department of Medical Statistics, Informatics and Health Economics, Medical University of Innsbruck, Austria
[c] Institute of Science and Technology in Medicine, Keele University, United Kingdom

https://www.sciencedirect.com/science/article/pii/S2352396417304280?via%3Dihub

Multiple Sclerosis



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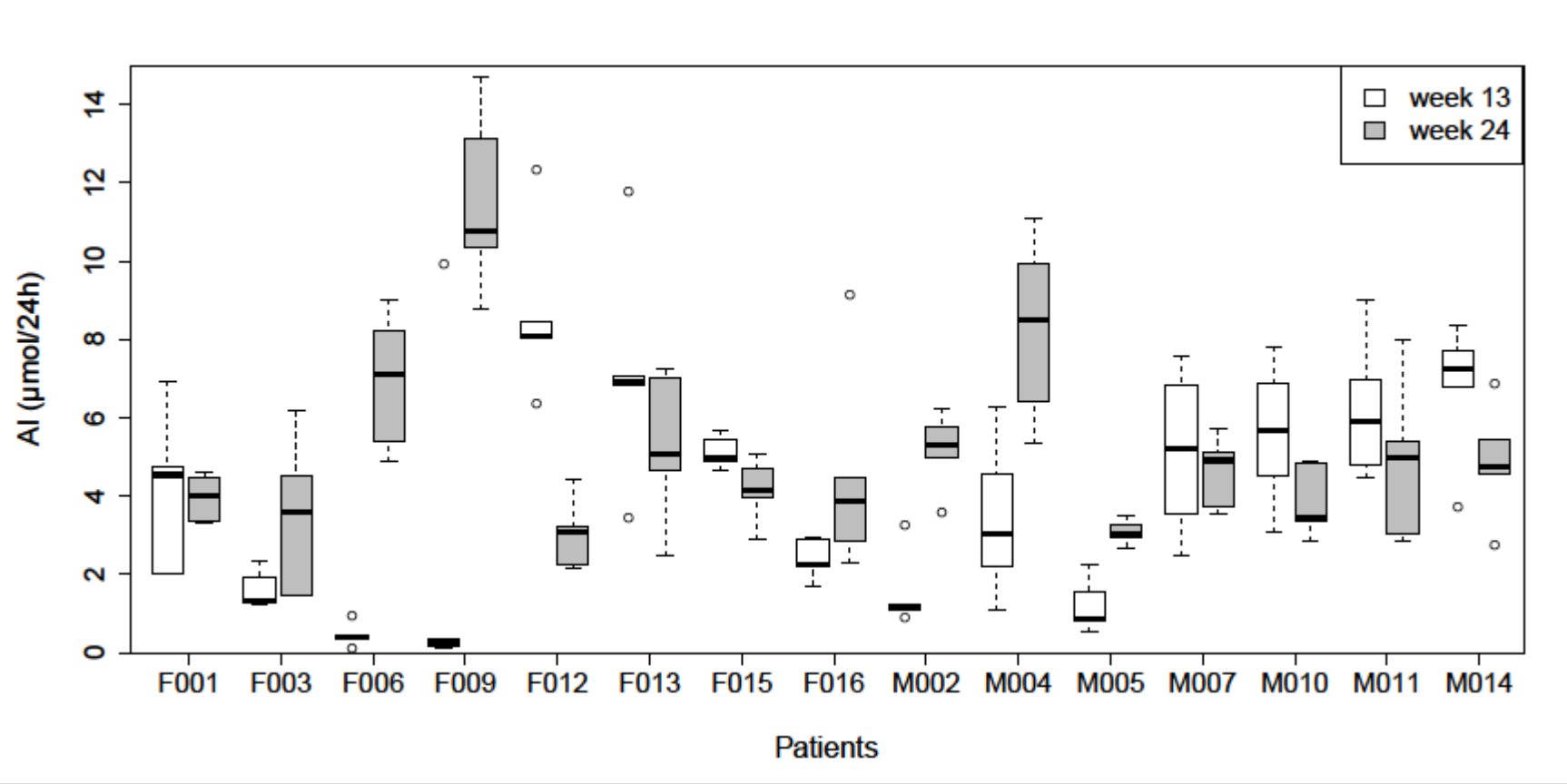
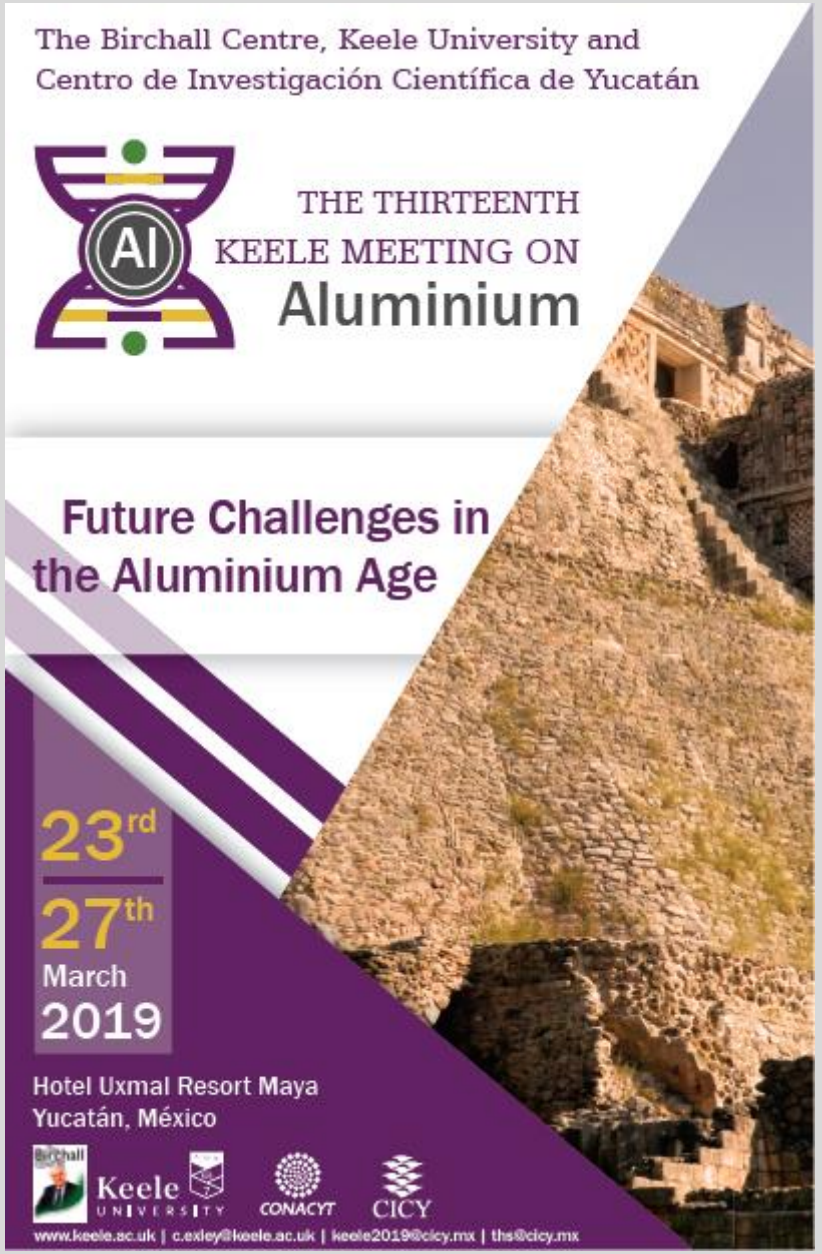
Multiple Sclerosis



https://www.sciencedirect.com/science/article/pii/S2352396417304280?via%3Dihub


I think I have the solution to healthy ageing…
Have a good day!
SPRITZER
Al MAN



Zurich Nov 2018