School of Natural and Computing Science - Institute/Centre Annual Report

Centre/Institute Title	TESLA (Trace Element Speciation Laboratory, Aberdeen)
Aims and objectives	**Aim:** We are studying environmental and biological processes in which toxic and essential metals and metalloids and increasingly non-metals are transformed. We are aiming to do pioneering analytical work to develop elemental speciation and elemental bioimaging methodologies for solving pertinent problems in environmental and biosciences. .
Academic Staff Involved	Professor Joerg Feldmann (Director), Dr Eva M. Krupp (Reader, Deputy Director) Dr Andrea Raab (PDRA, Lab & Resource Manager)
Summary of Work	1. Identification that inorganic arsenic in rice is a significant source of arsenic exposure. 2. Identification that mercury bioaccumulates in the marine food chain and that pilot whales have develop a unique way of detoxifying the neurotoxin mercury. 3. Mercury forms nanoparticles in oil and gas condensates and this is a reason why it cannot easily be removed from the petrochemical stocks.
Potential Impact Case Studies	Introduction of a maximum permissible concentration of inorganic arsenic in rice and rice-based products and make the analytical methodology fit for the market place (continuation case study)
Annual TESLA seminars	In addition to regular group meetings, the group meets twice a year for 4-5 days in the Highland retreats (Mar Lodge Braemar and Cromarty Arts Trust Centre) for a structured symposium in which every member of the centre gives an oral presentation.

Prizes and Awards:

J. Feldmann was elected to Fellow of the Royal Society of Edinburgh (FRSE), Feb. 2018

J. Feldmann was awarded a visiting professorship at University Federal of Santa Catarina (UFSC) in Florianopolis, SC Brazil (2014-2018).

M. Blanz, Effects of seaweed-fertilisation on barley, presentation prize at AEA, Aarhus, Dec. 2018.

A.H. Petursdottir (Alumni) Thermo-Hilger Award 2018 (RSC Atomic Spectroscopy Award for young scientists) including her PhD work on arsenic speciation at TESLA.

S. Sinaviwat, Hydrophilic arsenic compounds in whale brain, Poster prize at BNASS, Teddington, July 2018.

M. Mueller, Sulphur speciation in garlic, Poster Prize at 10th Scottish Symposium on Environmental Analytical Chemistry, Glasgow, Dec. 2018.

Primary Publications in peer-reviewed journals:

