



THE BIRCHALL CENTRE



Innovations in Inorganic and Materials Chemistry

Living in the Aluminium Age

Christopher Exley PhD FRSB

Professor of Bioinorganic Chemistry

Aluminium and Silicon Research Group

The Birchall Centre, Lennard-Jones Laboratories,

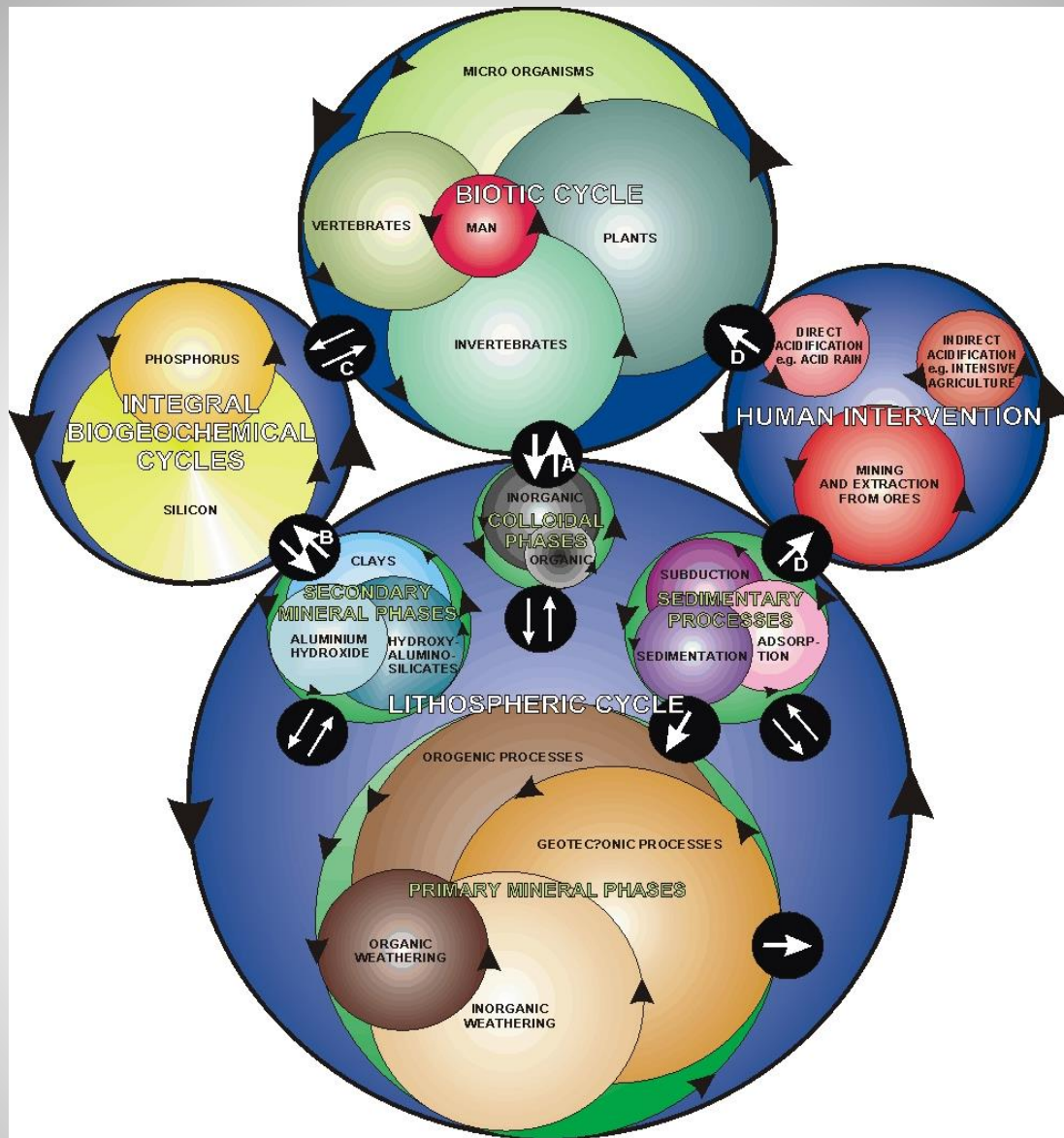
Keele University, Staffordshire, ST5 5BG, UK

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

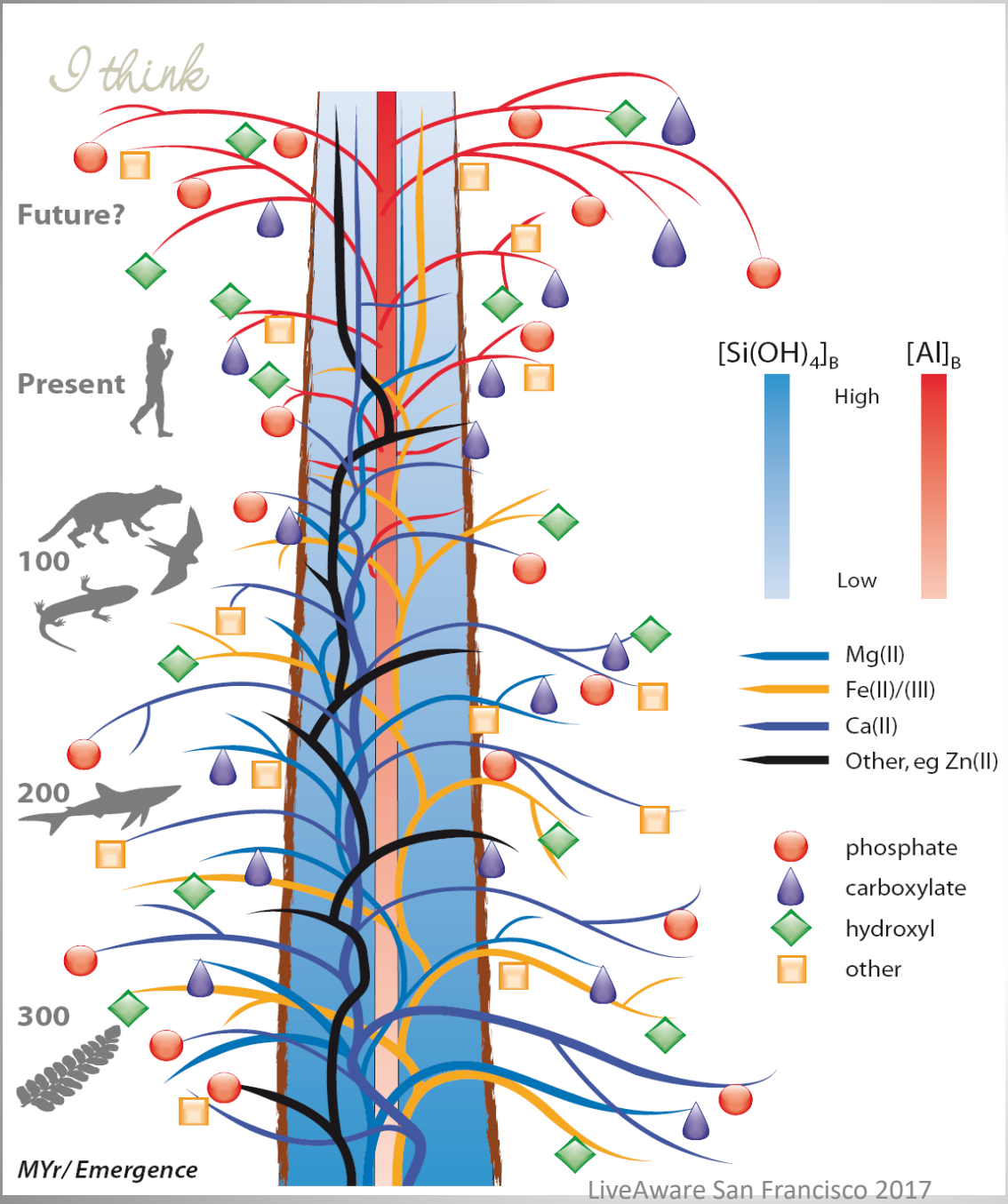
Honorary Professor, University of the Highlands and Islands,
Scotland, UK





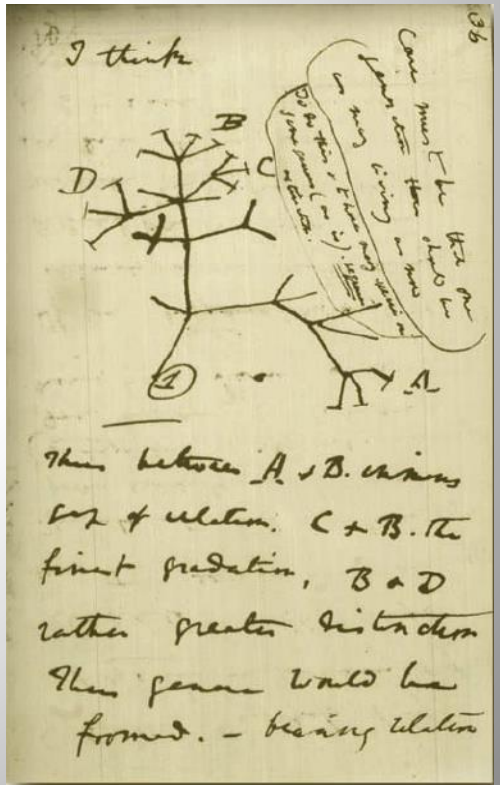
THE BIOGEOCHEMICAL CYCLE OF ALUMINIUM

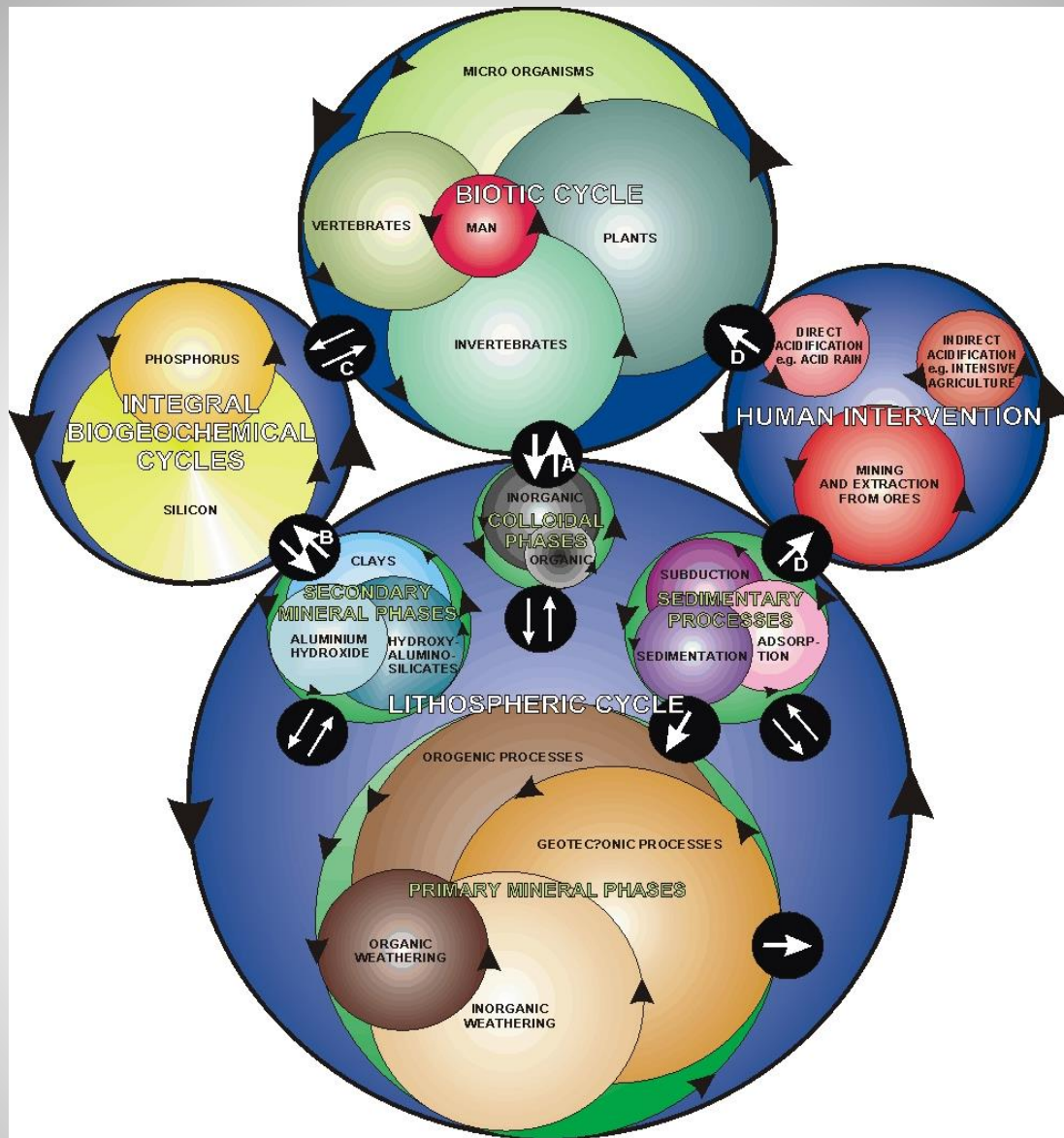
Exley C (2003) A biogeochemical cycle for aluminium? *J. Inorg. Biochem.* 97, 1-7.



