

# Living Safely in the Aluminium Age

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Aluminium and Silicon Research Group

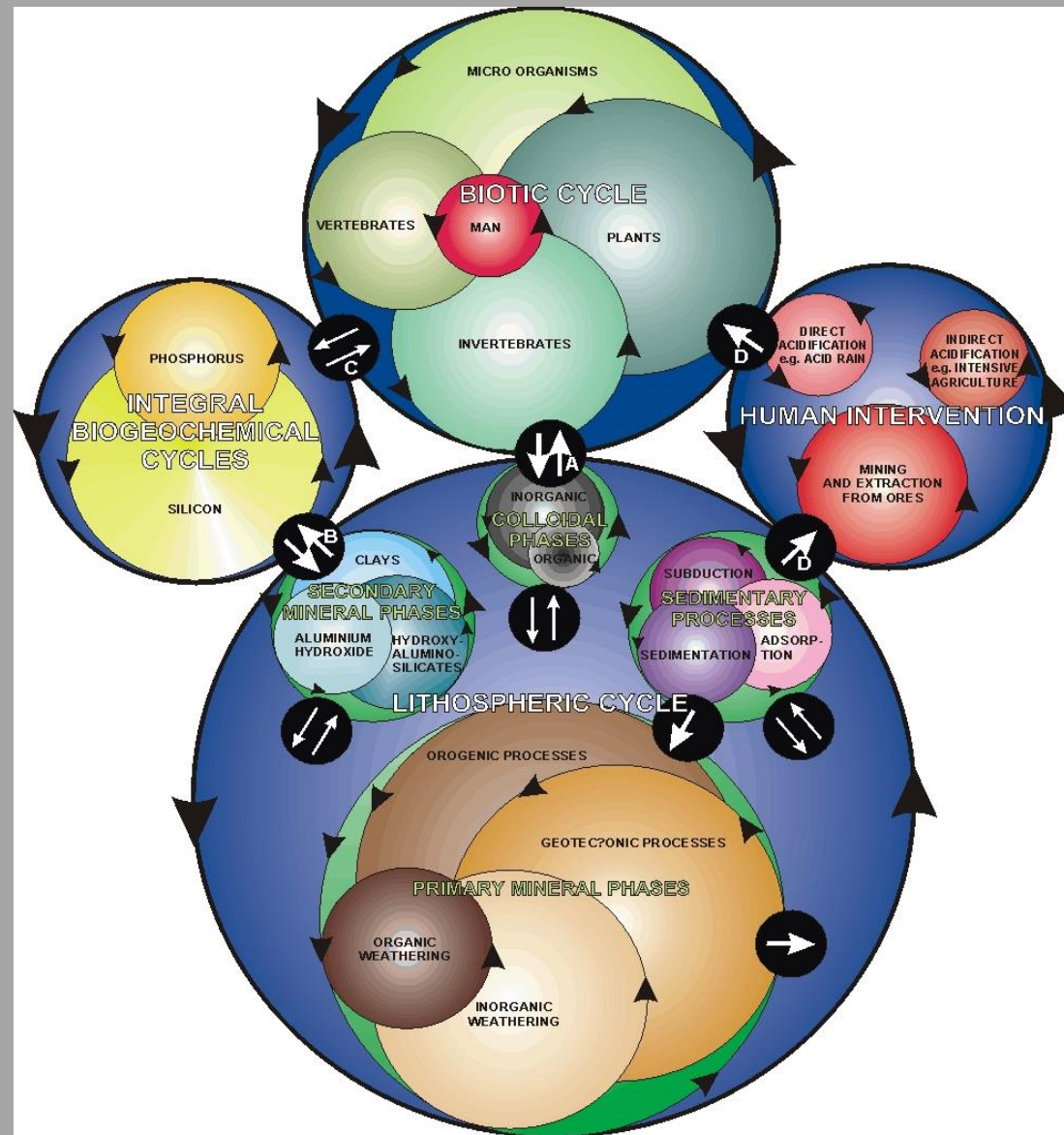
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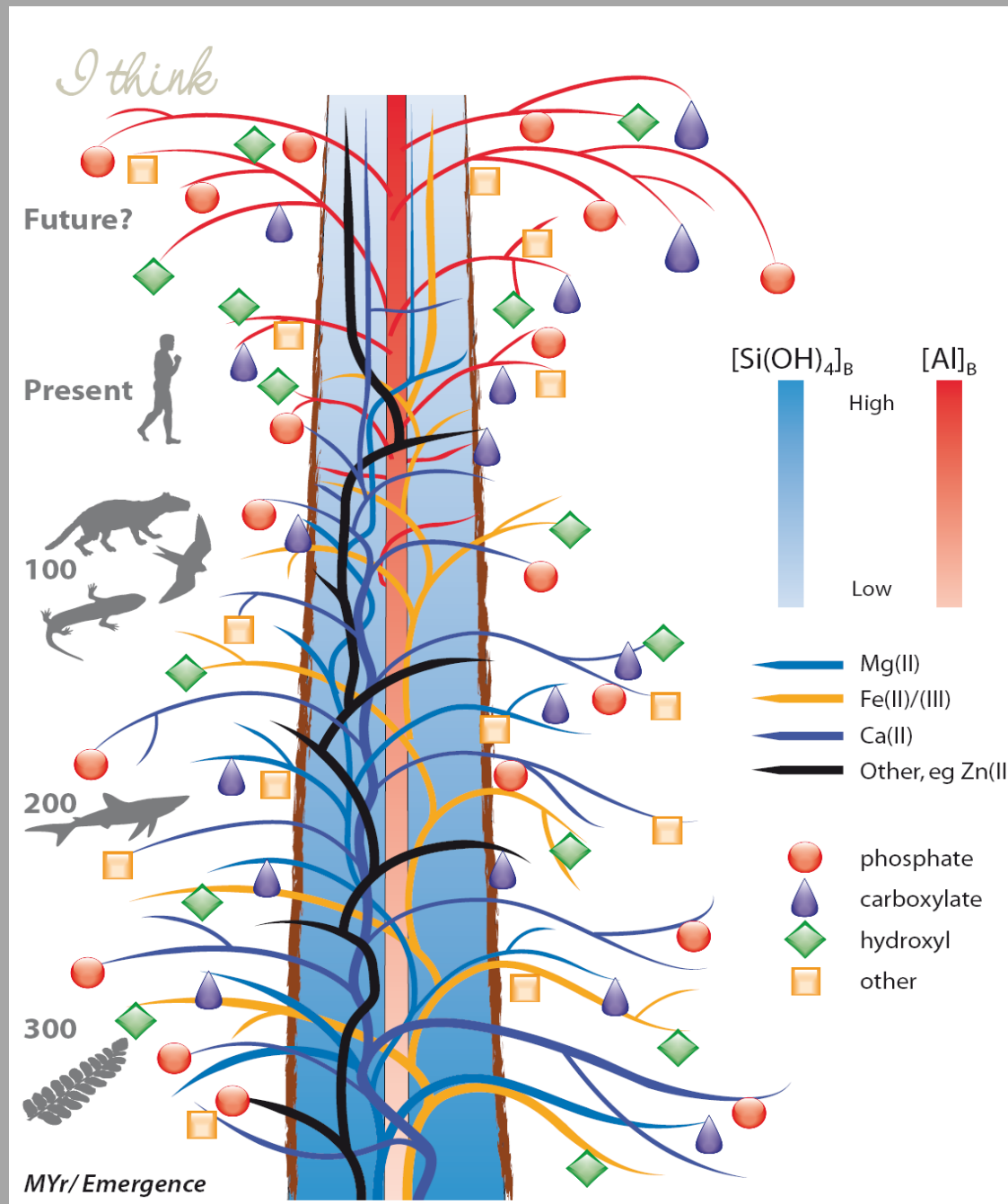
<http://www.keele.ac.uk/aluminium/>





# THE BIOGEOCHEMICAL CYCLE OF ALUMINIUM

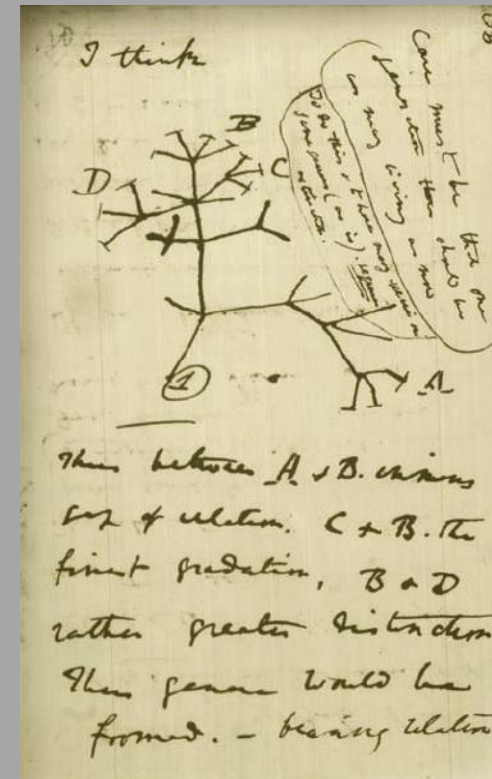
Exley C (2003) A biogeochemical cycle for aluminium ? J. Inorg. Biochem. 97, 1-7.