1. M. Schneider, H.R. Cadorim, B. Welz, E. Carasek, J. Feldmann, Determination of arsenic in agricultural soil samples using high-resolution continuum source graphite furnace atomic absorption spectrometry and direct solid sample analysis, **Talanta** (2018) **188**, 722-728.
2. A.S. Henn, E.M.M. Flores, V.L. Dressler, M.F. Mesko, J. Feldmann, P.A. Mello, Feasibility of As, Sb, Se and Te Determination in Coal by Solid Sampling Electrothermal Vaporization Inductively Coupled Plasma Mass Spectrometry. **Journal of Analytical Atomic Spectrometry** (2018) **33**, 1384-1393.
3. G. Cabello, K.C Nwoko, M. Mingarelli, A.C McLaughlin, L. Trembleau, J. Feldmann, A. Cuesta, T.A.D. Smith, Physico-chemical tools: towards a detailed understanding of the architecture of targeted radiotherapy nanoparticles, **Applied Bio Materials** (2018) **1**, 1639-1646.
4. L.A. Bullock, J. Parnell, M. Perez, A.J. Boyce, J. Feldmann, High selenium in the carboniferous coal measures of Northumberland, North East England, **International Journal of Coal Geology** (2018) **195**, 61-74.
5. T. Narukawa, T. Iwai, K. Chiba, J. Feldmann, A determination method for methylmercury and inorganic mercury in biological samples using high performance liquid chromatography-inductively coupled plasma mass spectrometry. **Analytical Sciences** (2018) 34, 1329-1334.
6. L.A. Bullock, A. Perez, J. Parnell, J. Armstrong, J. Feldmann, Selenium and tellurium resources in Kisgruva Proterozoic volcanogenic massive sulphide deposit (Norway) **Ore Geolology Reviews** (2018) **99**, 411-424.
7. R. Chowdhury, R. Lawrence, K. van Daalen, S. Hawkes, J. Feldmann, Reducing NCDs globally: the under-recognised role of environmental risk factors, **The Lancet** (2018) **392**, (10143) 212.
8. L.A. Bullock, J. Parnell, J. Feldmann, J. G. Armstrong, A.S. Henn, F.S. Rondan, M.F. Mesko, P.A. Mello, E. M. M. Flores, Selenium and tellurium concentrations of British Coal Measures, **Geological Journal** (2018) 1-12 doi: 10.1003/gj.3238.
9. N.L.A. Jamari, A. Behrens, A. Raab, E.M. Krupp, J. Feldmann, Plasma processes to detect fluorine with ICPMS as M-F+: an argument for building a negative mode ICPMS/MS. **Journal of Analytical Atomic Spectrometry** (2018) **33**, 1304-1309 (Cover page).
10. J. Parnell, M. Perez, J.G. Armstrong, L.A. Bullock, J. Feldmann, A.J. Boyce, Trace elements in Neoproterozoic oxic and anoxic pyrite, **Geochemical Perspective Letters** (2018) **7**, 12-16.
11. A.T. Mlangeni, V. Vecchi, G. Norton, A. Raab, E.M. Krupp, J. Feldmann, Comparison of on-site field measured inorganic arsenic in rice with laboratory measurements using a field deployable method: method validation, **Food Chemistry** (2018) **263**, 180-185.
12. M. Blanz, K. Briton, K. Grant, J. Feldmann, Potential dietary, non-metabolic accumulation of arsenic (As) in teeth: Implications for archaeological studies. **Journal of Archaeological Science** (2018) **94**, 21-31.
13. A.S. Henn, F.S. Rondan, M.F. Mesko, P.A. Mello, M. Perez, L.A. Bullock, J. Parnell, J. Feldmann, E.M.M. Flores, Determination of Se at Low Concentration in Coal by Collision/Reaction Cell Technology Inductively Coupled Plasma Mass Spectrometry After Microwave-Assisted Wet Digestion, **Spectrochimica Acta B** (2018) **143**, 48-54.
14. A.A.S. Elgazali, Z. Gajdosechova, Z.Abbas, H. Fiedler, E. Lombi, K.G. Scheckel, E. Donner, J. Feldmann, E.M. Krupp, Fast adsorption and slow release of reactive gaseous Hg from the hair of chloralkali, **Scientific Reports** (2018) **8**, 3675.

15. L.A. Bullock, J. Parnell, M. Perez, A. Boyce, J. Feldmann, J.G. Armstrong, Multi-stage pyrite genesis and late selenium enrichment of Greenburn coals (East Ayrshire), **Scottish Geological Journal** (2018) sjg2017-010.
16. A.H. Petursdottir, J.R. de Jesus, H. Gunnlaugsdottir, J. Feldmann, Quantification of labile and stable non-polar arsenolipids in commercial fish meals and edible seaweed samples, **Journal of Analytical Atomic Spectrometry** (2018) **33**, 102-110.
17. J.G.T. Armstrong, J. Parnell, L.A. Bullock, M. Perez, A.J. Boyce, J. Feldmann, Tellurium, selenium and cobalt enrichment in Neoproterozoic black shales, Gwna Group, UK: deep marine trace element enrichment during the second great oxygenation event, **Terra Nova** (2018) **30**, 244-253.
18. M. Baba, J. Parnell, S. Bowden, J. Armstrong, M. Perez, X. Wang, Emplacement of oil in the Weardale Granite. **Proceedings of The Yorkshire Geological Society** (2018). Dec 7

Invited Book Chapters and Reviews:

19. J. Feldmann, A. Raab, E.M. Krupp, Importance of ICPMS for speciation analysis is changing: future trends for targeted and non-targeted element speciation analysis, **Analytical & Bioanalytical Chemistry** (2018) **410**, 661-667.
20. Z. Gajdosechova, Z. Mester, J. Feldmann, E.M. Krupp, The role of selenium in mercury toxicity – current analytical techniques and future trends in analysis of selenium and mercury interactions in biological matrices. **TrAC Trends in Analytical Chemistry** (2018) **104**, 95-109
21. J. Feldmann, K. Bluemlein, E.M. Krupp, M. Mueller, B.A. Wood, Metallomics study in plants exposed to arsenic, mercury, selenium and Sulphur, in **Metallomics** (ed. M. Aruda) Springer, (2018), 67-100

Research metrics for TESLA (Web of Science):