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.



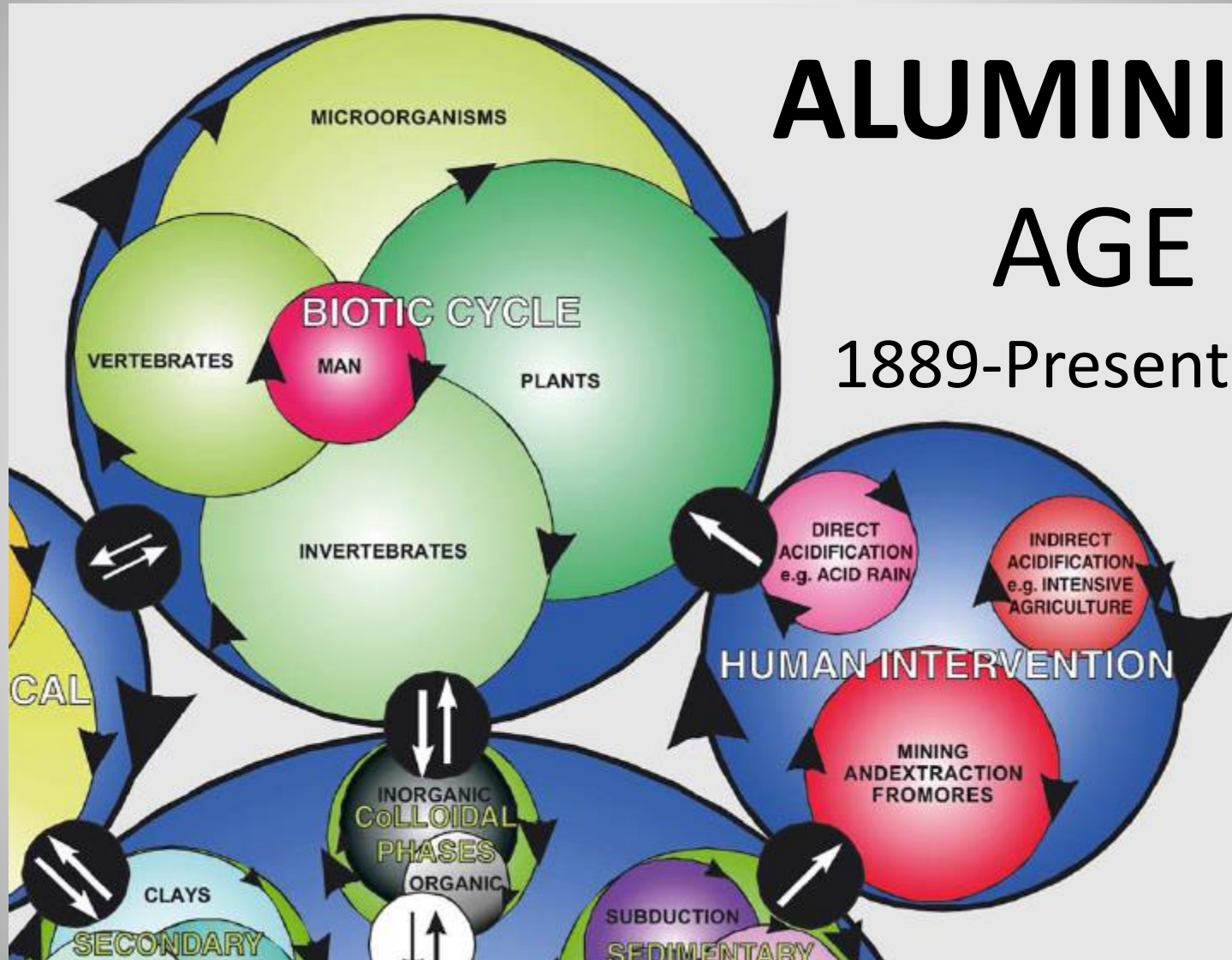


THE BIOGEOCHEMICAL CYCLE OF ALUMINIUM

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

THE ALUMINIUM AGE

1889-Present Day



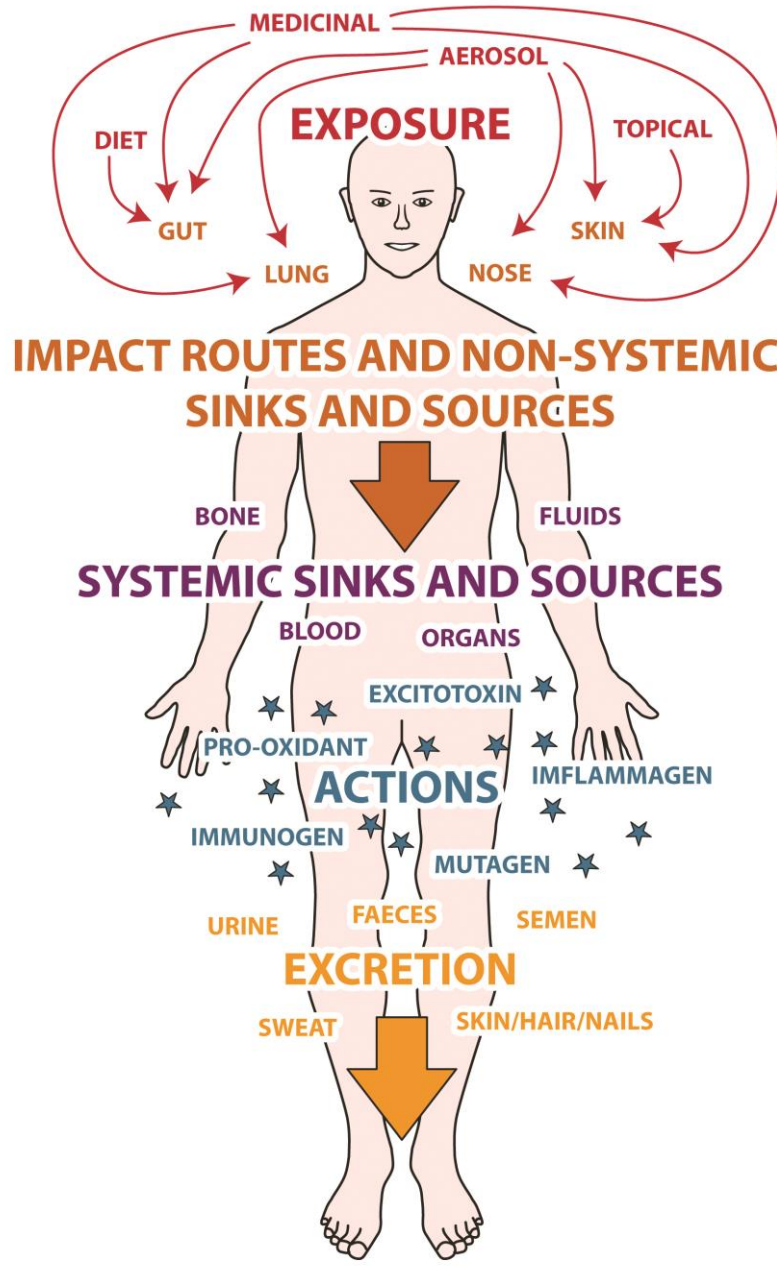
<https://www.hippocraticpost.com/mens-health/the-aluminium-age/>

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“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.

<http://pubs.rsc.org/en/content/articlepdf/2013/em/c3em00374d>

The Body Burden of Aluminium: What is it?