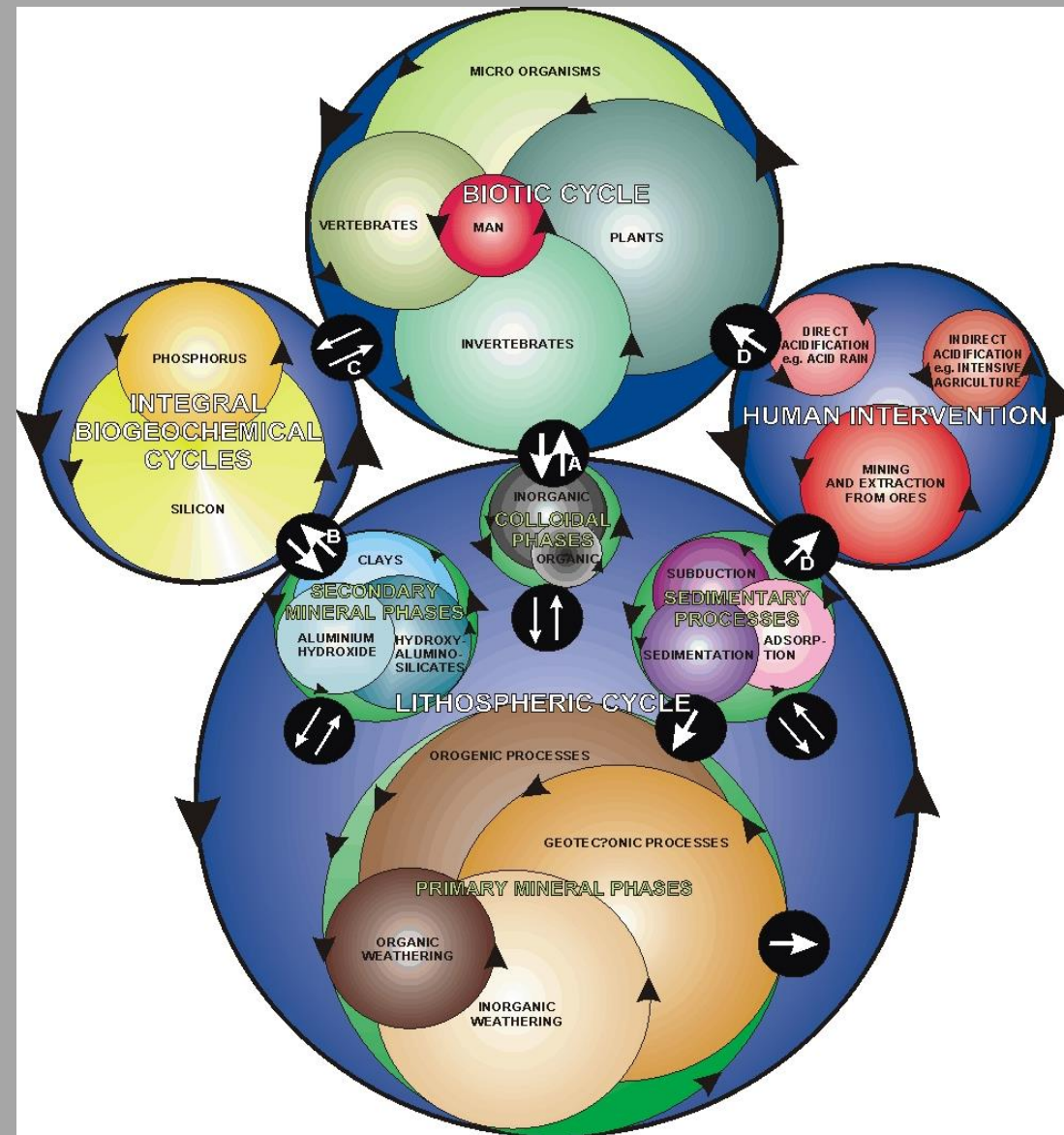
# A Biochemical 'Tree of Life' for the Natural Selection of Aluminium

Exley C (2009) Darwin, natural selection and the biological essentiality of aluminium and silicon.

Trends in Biochemical Sciences 34, 589-593.





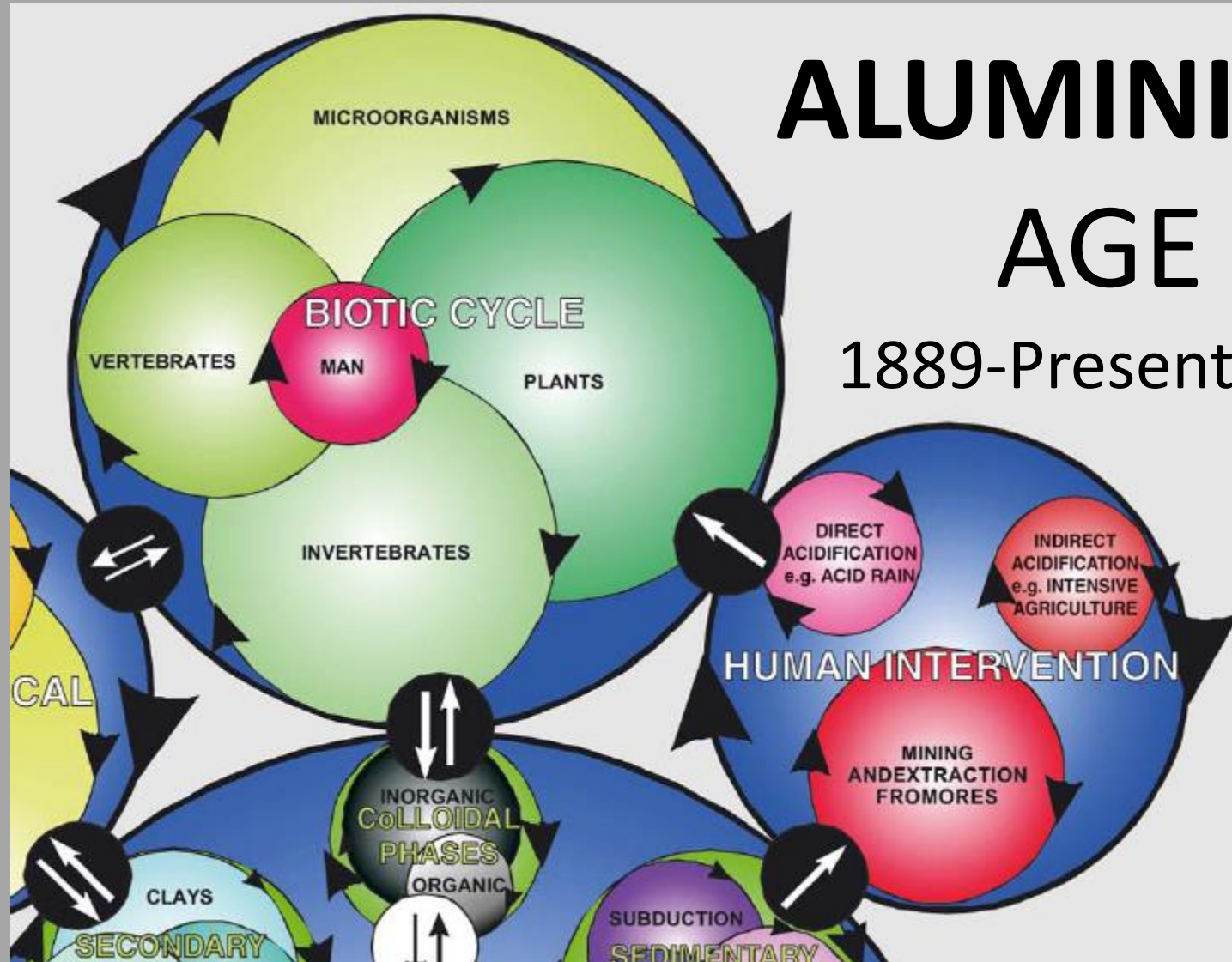


# THE BIOGEOCHEMICAL CYCLE OF ALUMINIUM

Exley C (2003) A biogeochemical cycle for aluminium ? J. Inorg. Biochem. 97, 1-7.

# THE ALUMINIUM AGE

1889-Present Day



<https://www.hippocraticpost.com/mens-health/the-aluminium-age/>

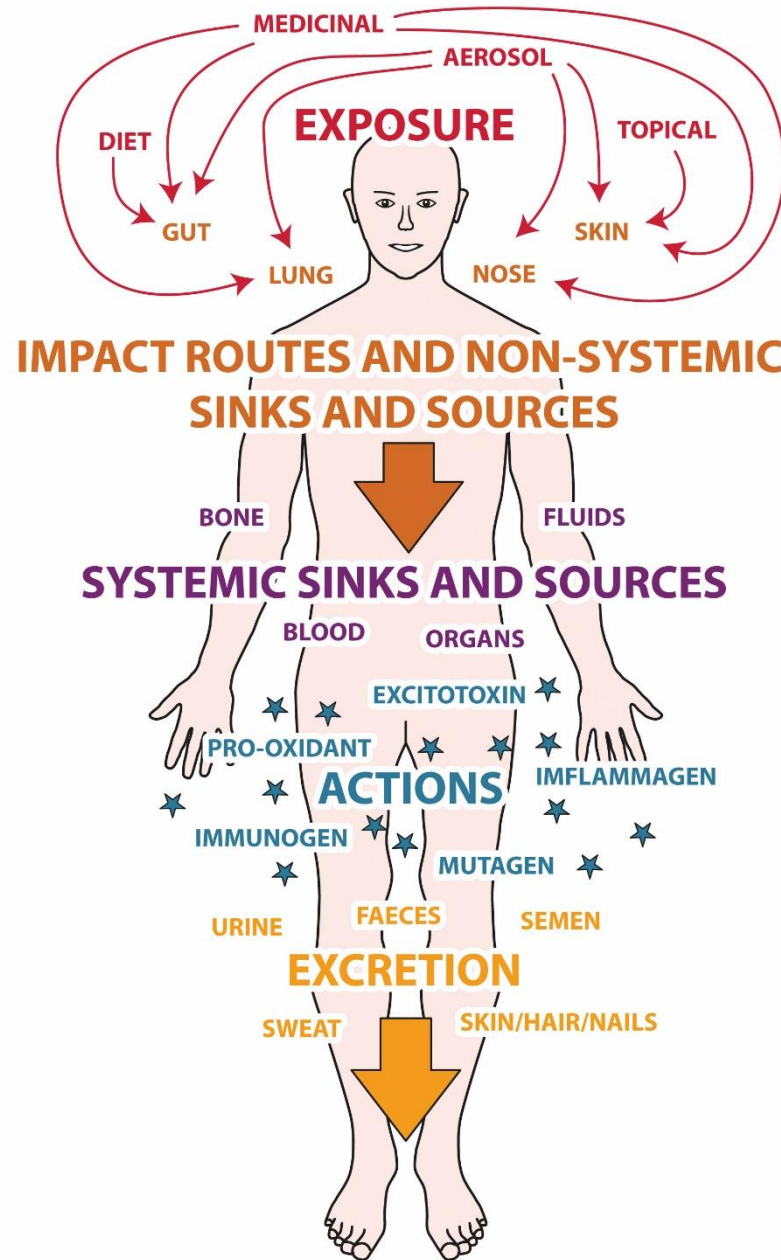
ICNH 8 Dec 2018

*“It is indisputably true to say that the evolving modernity of the last and present centuries could not have been possible and will not continue at its current pace without aluminium metal and all of its salts and compounds.”*

*“ No other metal could be used to make the fuselage of an aeroplane while being the active ingredient in an antiperspirant and also the colouring agent used for a child’s favourite sweet. No other metal shows such a degree of versatility and no other metal, perhaps in history, deserves an ‘age’ like aluminium!”*

<https://www.hippocraticpost.com/mens-health/the-aluminium-age/>

Exley C (2013) Human exposure to aluminium. Environmental Science:Processes and Impacts 15, 1807-1816.



# The Body Burden of Aluminium: What is it?





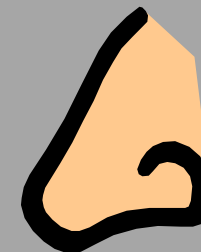
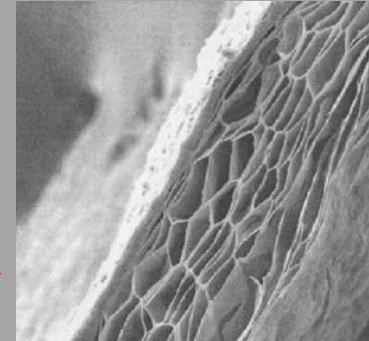


# EXPOSURE

Beverages



Yokel et al. (2001). Toxicology  
16,193-101.