J. Feldmann (h-index 52, citations 10,500, annual citations (2018) 1020
E.M. Krupp (h-index 28, citations 2,500, annual citations (2018) 238
A. Raab (h-index 40, citations 6,300, annual citations (2018) 689

Invited/keynote and plenary lectures

1. J. Feldmann, From rice to pilot whales, **Sapienza Universita di Roma, Italy,** February 2018.

2. J. Feldmann, The new role of ICPMS in speciation studies in the environment and in biological samples, CANAS/ESAS**, Berlin, Germany**, March 2018

3. J. Feldmann, How analytical chemistry can make the difference in environmental and biological studies

4. J. Feldmann, Novel strategies to understand processes in biology and environmental studies, 2nd workshop on Biochemistry and Bioprospecting, **Pelotas, RS, Brazil**, June 2018 (plenary).

5. J. Feldmann, 5th Anniversary Celebration for the Institute of Biology and Chemistry at **University of Warsaw, Poland**, March 2018 (plenary).

6. J. Feldmann, Dynamic Bioimaging: what it is and how did we get there, 1st Workshop of Laser Bioimaging Mass Spectrometry, **Muenster, Germany**, May 2018 (plenary)

7. J. Feldmann, Characterisation of natural nanoparticles in pilot whales and in gas condensates, Postnova Workshop, **Great Malvern, UK**, March 2018

8. J. Feldmann, Elemental speciation analysis using ICPMS: routine and advanced techniques, **BNASS, Teddington, UK**, July 2018

9. J. Feldmann, Fluorine determination with ICPMS, Analytica Symposium, **Munich, Germany** April 2018

10. J. Feldmann, Fluorine speciation analysis using HPLC-ICPMS/MS and ESI-MS, 2nd Workshop for ICP-QQQ, Agilent, **Munich, Germany**, October 2018

11. J. Feldmann, The decade of the non-metals for speciation analysis using ICPMS, Analytica Symposium, **Shanghai, China,** November 2018.

12. E.M. Krupp, Mercury and selenium forming nanoparticles in the brain of whales, CANAS/ESAS**, Berlin, Germany**, March 2018

13. E.M. Krupp, Mercury in pilot whales, Analytica Symposium, **Munich, Germany,** April 2018

PhDs in 2018

	Name	Degree	Start date	Funder	Title
1	Parinda Manorut	PhD	2015	Royal Thai	Mercury in rice
2	Lara Schultes	PhD	2014 Writing up	FORMAS (Swedish RC)	Fluoronomics (with Stockholm University, Sweden)
3	Angstone Mlangeni	PhD	2015	Commonwealth	Sourcing rice with low inorganic arsenic in Malawi
4	Daniel Ruhland	PhD	2016	Johnson & Matthey	Mercury speciation in gas condensates
5	Dennis Tutogon	PhD	2016	National Tsing Hua University (Taiwan)	Antimony speciation in plants (with University of Liverpool, UK and NTHU, Taiwan)
6	Sa'adatu O. Abatemi-usman	PhD	2016	PTDF (Nigeria)	Exposure to metals in the environment
7	Elizabeth Griffin	PhD	2016	EU funded EMPIR	Absolute quantification of the Tau protein
8	Magdalena Blanz	PhD	2016	UHI funded	Identification of seaweed use in Neolithic times (UHI and Uni Glasgow)
9	Shaun Lancaster	PhD	2017	PS Analytical Ltd	Use of atomic fluorescence for mercury and arsenic speciation in environmental chemistry
10	Martin Mueller	PhD	2017	Equinor/Statoil and Genesis	Sulfur speciation studies and solubility of mercury in condensates

11	Johannes F Kopp	PhD	2014	Aptalis Ltd.	Arsenolipids in biological samples
12	Nor Laili Azua Jamari	PhD	2015	Malaysian Research Foundation	Fluoride speciation using ICPMS
13	Nunnapus Laitip	PhD	2015	Royal Thai	Selenium speciation studies in fish and whales
14	Abdullah Akhdhar	PhD	2017	Saudi Arabia Cultural Bureau	Determination of fluorinated particles
15	Tengentile Nxumalo	PhD	2017	Commonwealth	Organofluorines using ICPMS/MS and ESI-MS in the environment
16	Louise Hair	PhD	2018	University of Cambridge DPHPC	Arsenic speciation in toenails in a case study for cardiovascular disease (BRAVE study)
17	Camilla Faidutti	PhD	2018	University of Cambridge DPHPC	Trace element exposure of Bangladeshi's in Dhaka (BRAVE study)
18	Ahmed Alanazi	PhD	2018	Saudi Arabia Cultural Bureau	Nanoparticles in e-cigarettes
19	Kenneth Nwoko	PhD	2016	Elphinstone Scholarship and NDDF	Nanoparticles in non-aqueous media
20	Savarin Sinaviwat	PhD	2015	Royal Thai	Arsenic speciation in biological samples
21	Mauana Schneider	PhD	2016	CNPq	Halogen determination with HR-CS MAS (with UFSC, SC, Brazil)