EXPOSURE



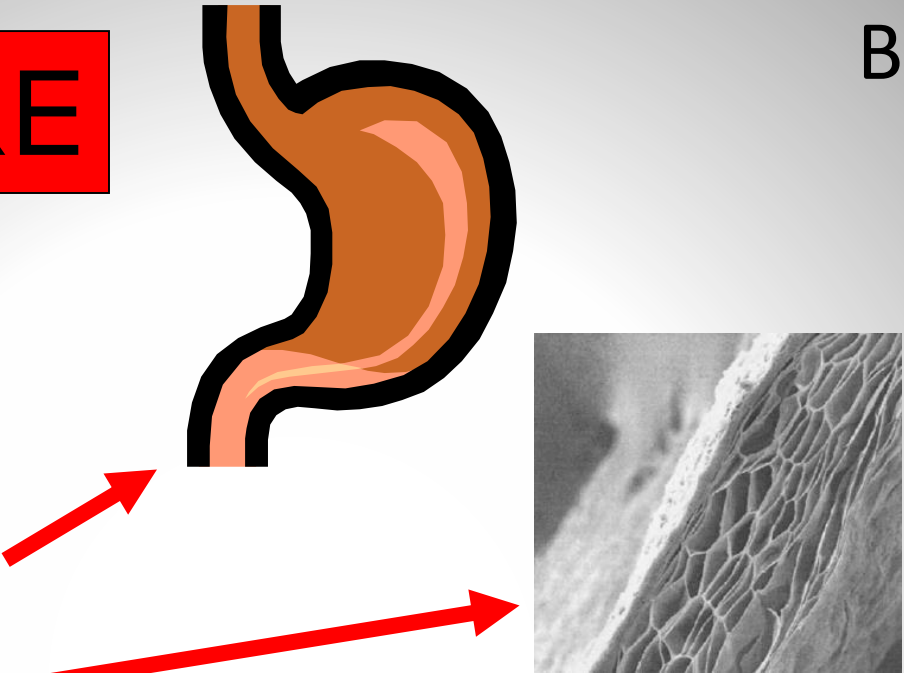
BURDEN



EXCRETION

EXPOSURE

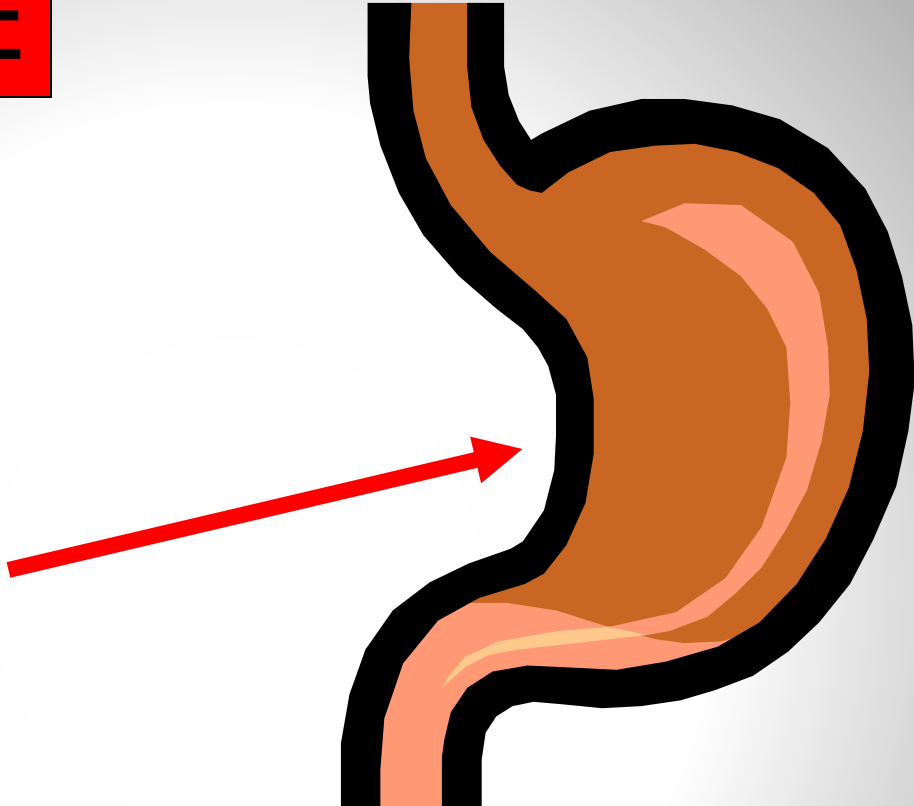
Beverages



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

EXPOSURE

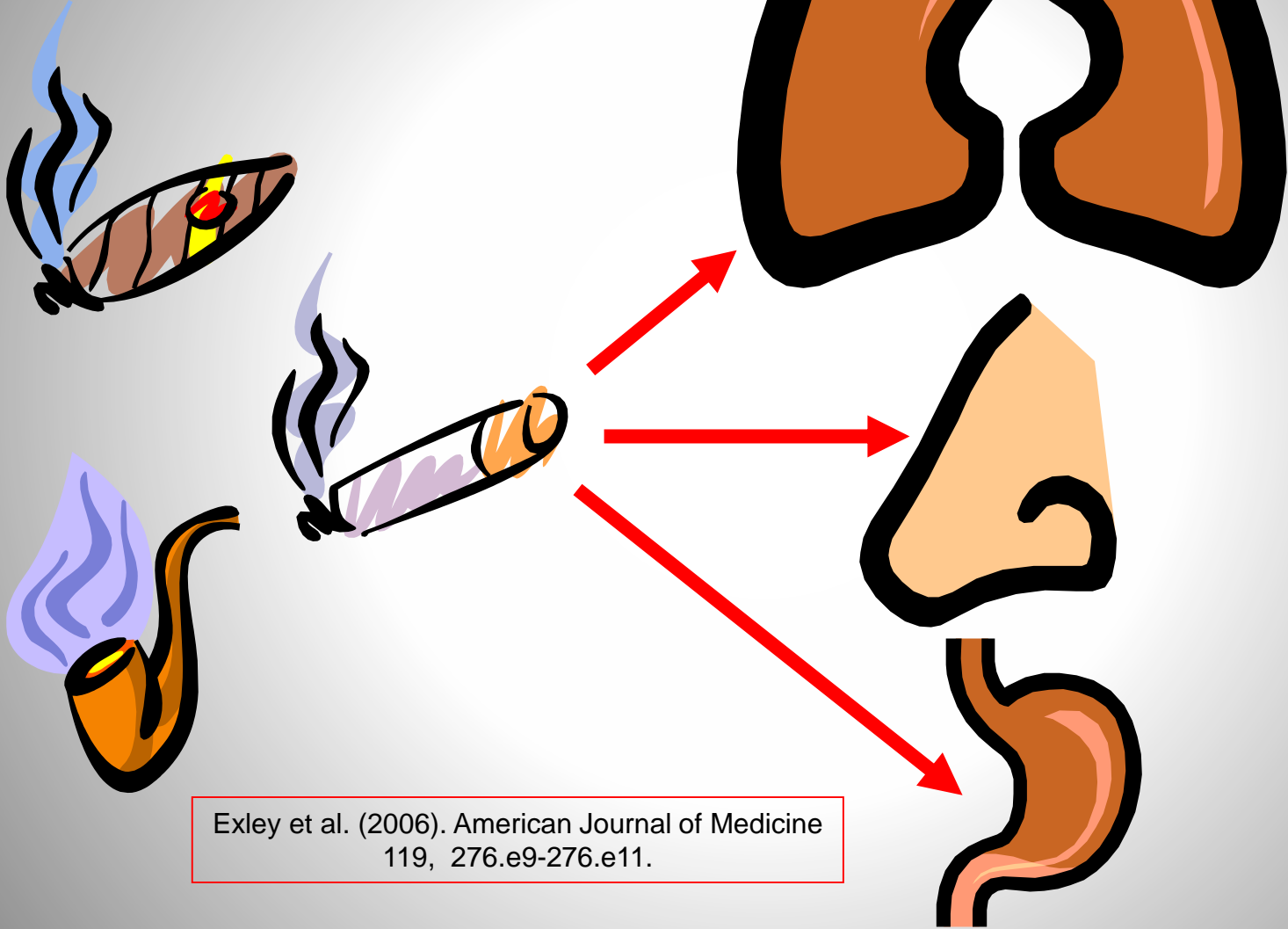
Food



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

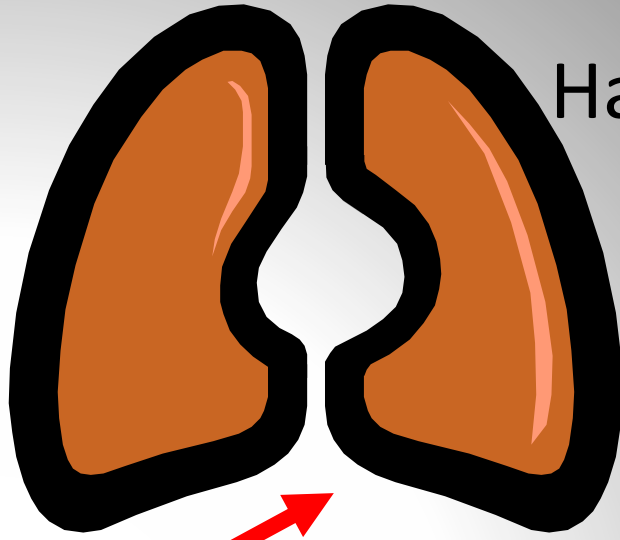
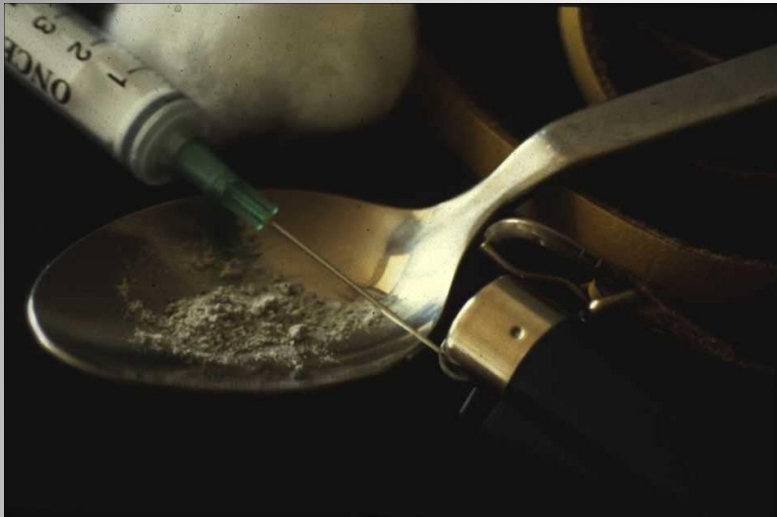
EXPOSURE

Recreational
Drugs

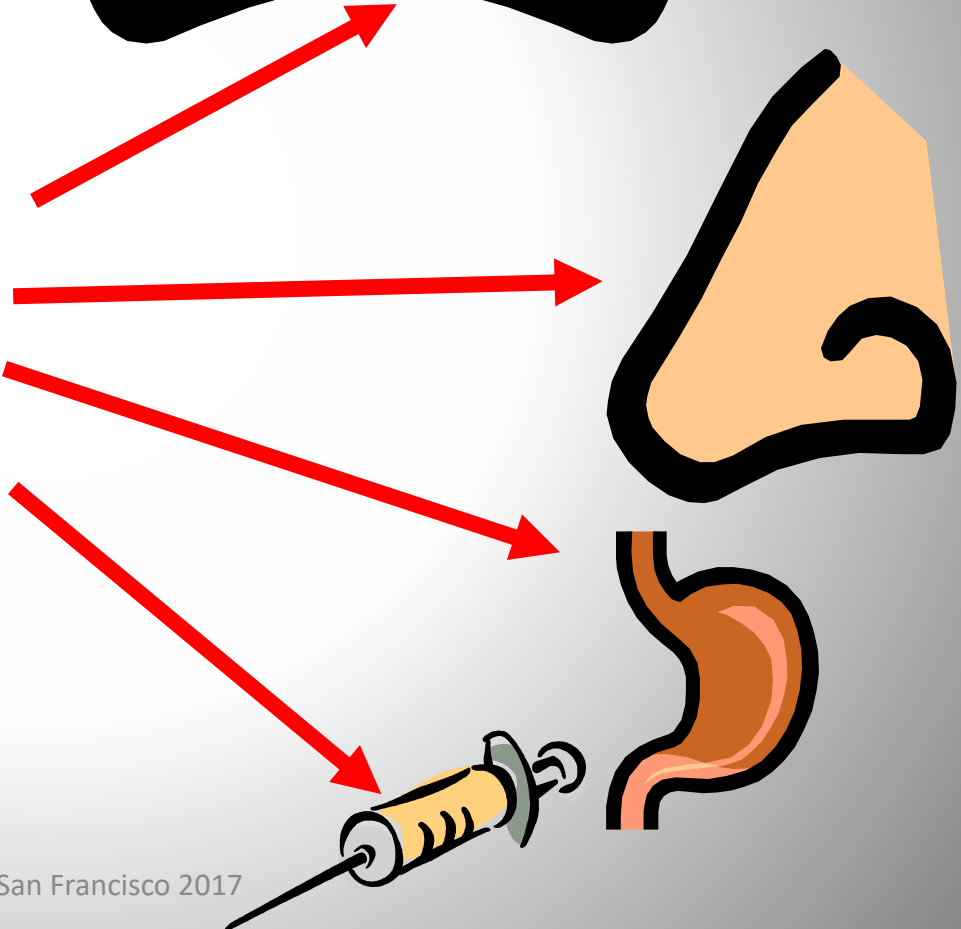


Exley et al. (2006). American Journal of Medicine
119, 276.e9-276.e11.