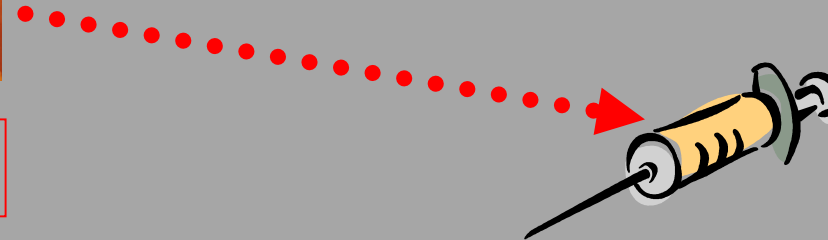
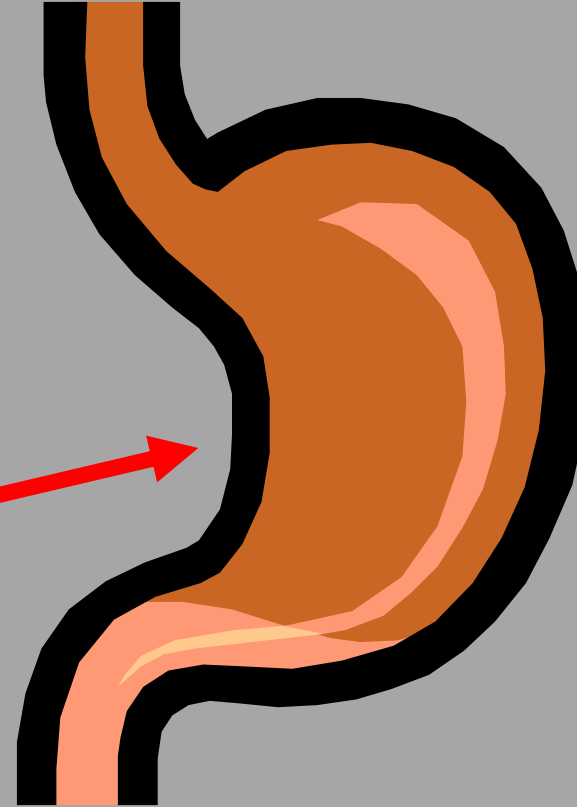


# EXPOSURE



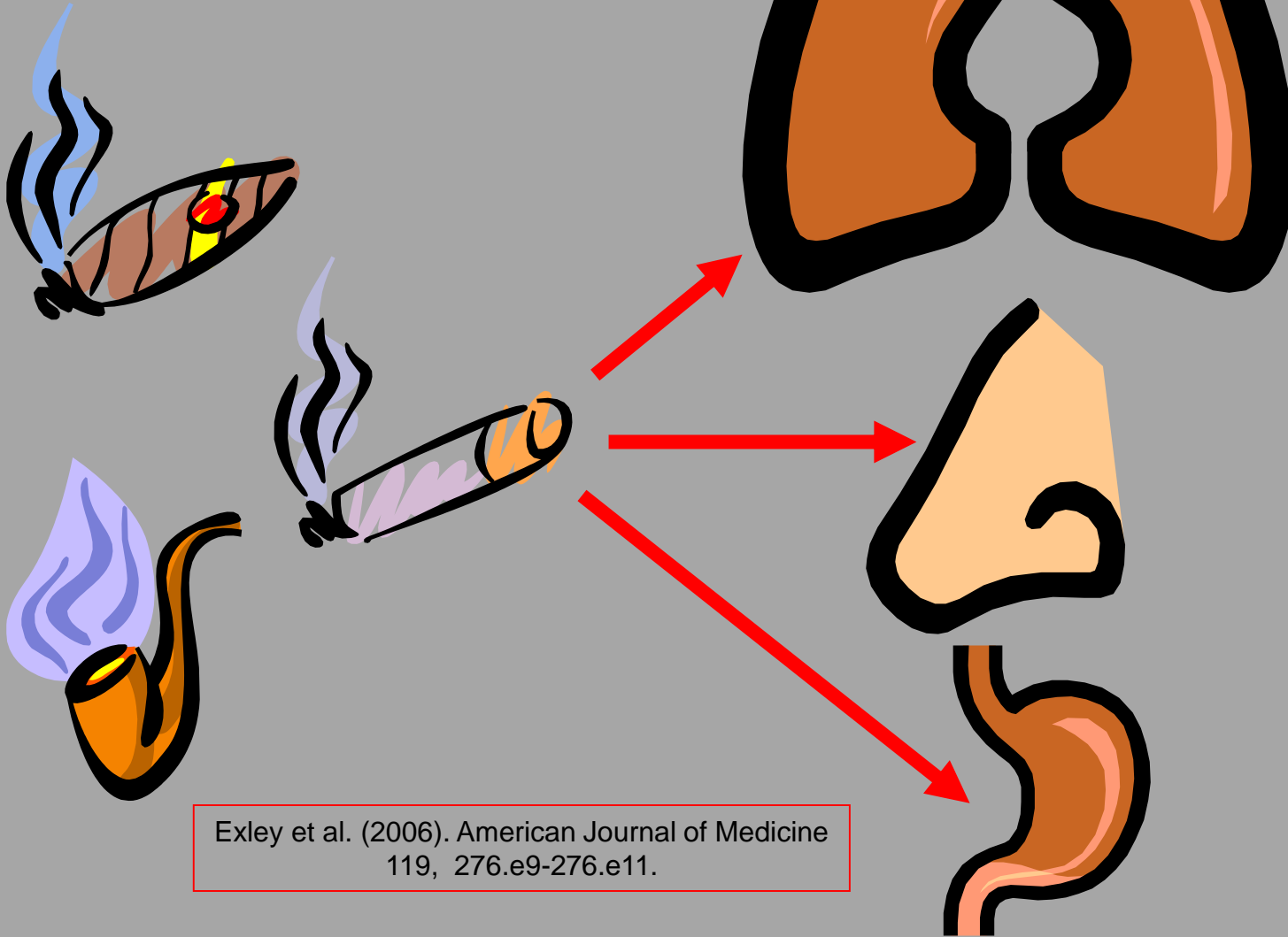
Saiyed & Yokel (2005). Food Additives and Contaminants 22, 234-244.

Food



# EXPOSURE

Recreational  
Drugs



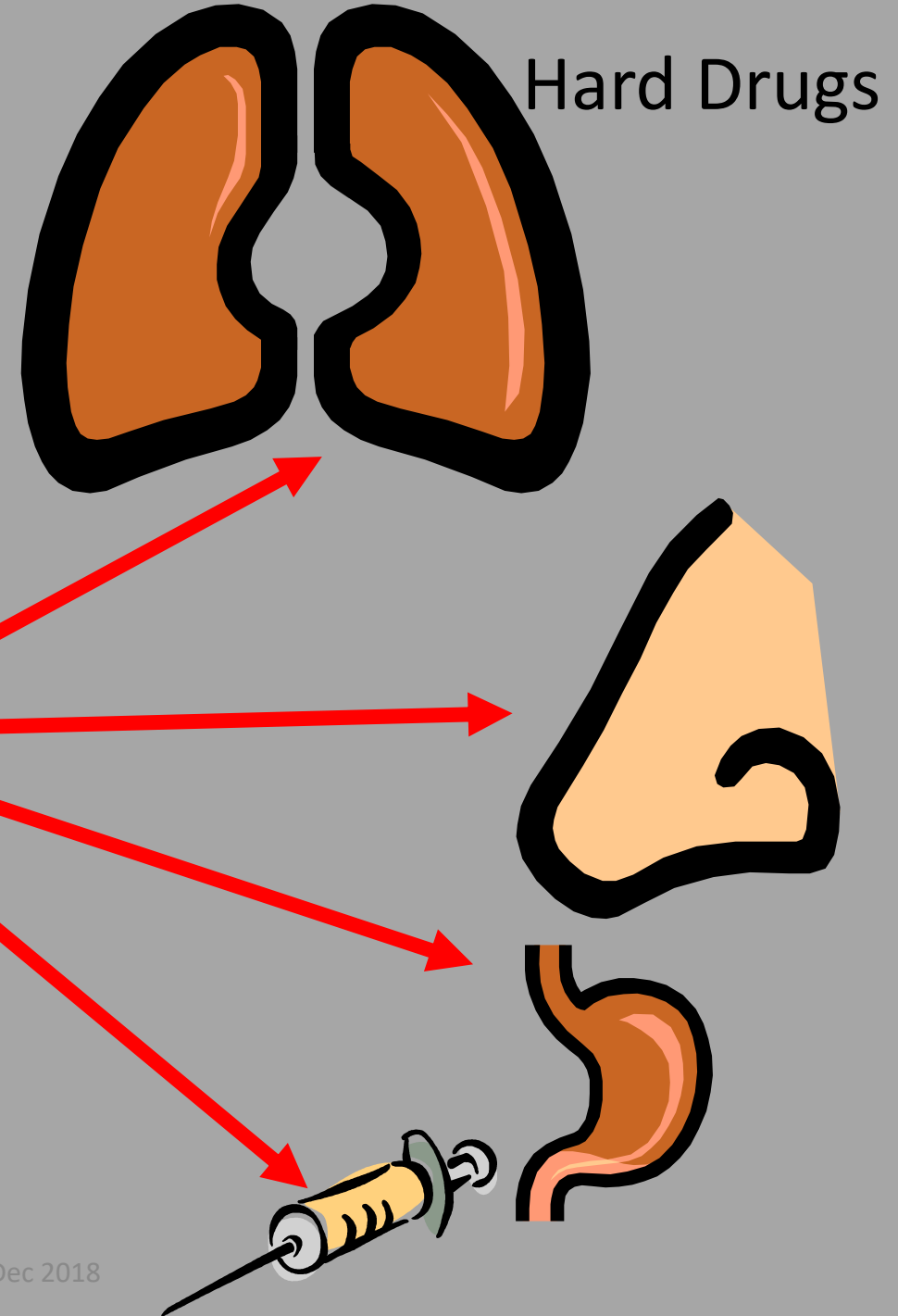
Exley et al. (2006). American Journal of Medicine  
119, 276.e9-276.e11.