Graduation of PhDs in 2018

1	Johannes F Kopp	PhD	2014	Aptalis Ltd.	Arsenolipids in biological samples Now PDRA at Food Chemistry at University of Postdam, Germany
2	Nor Laili Azua Jamari	PhD	2015	Malaysian Research Foundation	Fluoride speciation using ICPMS Now Lecturer at National Defence University of Malaysia, Kuala Lumpur
3	Nunnapus Laitip	PhD	2015	Royal Thai	Selenium speciation studies in fish and whales Now Researcher at Metrology Institute in Thailand, Bangkok

PDRAs 2018

Name	Dates	Funder	Title
Xueying Wang	08/2018-09/2019	NERC	Tellurium and selenium cycling and supply (TeaSe)
Magali Perez	06/2016-05/2018	NERC	Tellurium and selenium cycling and supply (TeaSe)

Live Grants 2018

Start Date	Funder	Total Value	Title
2018	University of Cambridge DPHPC	£202k	BRAVE – Bangladesh Risk of Acute Vascular Events and environmental exposure
2016	Equinor/Statoil and Genesis		Mercury solubility in organic solvents
2018	Saudi Arabia Cultural Bureau	£73k	+ PhD stipend for A Alazari for NP in e-cigarettes
2018	GCRF-MRC	£8000k	CAPABLE (Global Challenges Research Funds through MRC) (Co-PI JF with University of Cambridge (PI)

2017	Commonwealth	£50.9k	+ PhD stipend for T Nxumalo, Fluorinated compounds in the environment
2017	Saudi Arabia Cultural Bureau	£70.5k	+ PhD stipend for A. Akhdhar: fluorinated nanoparticles
2016	Agilent technologies	£150k	Partner laboratory agreement with providing a 7900 ICPMS
2016	EU EMPIR	£227k	Role of metals and metal containing biomolecules in neurodegenerative diseases such as Alzheimer's disease
2016	EU-H2020-MSCA-RISE2016	£600k	MILEAGE (Microelements in Life Expectancy and Ageing)
2015	Johnson Matthey	£65k	Identification and quantification of the molecular form of mercury in gas condensates
2015	NERC	£666k	TeaSe: Tellurium and selenium cycling and supply
2018	University of Aberdeen Development Trust	£30k	Acquisition for a 21 angle MALS detector
2018	GCRF-RISE fund	£10k	Acquisition of a PM2.5 low volume sampler for air quality measurements in Bangladesh
2018	RSC-ACTF	£4.8k	3 summer scholarship stipends for arsenic field kit use for iAs in rice, bioimaging of metals using LA-ICPMS, fluorine determination using MP-AES
2015	Malaysia Research Fund	£61k	+ PhD stipend for NLA Jamari for fluorine speciation studies using ICPMS
2015	FORMAS Swedish RC	£57k	Environmental Fluorononomics – from anthropogenic emissions to accumulation in top predators
2015	Qatar National RC	$29.7k	Development of IR and RAMAN imaging for objective scoring of breast cancer tissue sections
2015	Commonwealth	£50.9k	Sourcing rice with low inorganic arsenic in Malawi
2014	CNPq (Brazil RC)	R$150k (£40k)	Arsenolipids in fish oil (visiting professorship for J Feldmann)
2014	Royal Thai Foundation	£57k	+ PhD stipend for Parinda Manorut for mercury speciation rice
2014	Royal Thai Foundation	£57k	+ PhD stipend for Nunnapus Laitip for selenium speciation in biological samples
2015	Royal Thai Foundation	£60k	+ PhD stipend for Savarin Sinaviwat for Arsenic speciation in biological samples
2016	Elphinstone Scholarship and NDDC (Nigeria)	£24k	+stipend for K. Nwoko for Nanoparticles in non-aqueous media
	Total Live Grants in which TESLA is involved	**£10.6 M**	