EXPOSURE



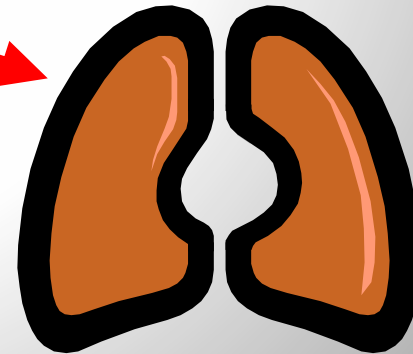
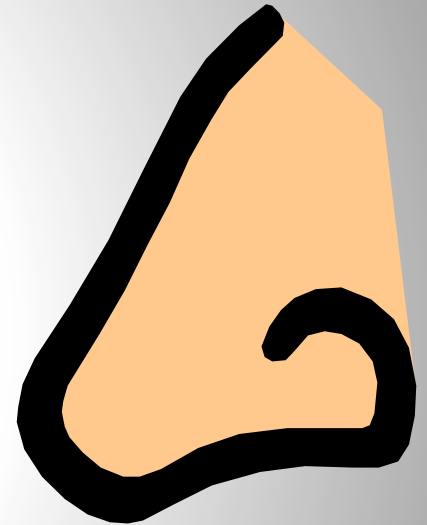
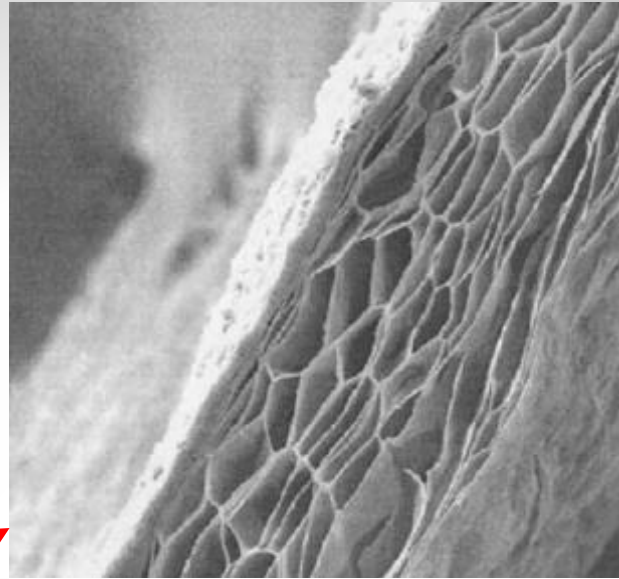
Hard Drugs



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

EXPOSURE

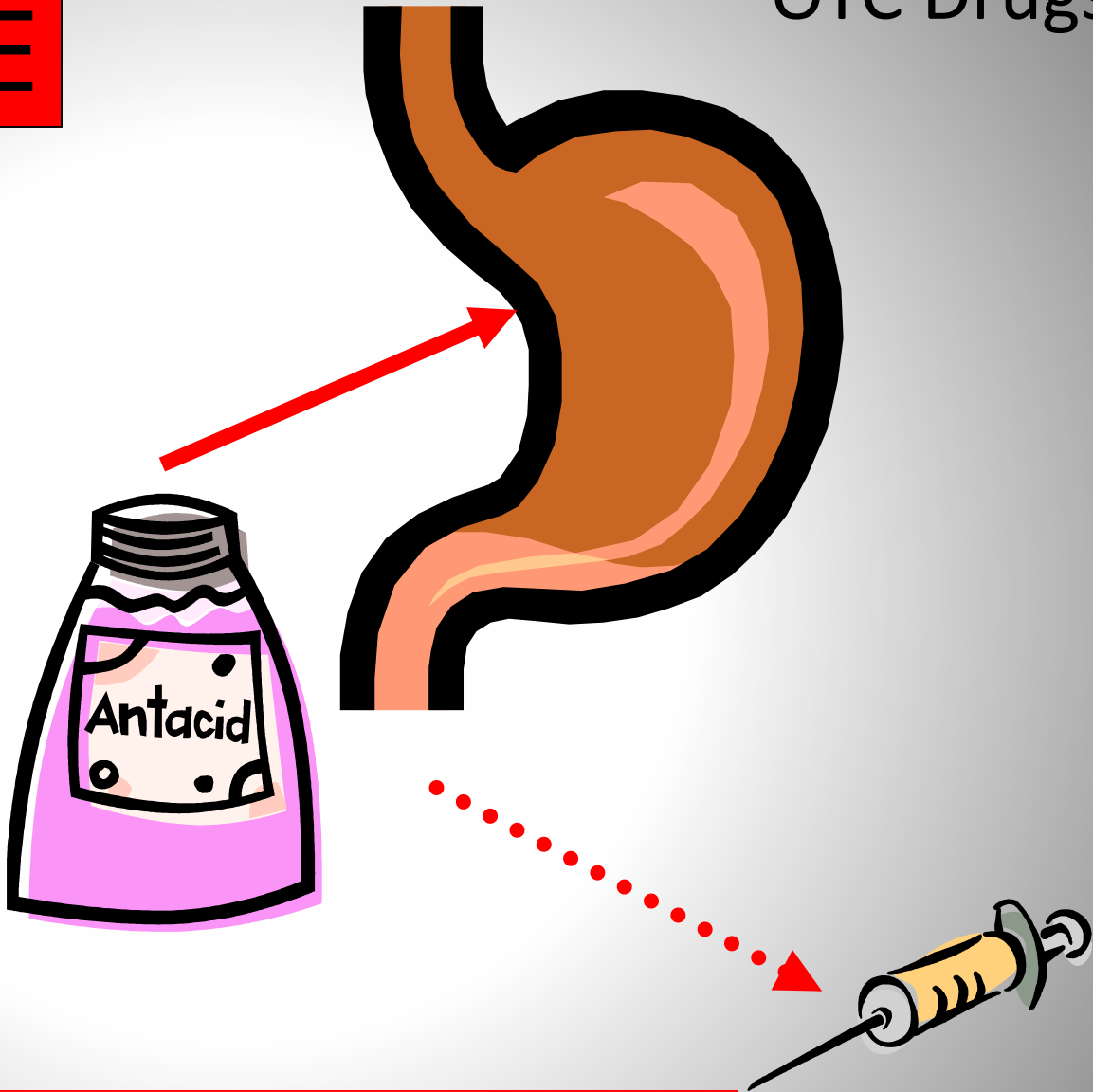
Antiperspirant



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

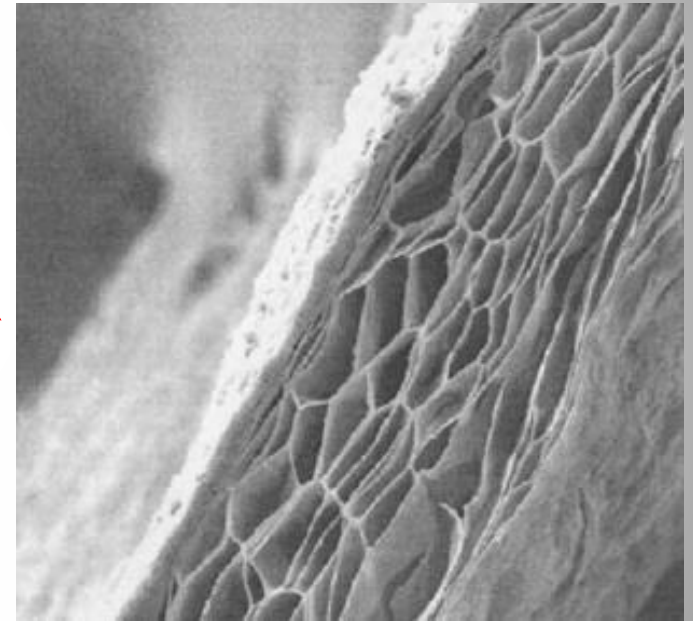
EXPOSURE

OTC Drugs



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

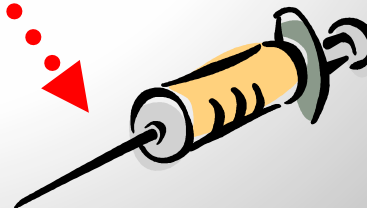
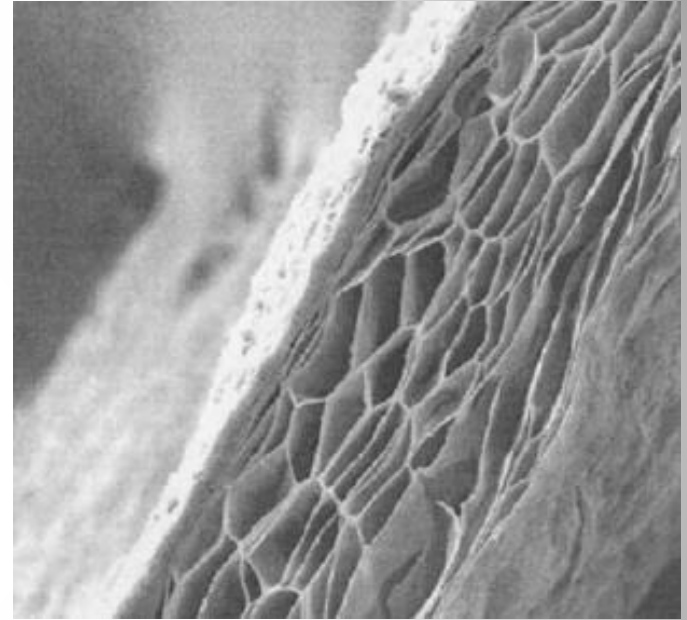
EXPOSURE



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

EXPOSURE

Vaccines



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

EXPOSURE

Infant Formulas



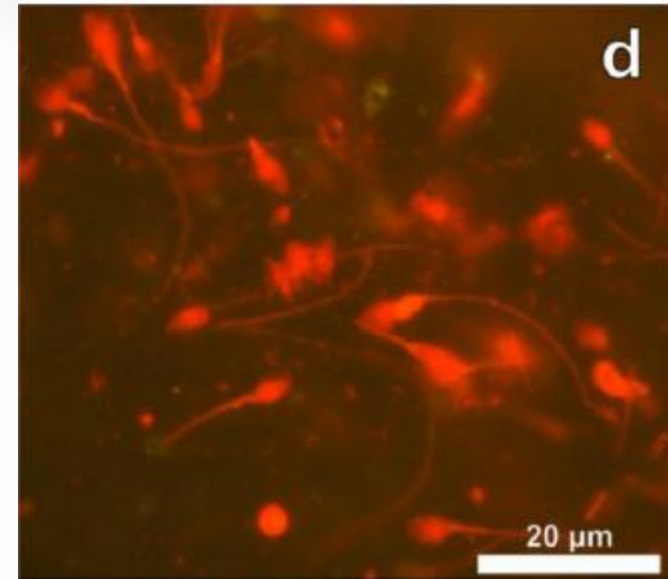
Burrell & Exley (2010) BMC Pediatrics 10, 63. <https://bmcpediatr.biomedcentral.com/articles/10.1186/1471-2431-10-63>

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.

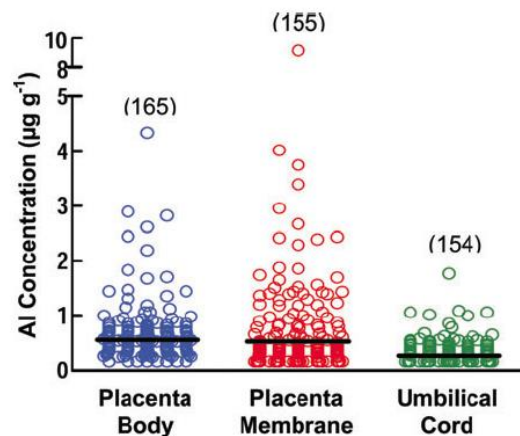


Fig. 3 Scatter dot plot showing geometric mean and range for Al ($\mu\text{g g}^{-1}$) in each placental tissue component. Each data point represents the average Al concentration measured by duplicate analysis of a sample. Black horizontal lines indicate geometric mean concentrations for each sample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



LiveAware San Francisco 2017

Breast Cancer

EBioMedicine 21 (2017) 79–85



Contents lists available at ScienceDirect

EBioMedicine

journal homepage: www.ebiomedicine.com



Research Paper

Use of Underarm Cosmetic Products in Relation to Risk of Breast Cancer: A Case-Control Study



Caroline Linhart^a, Heribert Talasz^b, Evi M. Morandi^c, Christopher Exley^d, Herbert H. Lindner^b,
Susanne Taucher^e, Daniel Egle^e, Michael Hubalek^e, Nicole Concini^{e,*}, Hanno Ulmer^{a,**}

^a Department of Medical Statistics, Informatics and Health Economics, Medical University of Innsbruck, Austria

^b Division of Clinical Biochemistry, Biocenter, Medical University of Innsbruck, Austria