# EXPOSURE

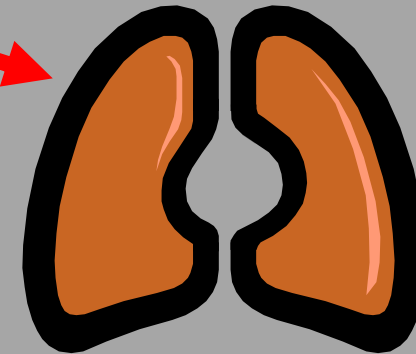
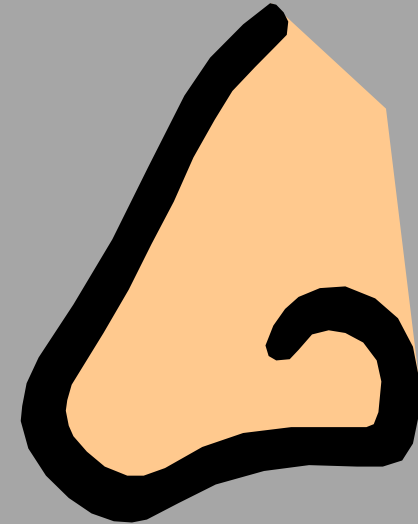
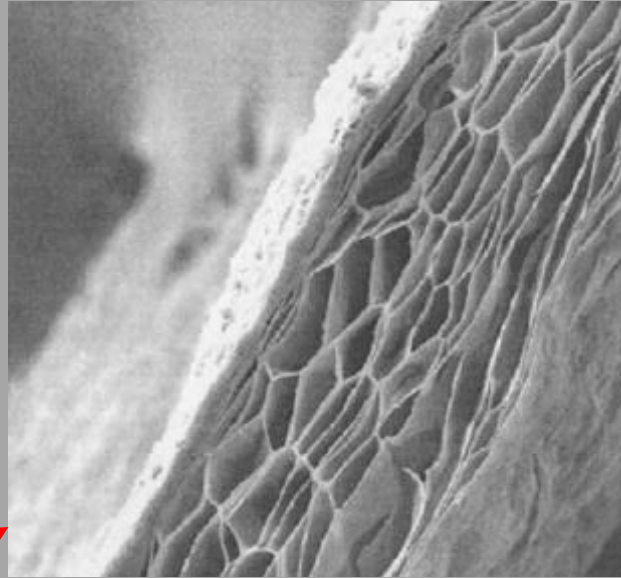


Exley et al. (2007) *Addiction Biology* 12, 197-199.



# EXPOSURE

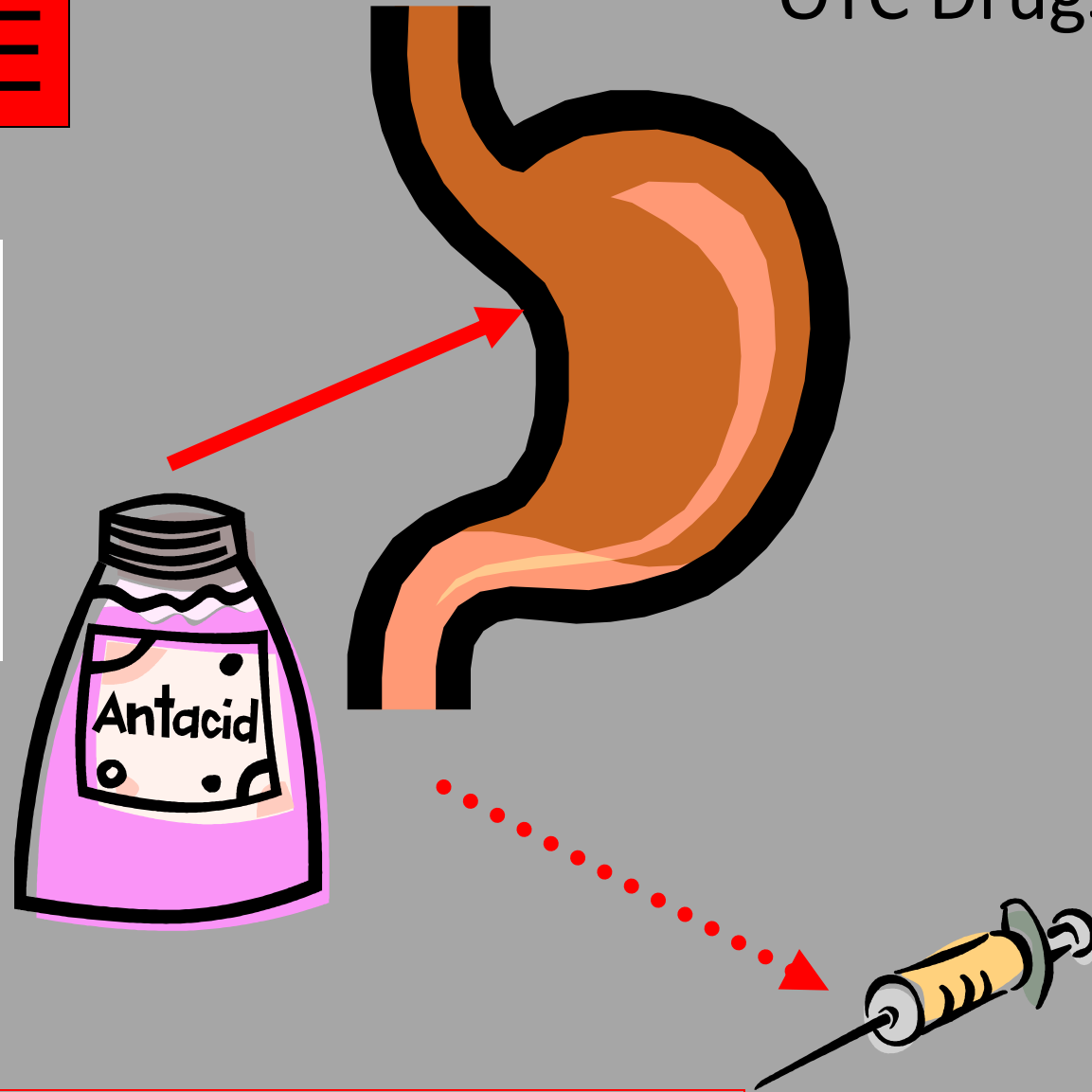
Antiperspirant



Flarend et al. (2001). Food and Chemical Toxicology 39, 163-168.

# EXPOSURE

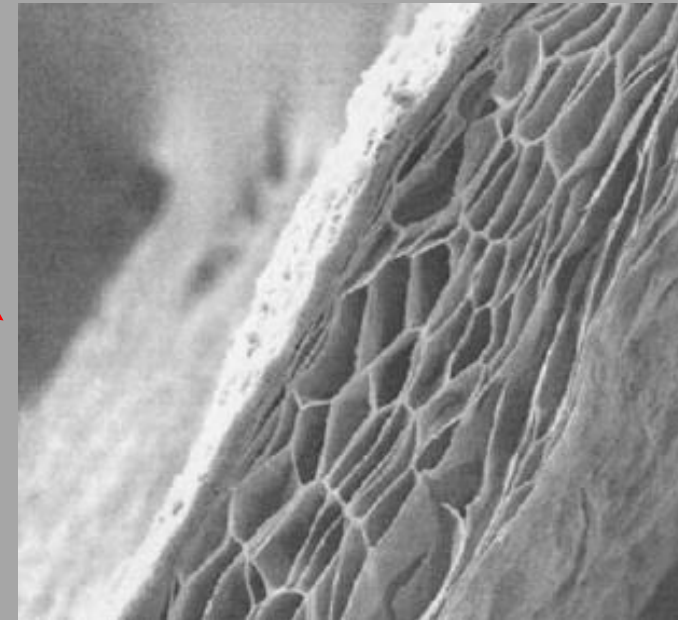
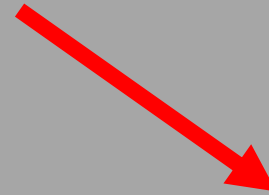
OTC Drugs



Reinke et al. (2003) Drug Safety 26, 1011-1025.

# EXPOSURE

## Cosmetics Including Sun Screens

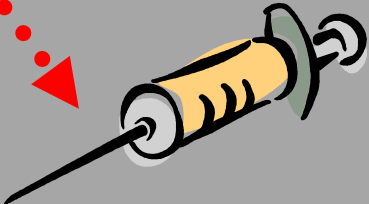
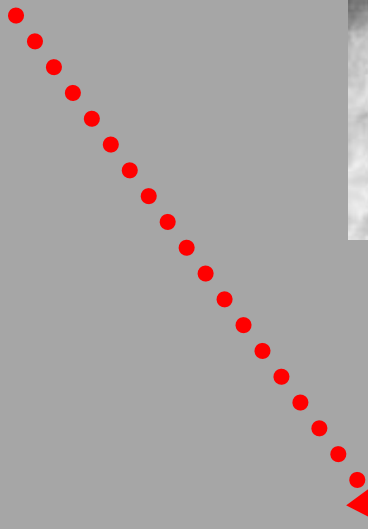
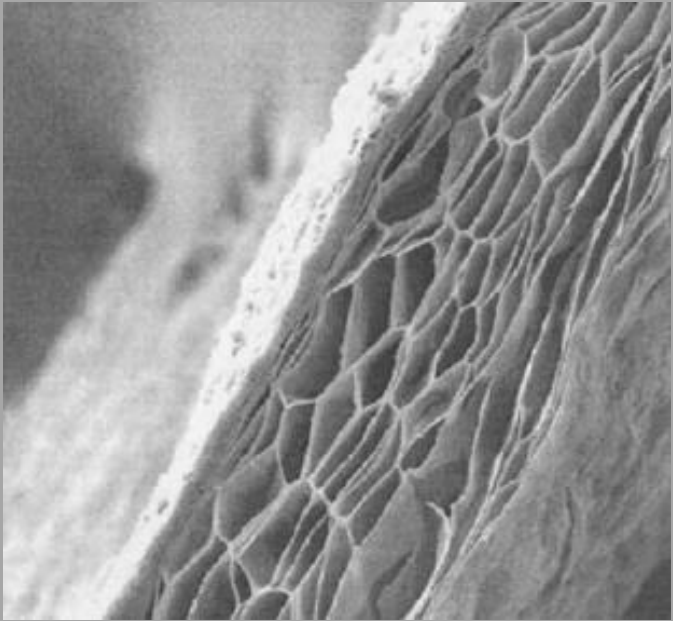


Nicholson & Exley (2007) Free Rad Biol Med 43, 1216-1217.



# EXPOSURE

## Vaccines



Flarend et al. (1997) Vaccine 15,1314-1318.

# EXPOSURE

## Infant Formulas



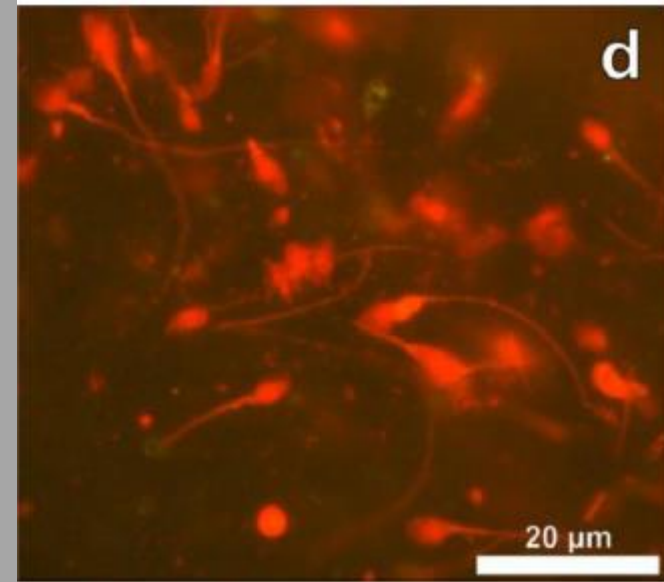
Burrell & Exley (2010) BMC Pediatrics 10, 63. <https://bmcpediatr.biomedcentral.com/articles/10.1186/1471-2431-10-63>

Chuchu et al. (2013) BMC Pediatrics 13, 162. <https://bmcpediatr.biomedcentral.com/articles/10.1186/1471-2431-13-162>

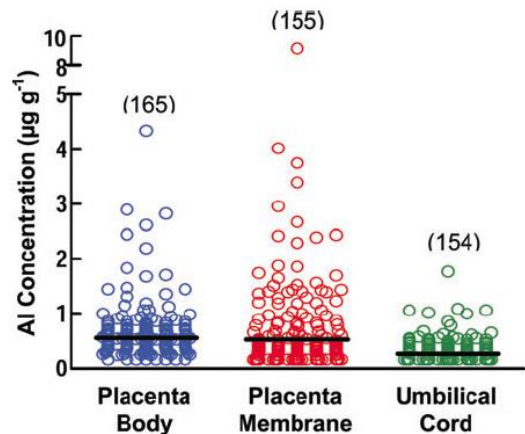
# Reproduction



Human exposure to  
aluminium  
begins at conception!



Klein JP, Mold M, Mery L, Cottier M and Exley C  
(2014) Reproductive Toxicology 50, 43-48.



**Fig. 3** Scatter dot plot showing geometric mean and range for Al ( $\mu\text{g g}^{-1}$ ) in each placental tissue component. Each data point represents the average Al concentration measured by duplicate analysis of a sample. Black horizontal lines indicate geometric mean concentrations for each sample component. Numbers in parentheses indicate the number of placenta samples analyzed for each component.

Kruger PC, Schell LM, Stark AD and Parsons PJ (2010)  
Metallomics 2, 621-627.

Living in 'The Aluminium Age' ensures our body burden of Al

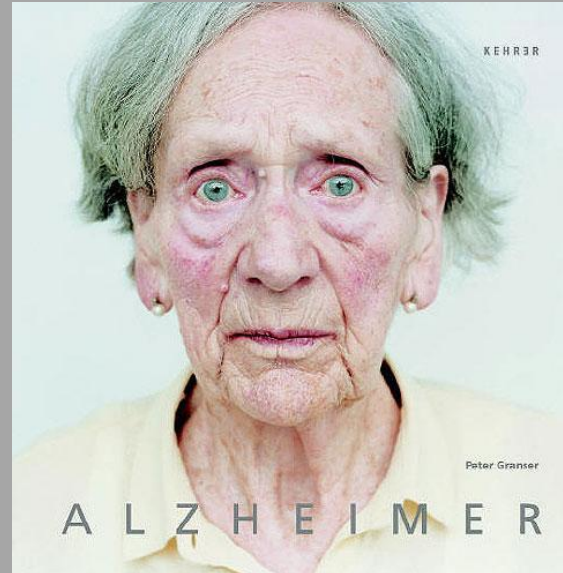
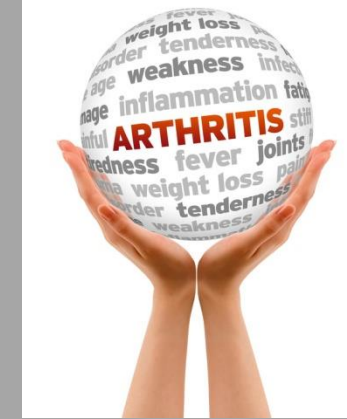
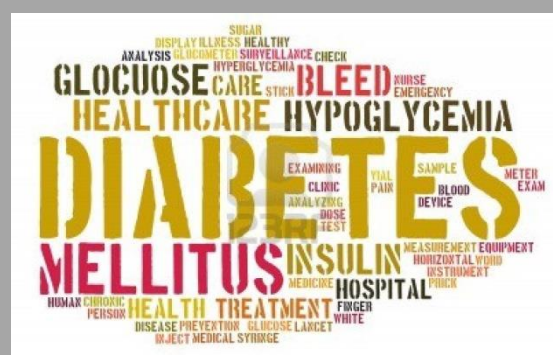
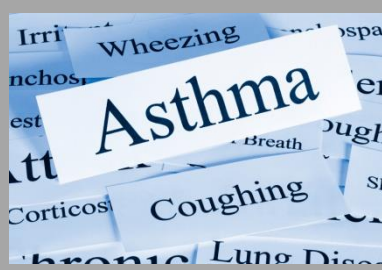




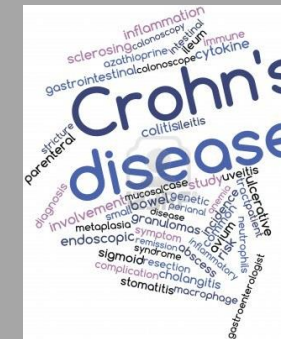
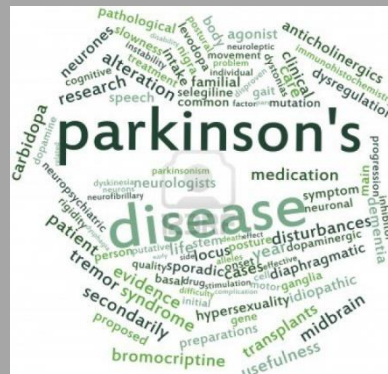
# What About Excretion of Aluminium from the Body?



Minshall C et al. (2014) Journal of Trace Elements in Medicine and Biology 28, 87-88