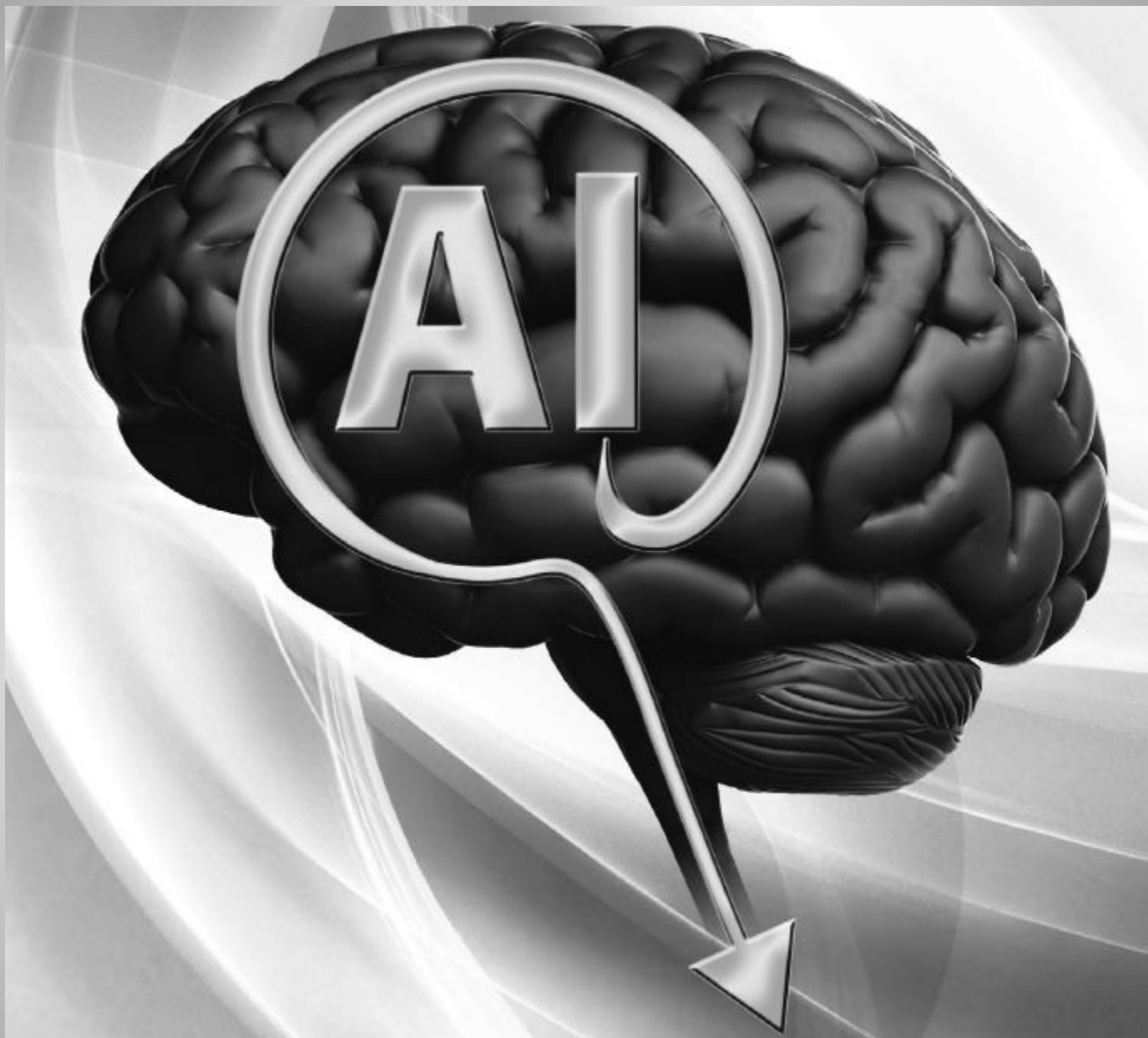
^c Department of Plastic, Reconstructive and Aesthetic Surgery, Medical University of Innsbruck, Austria

^d The Birchall Centre, Lennard-Jones Laboratories, Keele University, UK

^e Department of Obstetrics and Gynecology, Medical University of Innsbruck, Austria

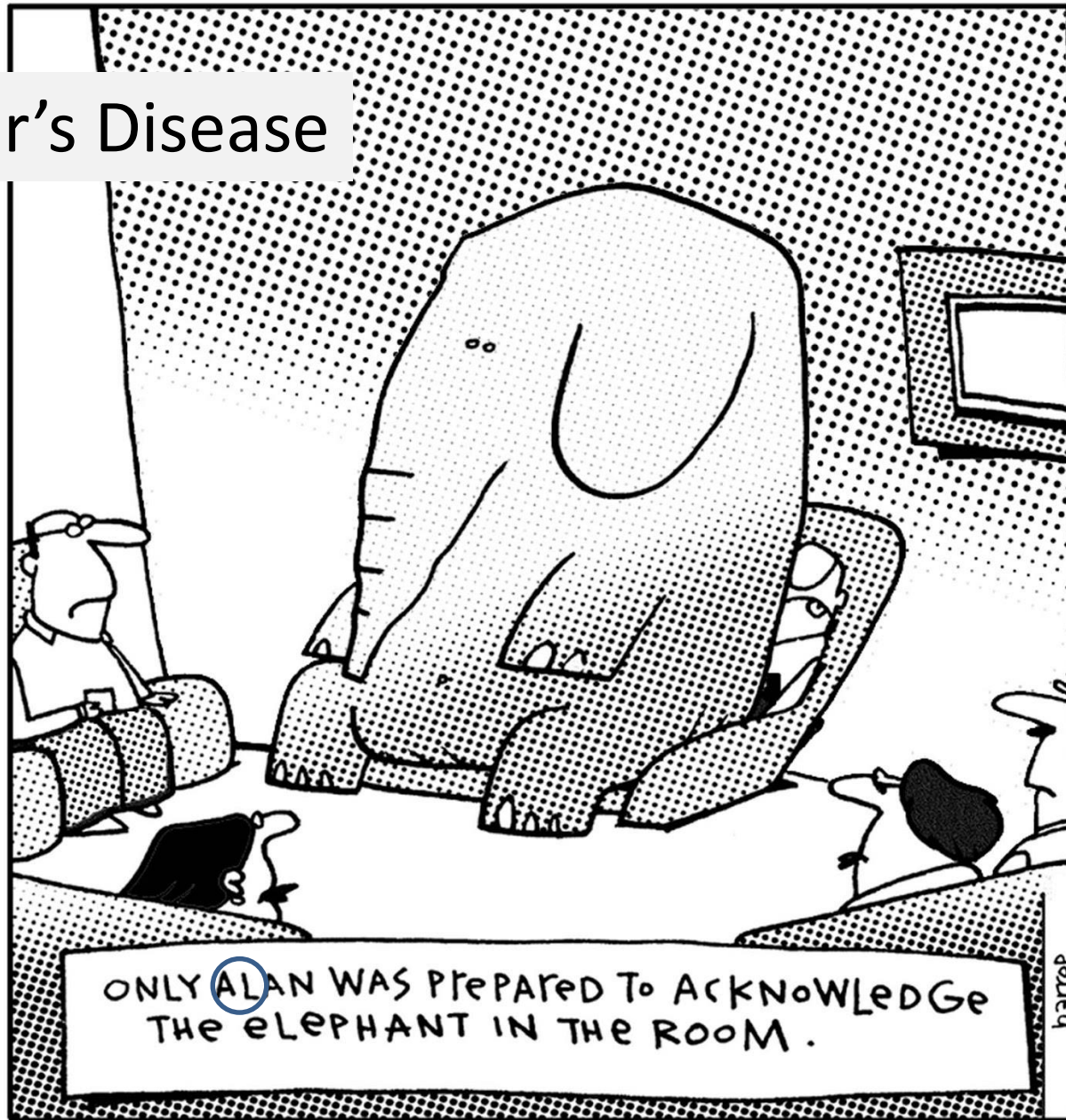
<https://www.hippocraticpost.com/cancer/antiperspirants-increase-risk-breast-cancer/>

“They found that the use of antiperspirants was significantly associated with breast cancer risk. This risk was increased substantially (Odds Ratio of 3.88) in individuals who applied antiperspirant more than once a day before they had reached the age of 30.”



<http://pubs.rsc.org/en/content/articlepdf/2013/em/c3em00374d>
LiveAware San Francisco 2017

Alzheimer's Disease



Alzheimer's Disease

Journal of Alzheimer's Disease Reports 1 (2017) 23–25
DOI 10.3233/ADR-170010
IOS Press

23

Editorial

Aluminum Should Now Be Considered a Primary Etiological Factor in Alzheimer's Disease

Christopher Exley*

The Birchall Centre, Lennard-Jones Laboratories, Keele University, Staffordshire, UK

<http://content.iospress.com/articles/journal-of-alzheimers-disease-reports/adr170010>

“The Emperor is Naked: No aluminium, no Alzheimer's disease”