researching the cure



# THE ALUMINIUM AGE?

<https://www.hippocraticpost.com/mens-health/the-aluminium-age/>



Awareness

ICNH 8 Dec 2018



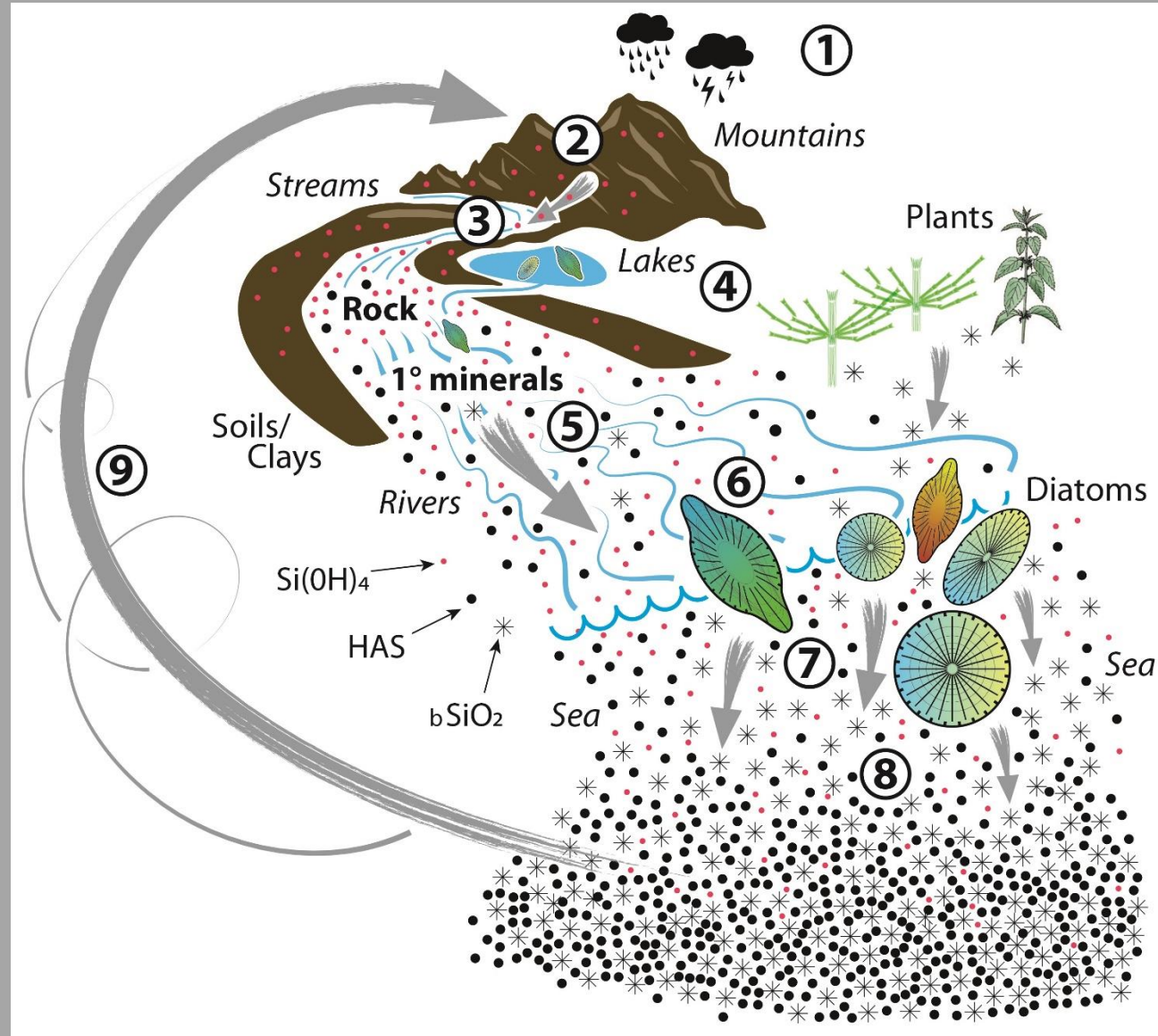
Unmasking Osteomalacia





# THE SILICIC ACID CYCLE

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

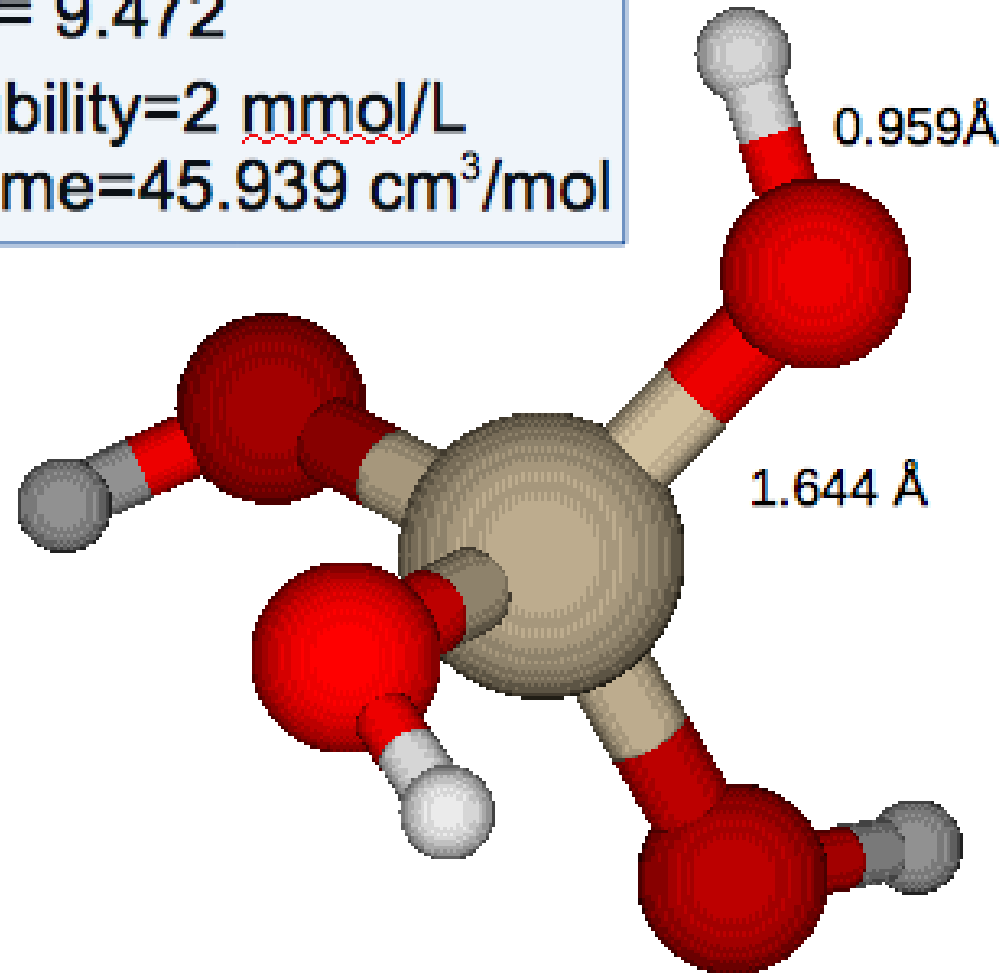


# Silicic Acid

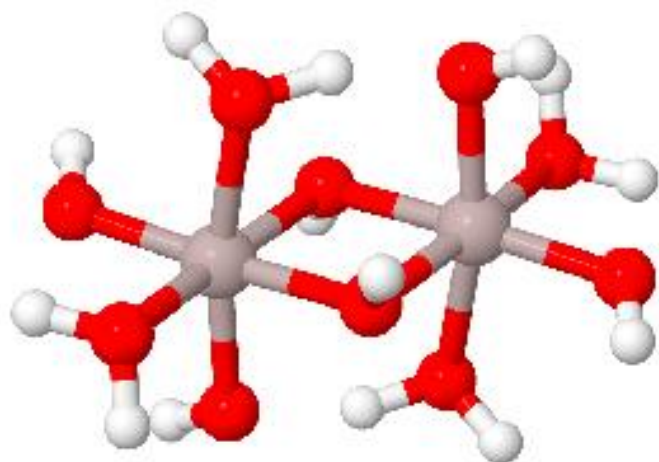
$\text{pK}_a = 9.472$

Solubility=2 mmol/L

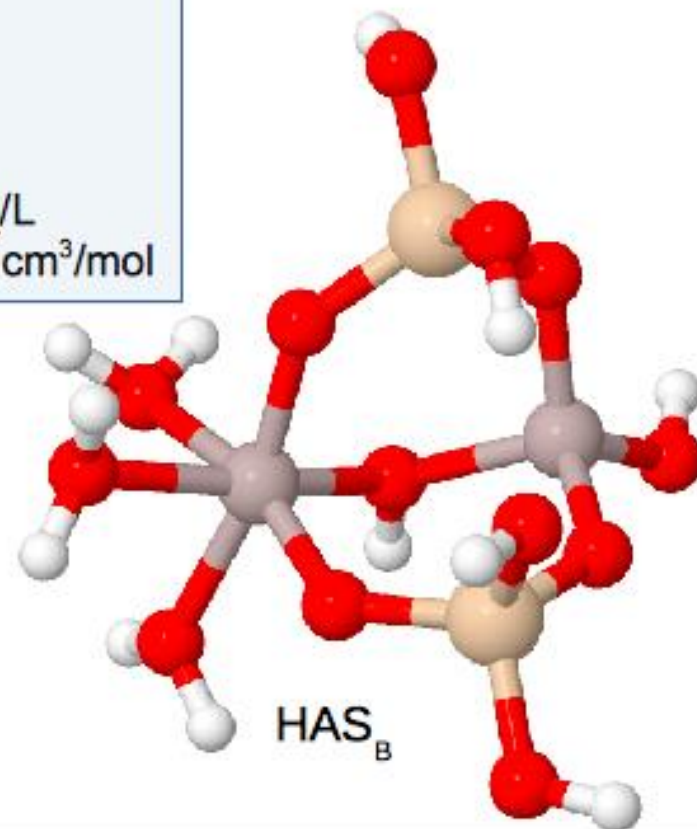
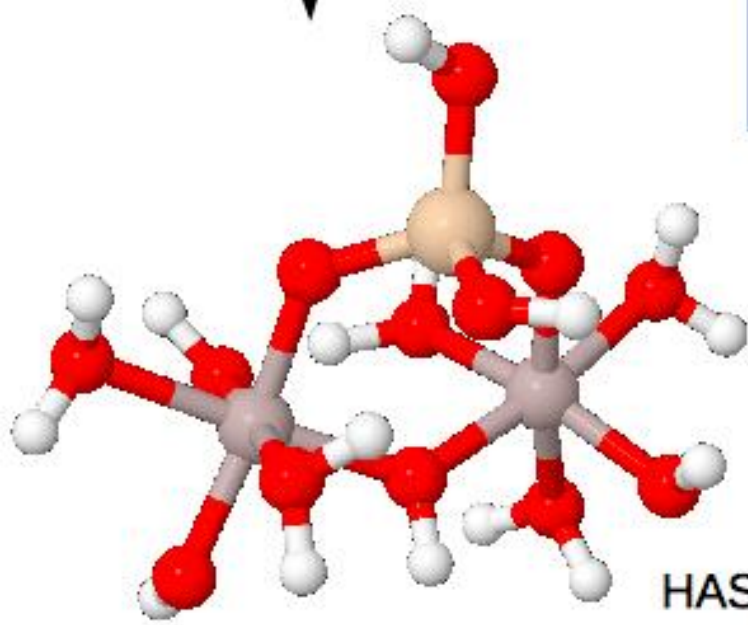
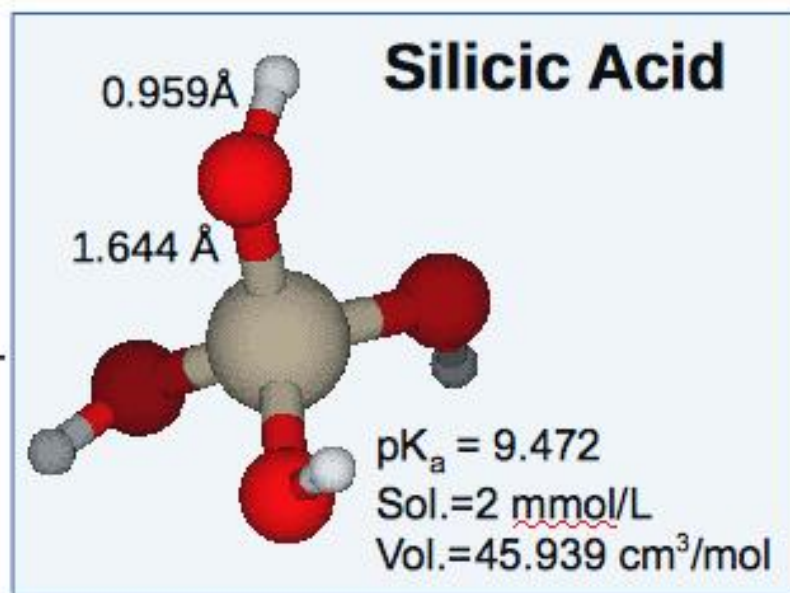
Volume=45.939  $\text{cm}^3/\text{mol}$



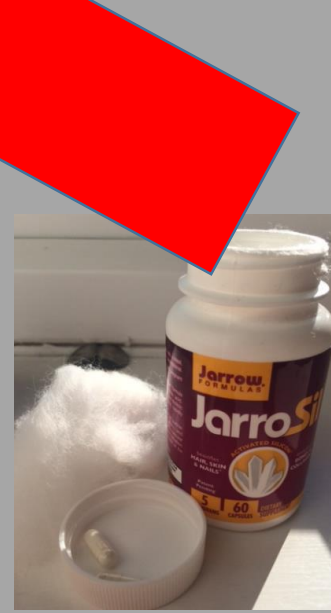




Aluminium Hydroxide



# SILICON/SILICA SUPPLEMENTS



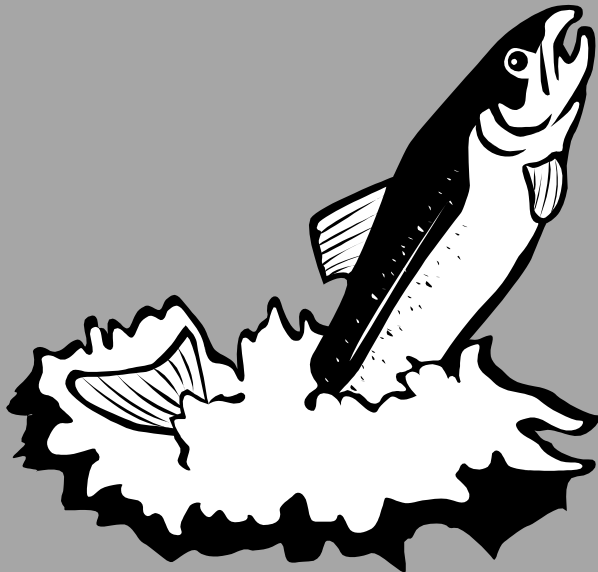
# A Bioinorganic Solution to Aluminium-Related Disease?

**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**



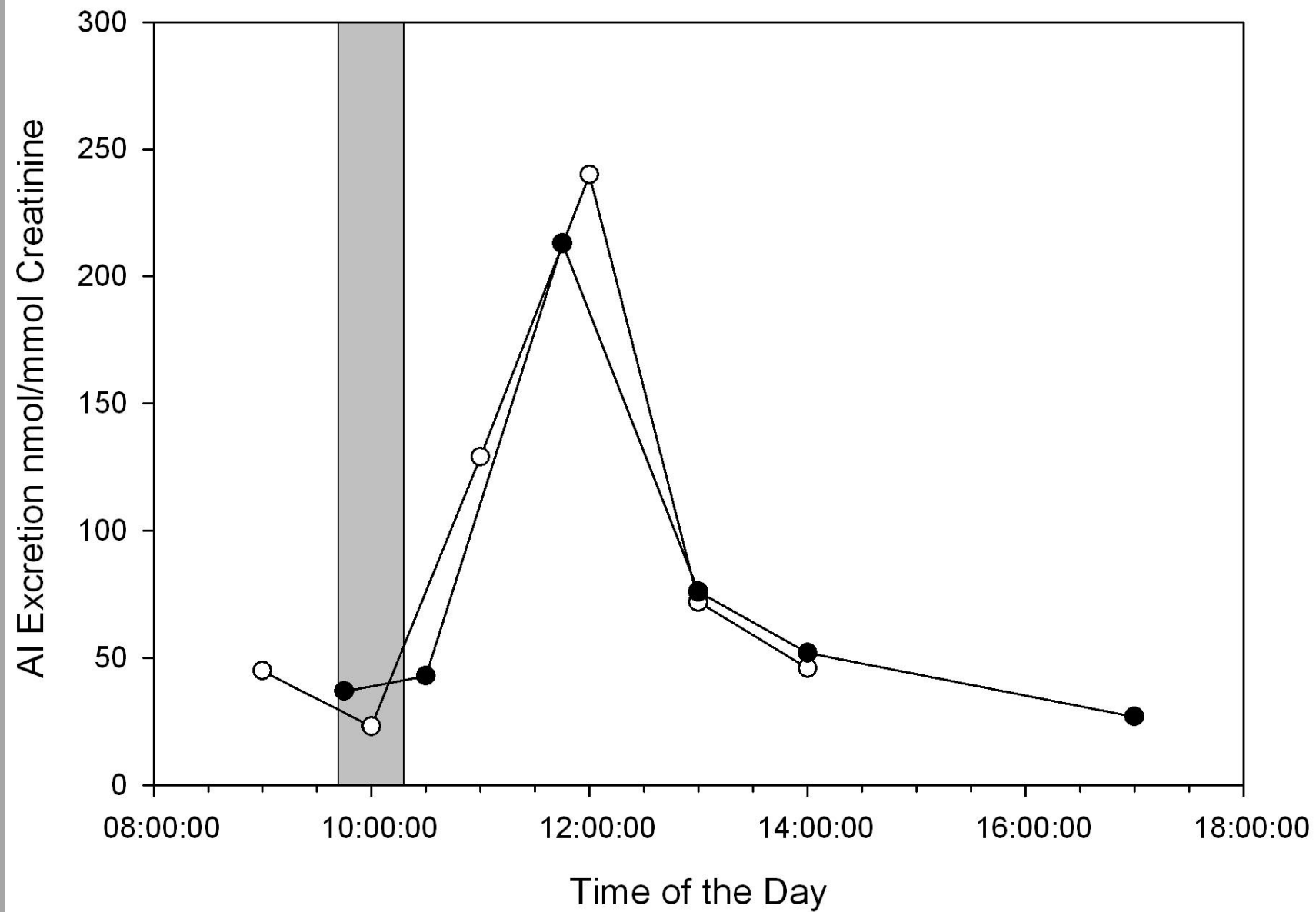
**2006**

**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**







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

Christopher Exley<sup>a,\*</sup>, Olga Korchazhkina<sup>b</sup>, Deborah Job<sup>c</sup>, Stanislav Strekopytov<sup>a</sup>,  
Anthony Polwart<sup>d</sup> and Peter Crome<sup>c,e</sup>

<sup>a</sup>*Birchall Centre for Inorganic Chemistry and Materials Science, Keele University, Staffordshire, UK*

<sup>b</sup>*Institute for Science and Technology in Medicine, Keele University, Staffordshire, UK*

<sup>c</sup>*Department of Gerontology, University Hospital of North Staffordshire, Staffordshire, UK*

<sup>d</sup>*Life Sciences, Keele University, Staffordshire, UK*

<sup>e</sup>*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.



## The Second Test!

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

Samantha Davenward<sup>a</sup>, Peter Bentham<sup>b</sup>, Jan Wright<sup>b</sup>, Peter Crome<sup>c</sup>, Deborah Job<sup>c</sup>, Anthony Polwart<sup>d</sup> and Christopher Exley<sup>a,\*</sup>

<sup>a</sup>*The Birchall Centre, Lennard-Jones Laboratories, Keele University, Stoke-on-Trent, Staffordshire, UK*

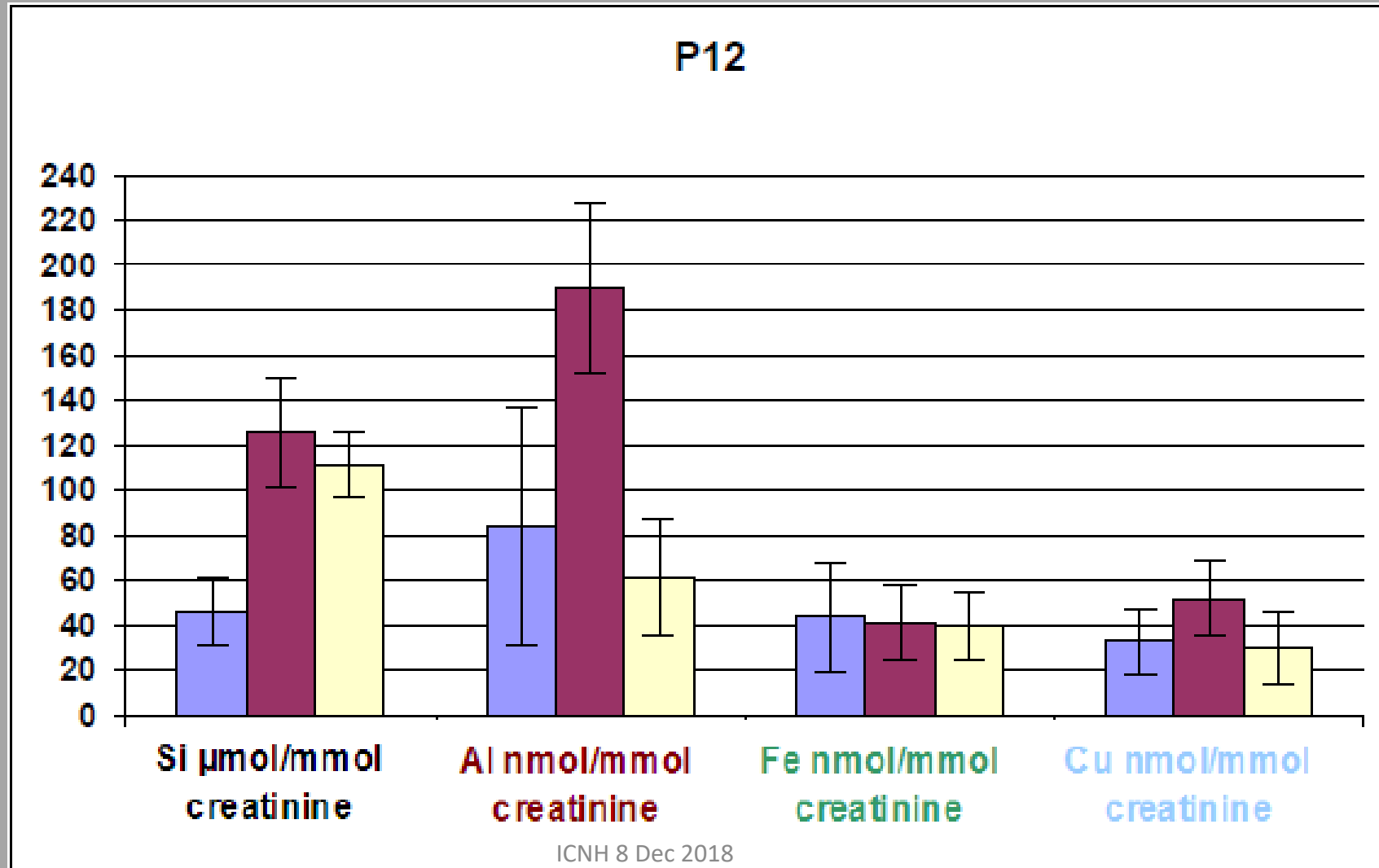
<sup>b</sup>*Birmingham and Solihull Mental Health NHS Foundation Trust, The Barberry Centre, Birmingham, UK*

<sup>c</sup>*North Staffordshire Combined Healthcare NHS Trust, Harplands Hospital, Stoke-on-Trent, UK*