<https://www.hippocraticpost.com/ageing/no-aluminium-no-alzheimers-disease/>

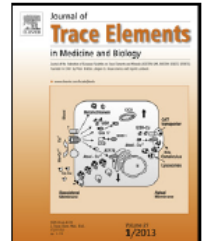


ELSEVIER

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

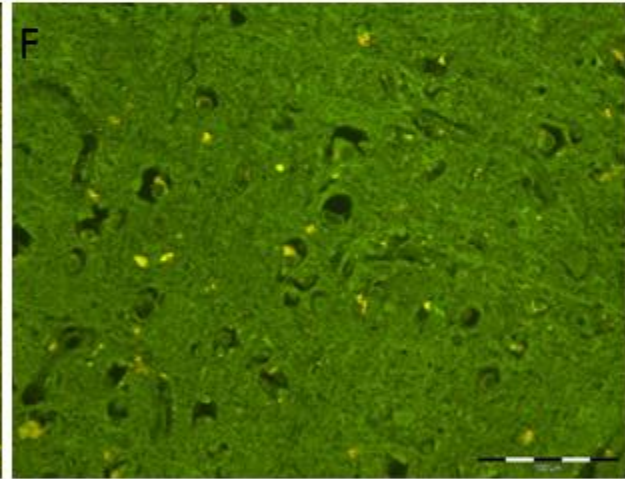
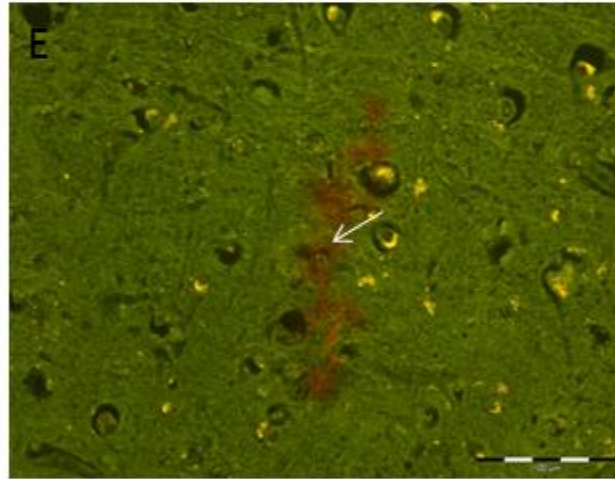
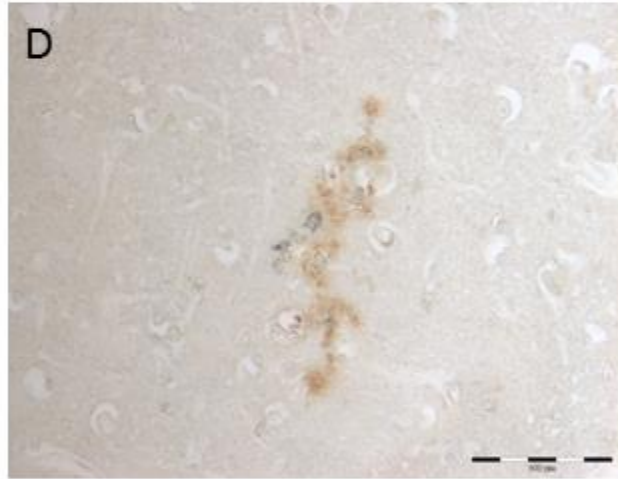
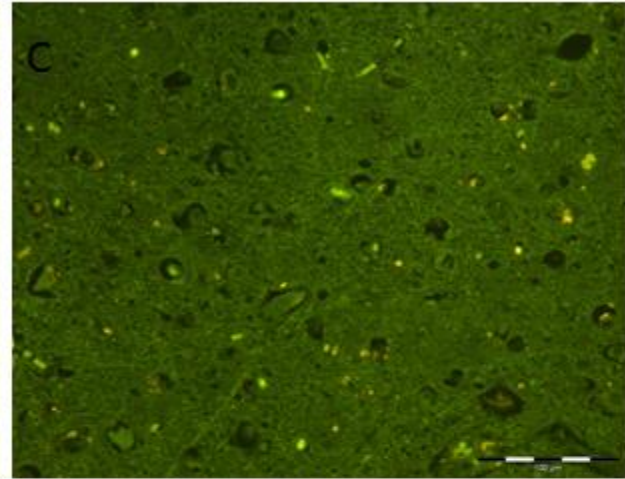
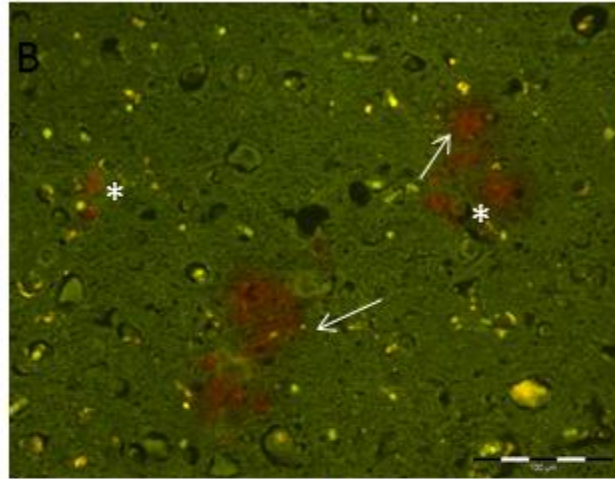
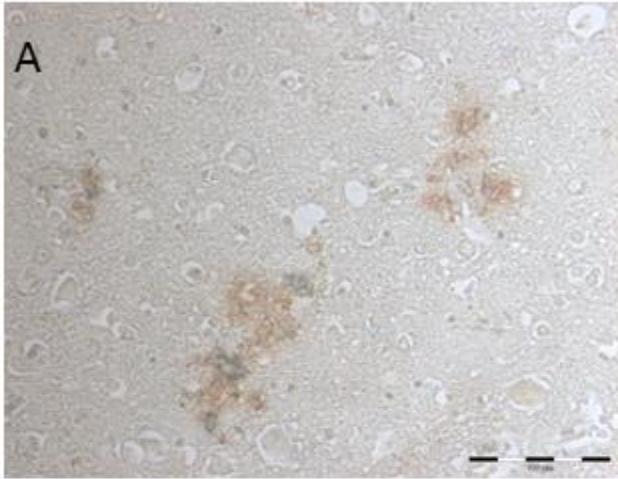
^b Department Of Clinical Neuropathology, King's College Hospital, London, SE5 9RS, United Kingdom

^c MRC London Neurodegenerative Diseases Brain Bank, Institute of Psychiatry, Psychology and Neuroscience, King's College, London, SE5 8AF, United Kingdom

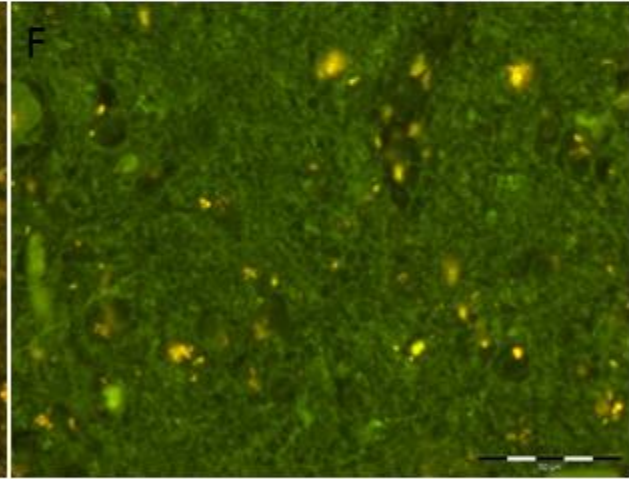
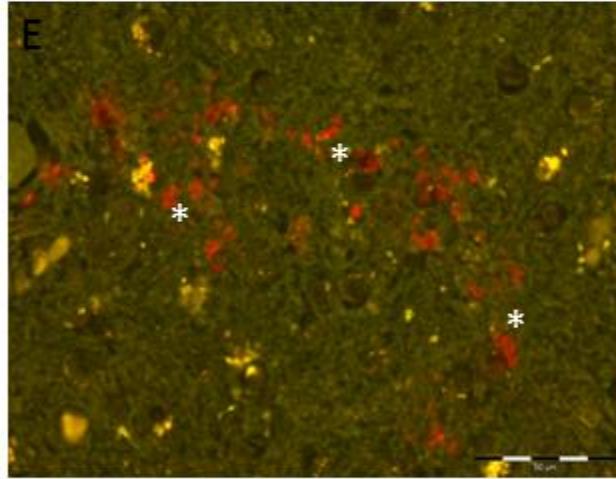
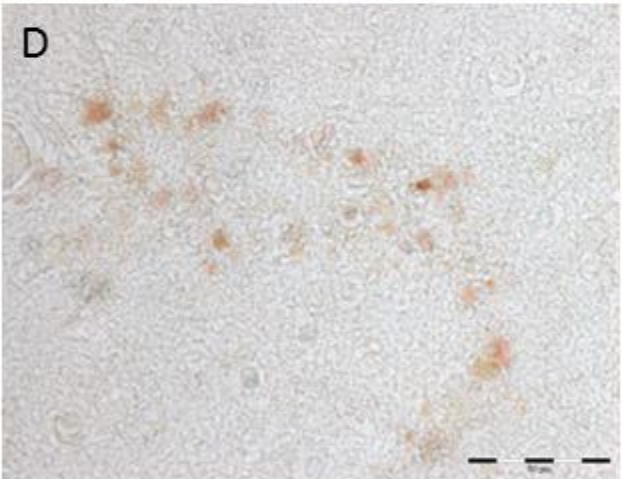
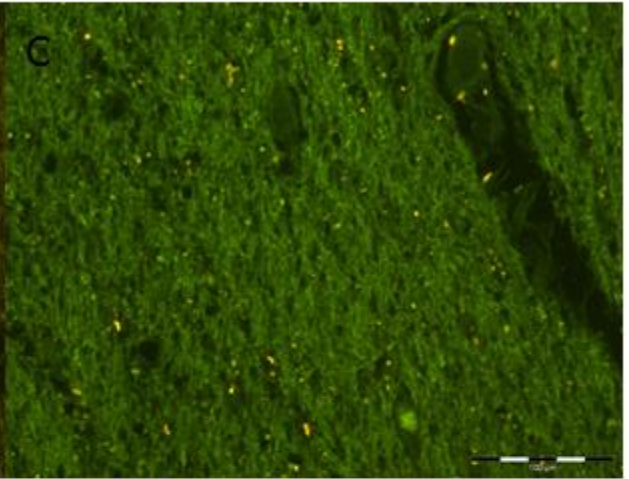
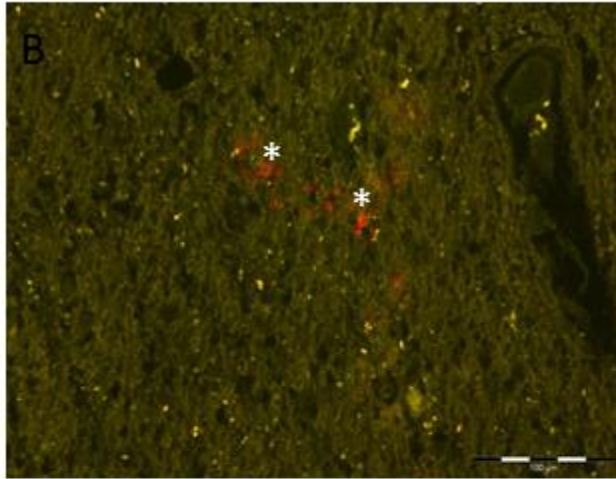
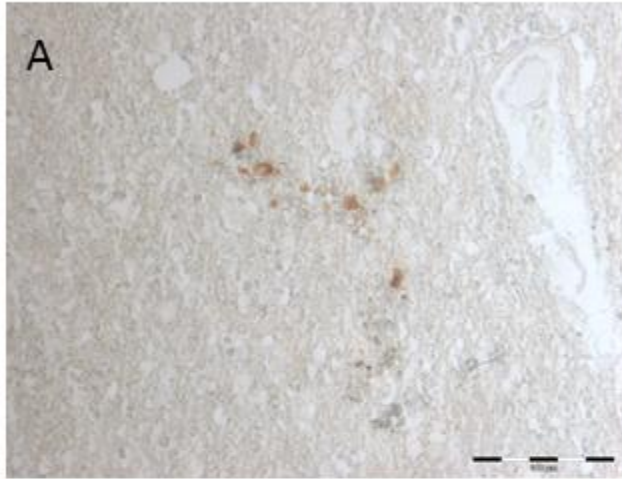


“Aluminium is neurotoxic and the concentrations of aluminium found in these familial AD brains are unlikely to be benign and indeed are highly likely to have contributed to both the onset and the aggressive nature of any ongoing AD. These data lend support to the recent conclusion that brain aluminium will contribute towards all forms of AD under certain conditions.”

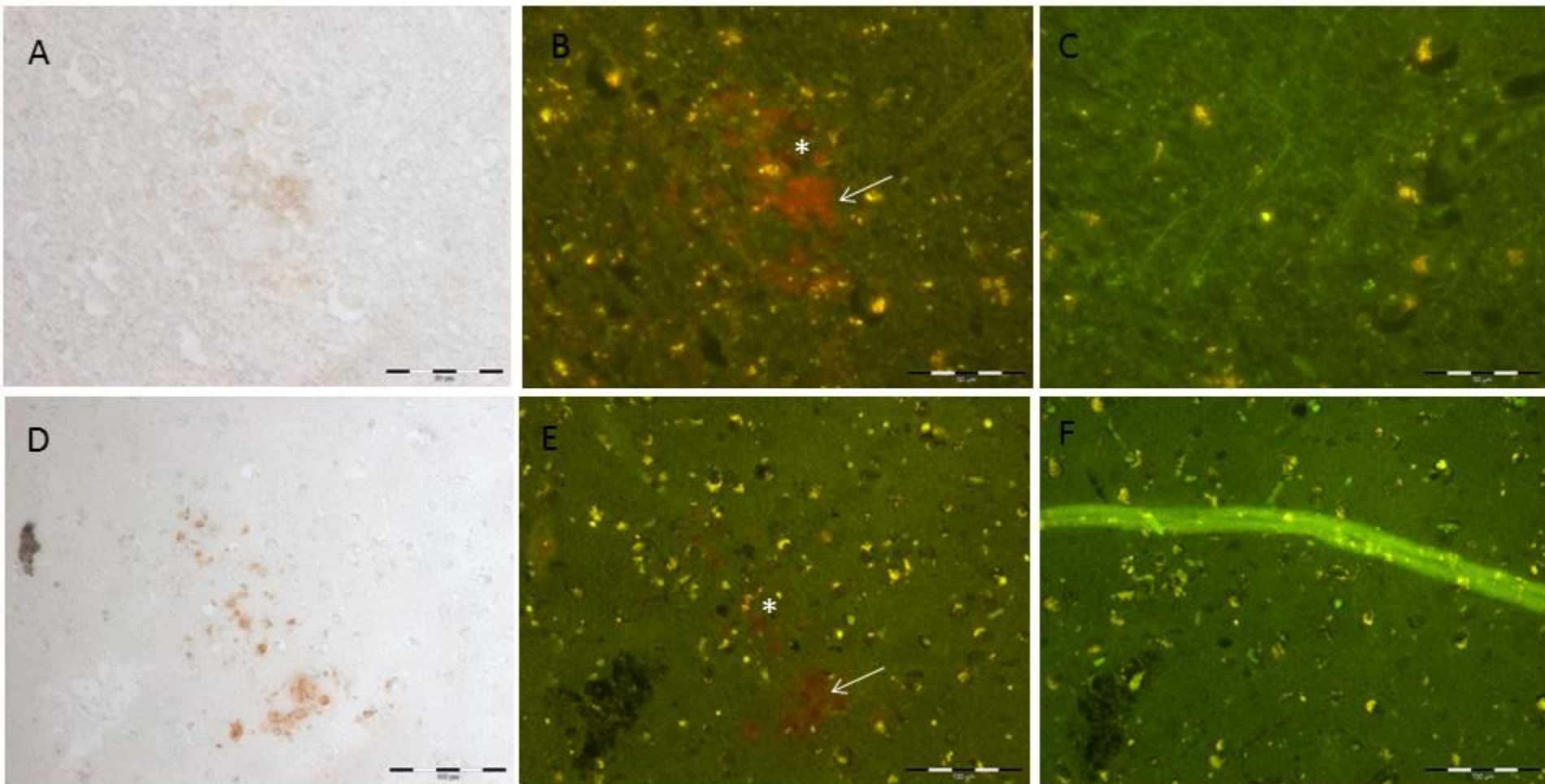
<http://www.sciencedirect.com/science/article/pii/S0946672X16303777>