<sup>d</sup>*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

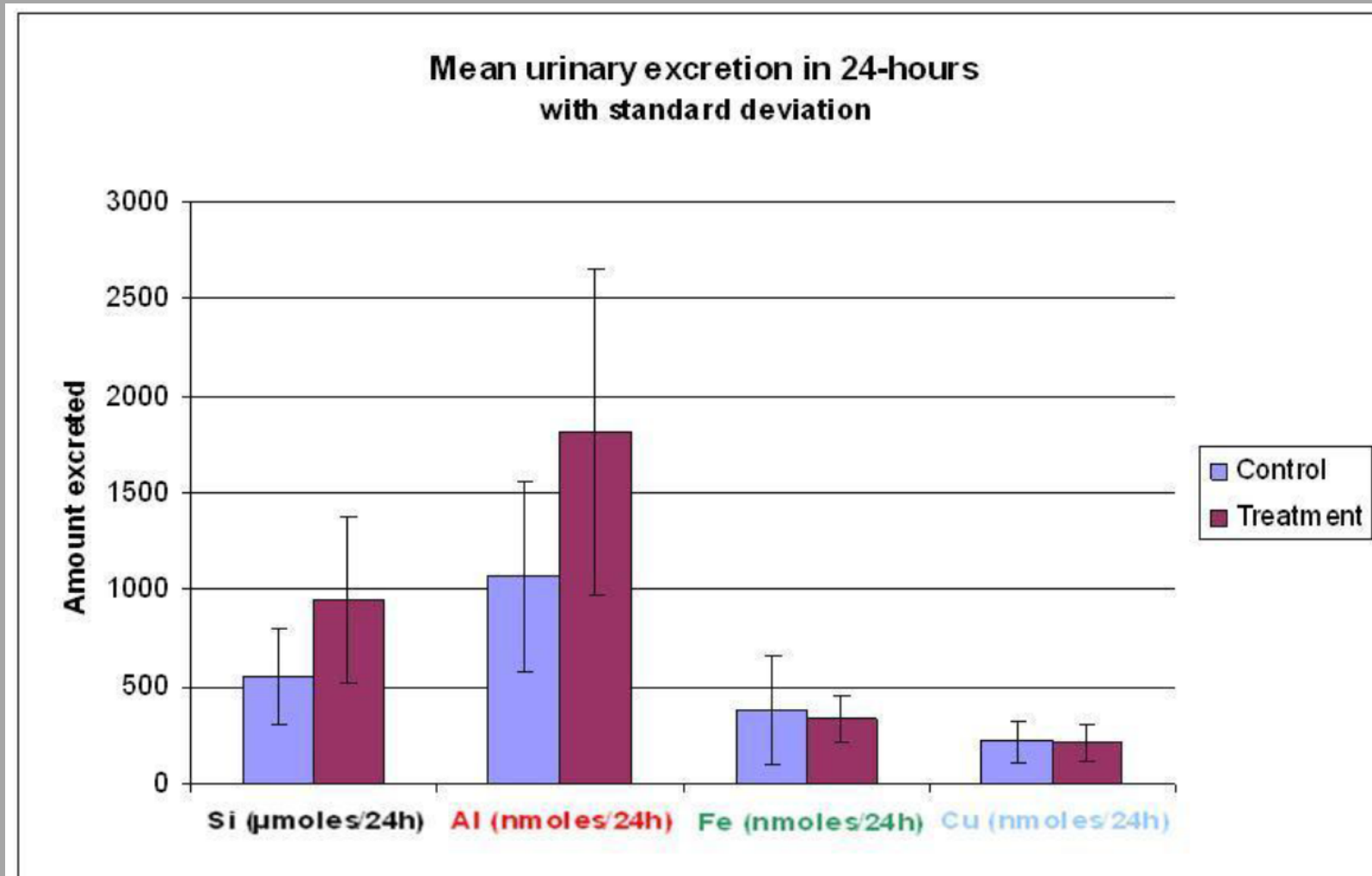


Figure 3.1.4.2: **Mean** amounts and standard deviation bars of excreted Si ( $\mu\text{moles}/24\text{h}$ ), Al, Fe and Cu ( $\text{nmoles}/24\text{h}$ ) in the control and treatment samples.



Contents lists available at ScienceDirect

EBioMedicine

journal homepage: [www.ebiomedicine.com](http://www.ebiomedicine.com)



Research Paper

# Urinary Excretion of Aluminium and Silicon in Secondary Progressive Multiple Sclerosis



Krista Jones<sup>a</sup>, Caroline Linhart<sup>b</sup>, Clive Hawkins<sup>c</sup>, Christopher Exley<sup>a,\*</sup>

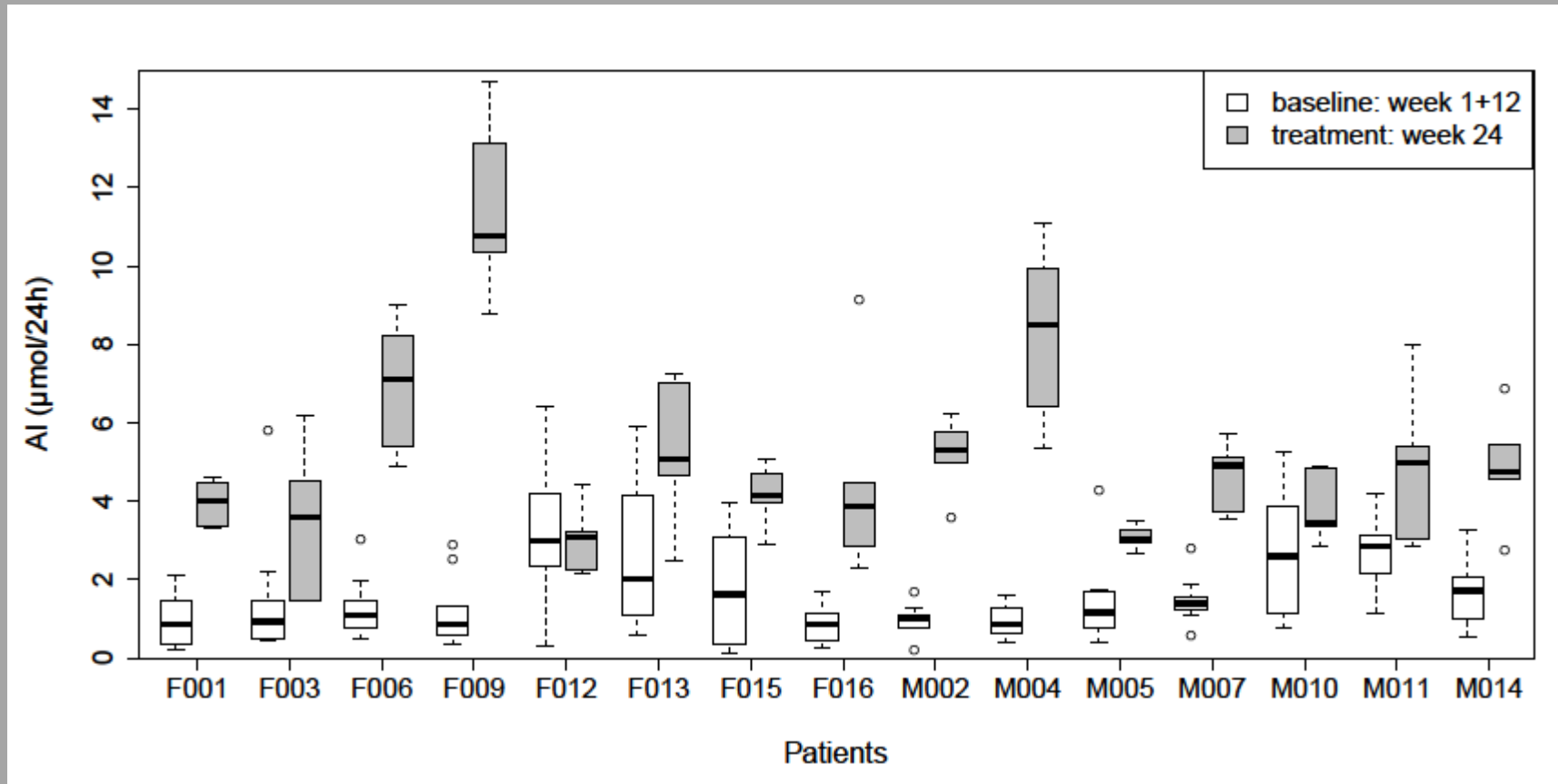
<sup>a</sup> *The Birchall Centre, Lennard-Jones Laboratories, Keele University, United Kingdom*

<sup>b</sup> *Department of Medical Statistics, Informatics and Health Economics, Medical University of Innsbruck, Austria*

<sup>c</sup> *Institute of Science and Technology in Medicine, Keele University, United Kingdom*

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

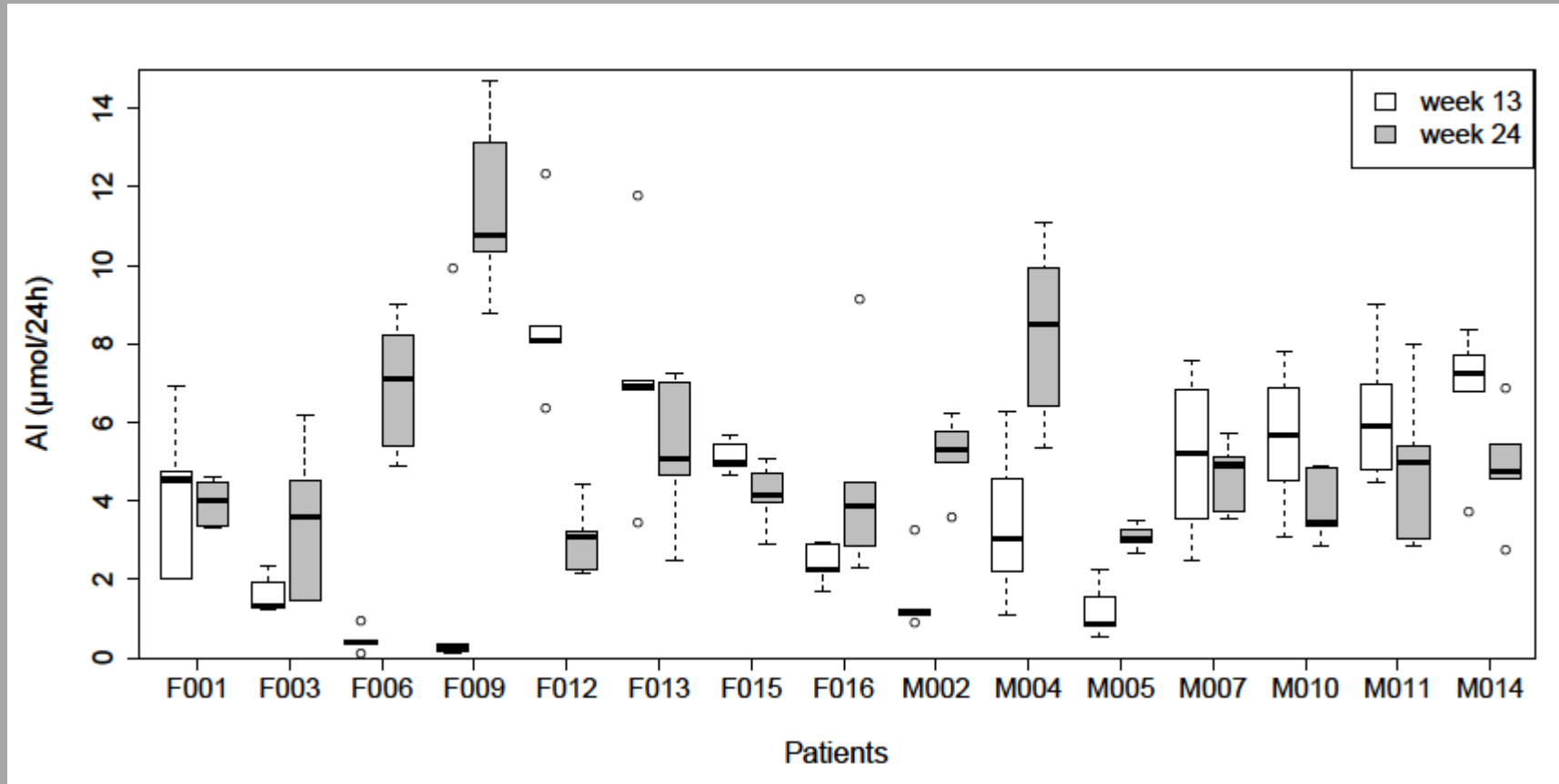
# Multiple Sclerosis



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



# 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!*

**AI MAN**



The Birchall Centre, Keele University and  
Centro de Investigación Científica de Yucatán



THE THIRTEENTH  
KEELE MEETING ON  
**Aluminium**

**Future Challenges in  
the Aluminium Age**

**23<sup>rd</sup>**  
**27<sup>th</sup>**  
March  
**2019**

Hotel Uxmal Resort Maya  
Yucatán, México



**Keele**  
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