Frontal Cortex



Parietal Cortex



Frontal (A-C) and Temporal (D-F) Cortex

Aluminium in human brain tissue in autism.

(Manuscript in Preparation)



OPEN

Unequivocal identification of intracellular aluminium adjuvant in a monocytic THP-1 cell line

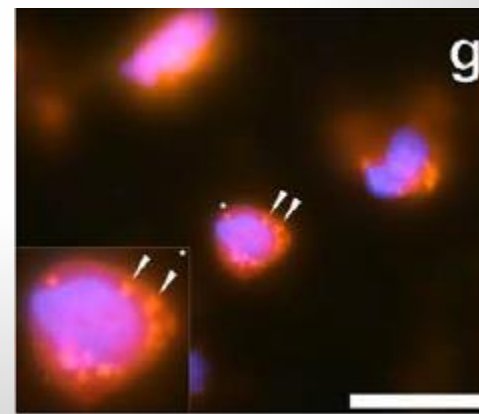
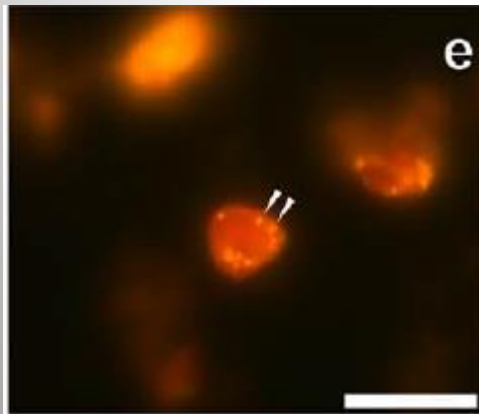
SUBJECT AREAS:

CELL BIOLOGY

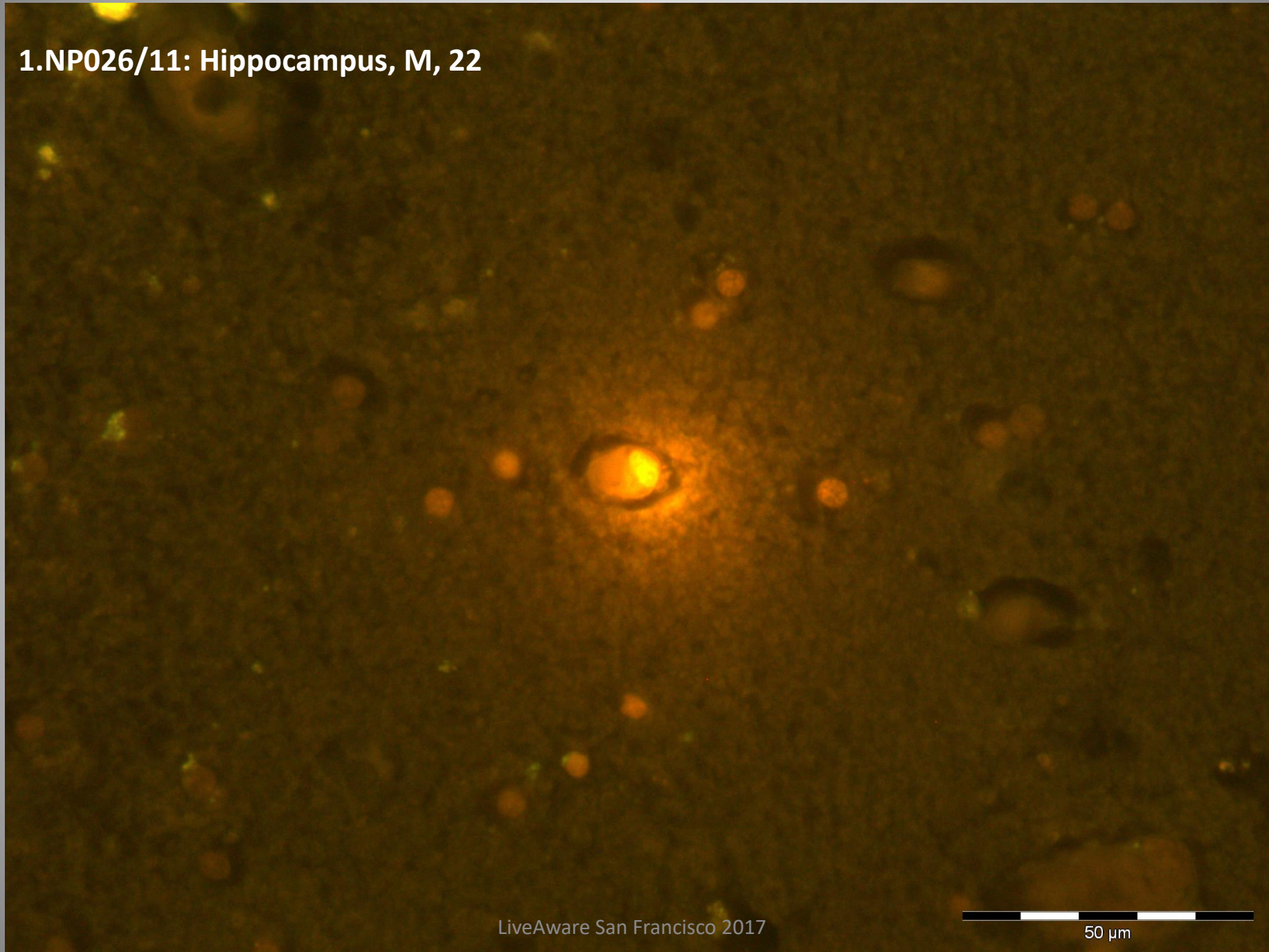
FLUORESCENCE IMAGING

Matthew Mold¹, Håkan Eriksson², Peter Siesjö³, Anna Darabi³, Emma Shardlow¹ & Christopher Exley¹

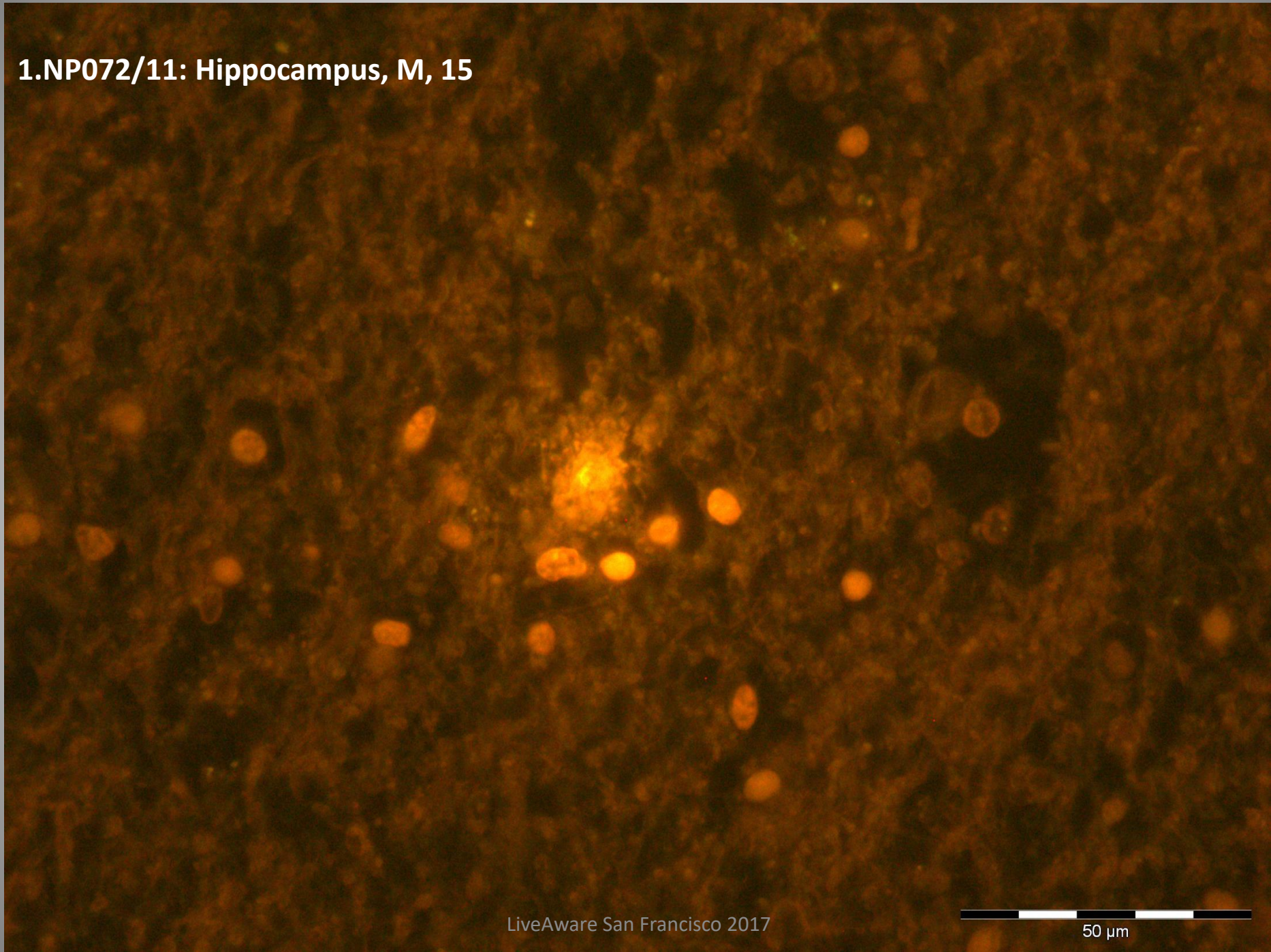
<http://www.nature.com/articles/srep06287>



1.NP026/11: Hippocampus, M, 22

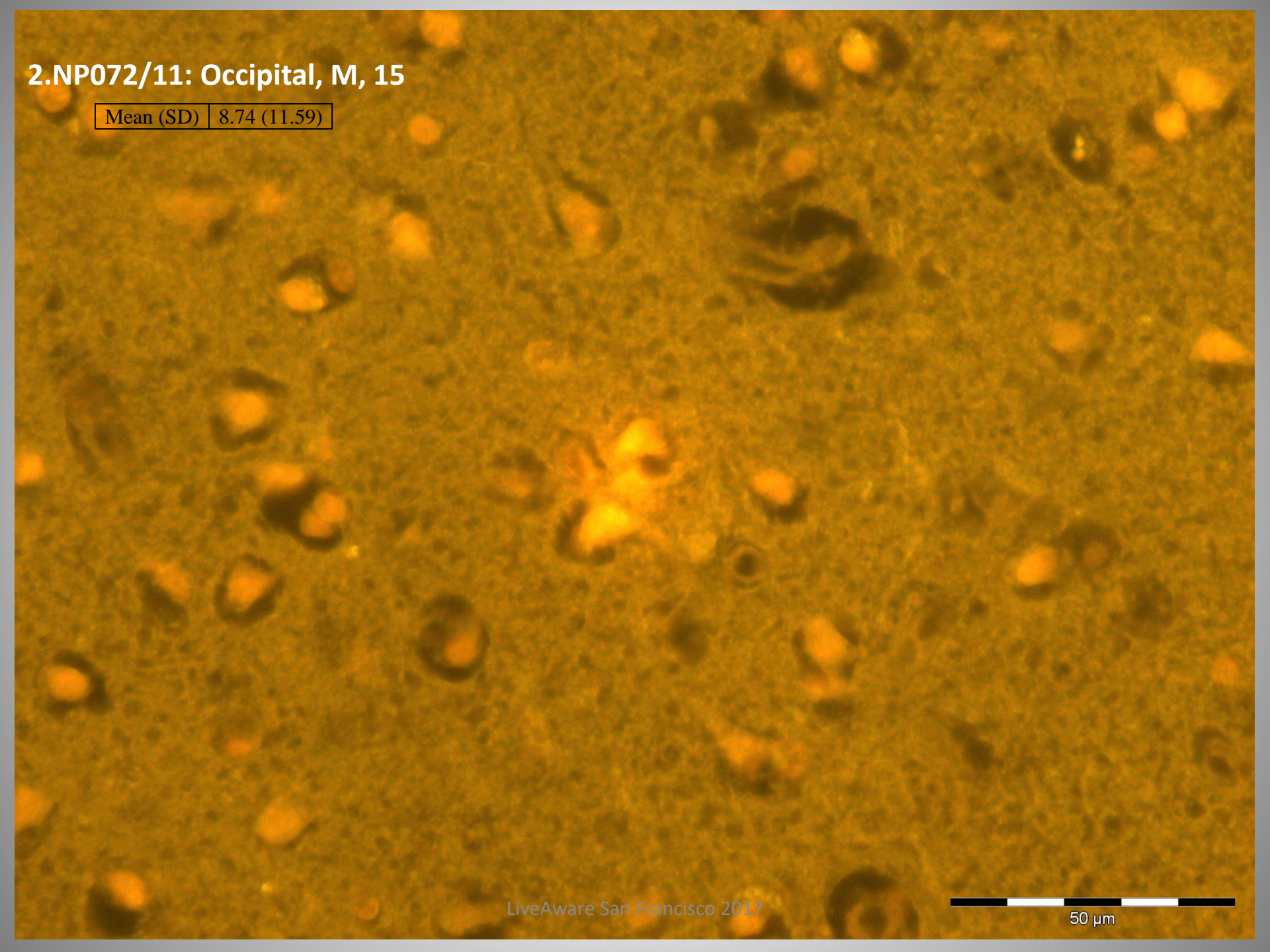


1.NP072/11: Hippocampus, M, 15

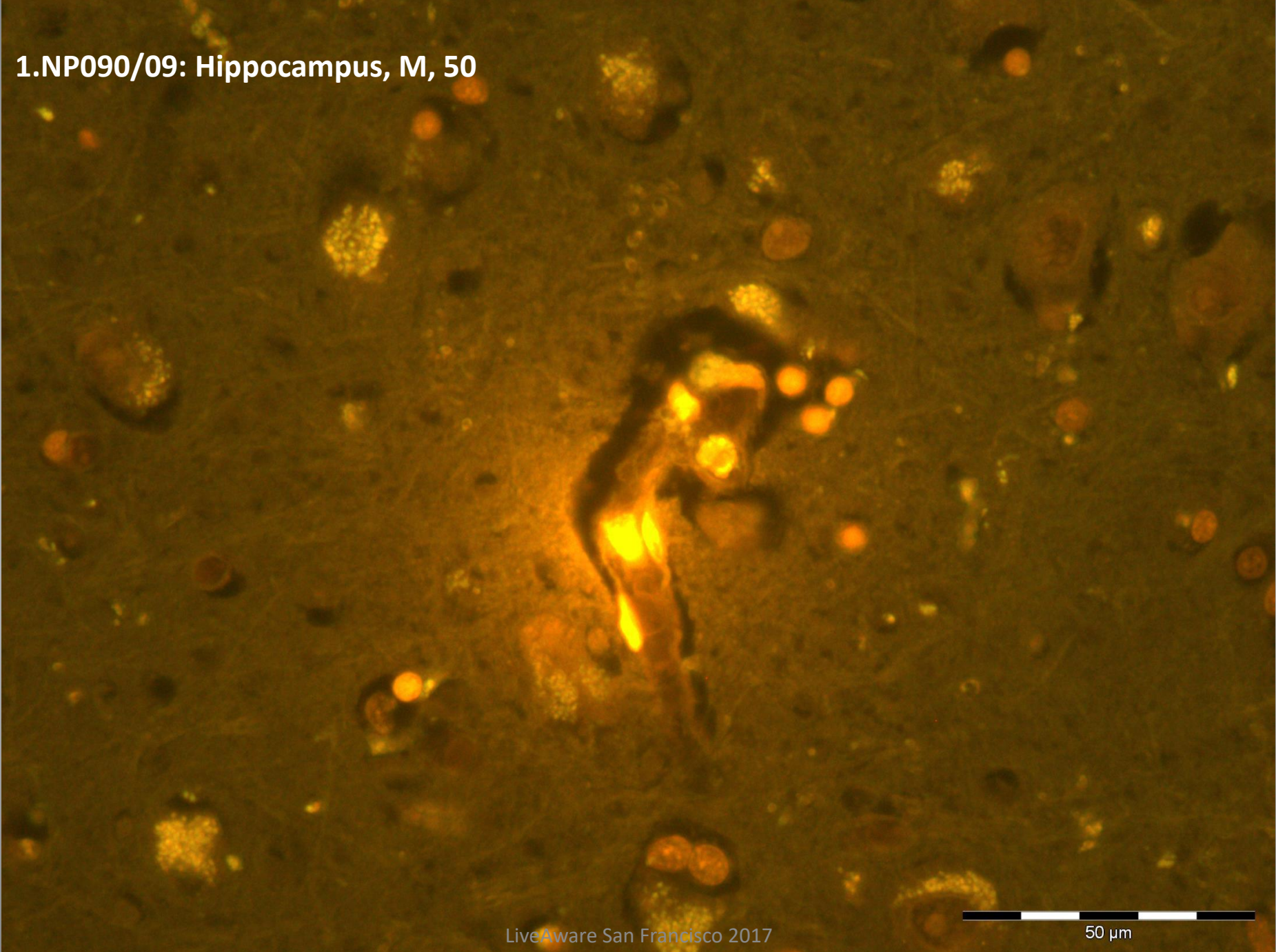


2.NP072/11: Occipital, M, 15

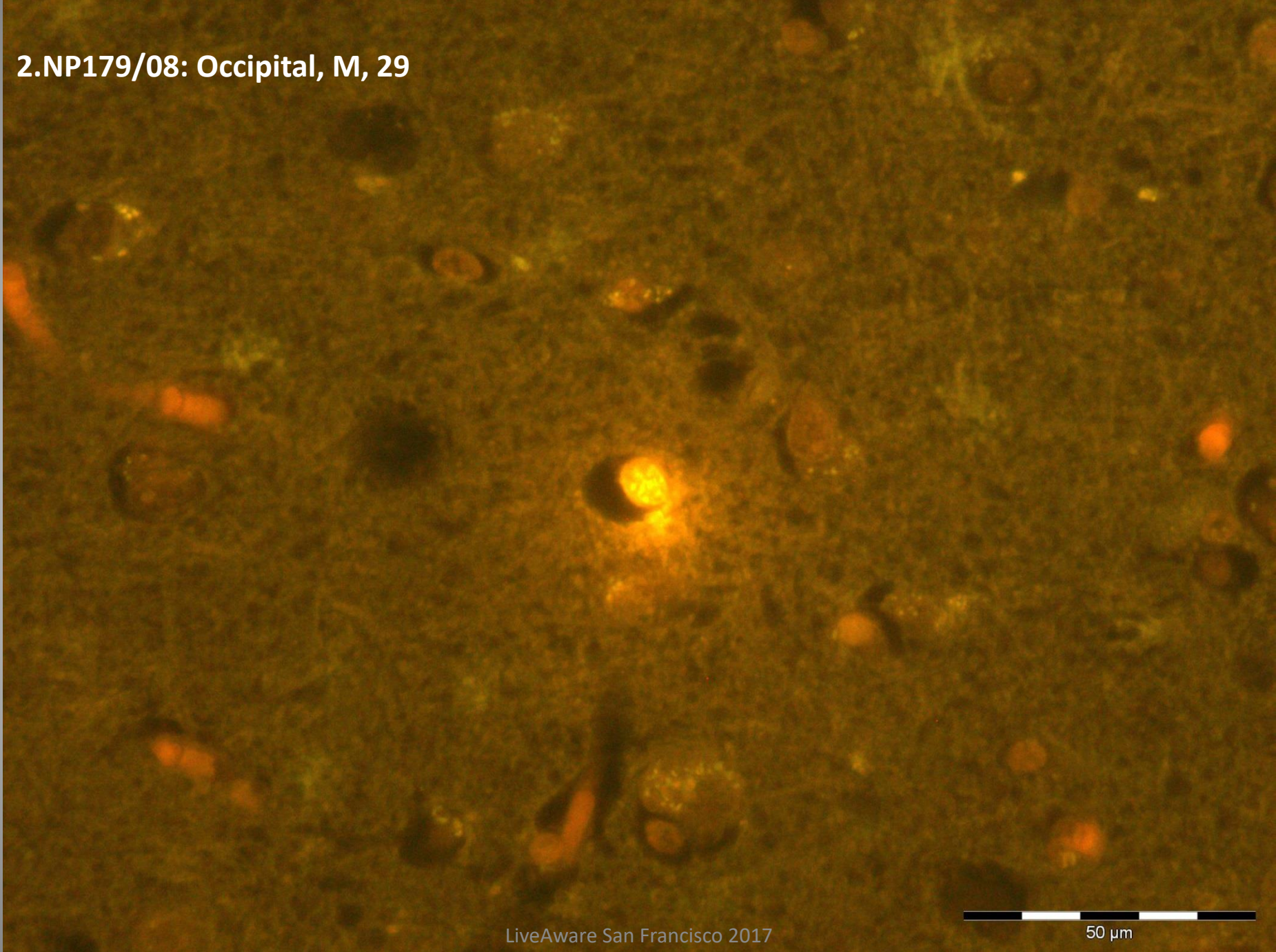
Mean (SD)	8.74 (11.59)
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1.NP090/09: Hippocampus, M, 50



2.NP179/08: Occipital, M, 29



In both familial Alzheimer's disease (fAD) and in autism the brain is 'loaded' with aluminium. However in fAD aluminium is primarily observed in extracellular locations whereas in autism aluminium is primarily observed as intracellular, mainly in glia (house-keeping cells) but also intraneuronal.

The observation of significant deposits of intracellular aluminium in autism brain tissue has significant implications for a possible role for aluminium in the aetiology of autism and any potential link with aluminium adjuvants in vaccines.