SCOTTISH METABOLOMICS NETWORK

Scottish Metabolomics Network Newsletter

4th Jan 2021

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Twitter updates: #ScotMetNet

Office

Phil Whitfield has been appointed as Secretary of the network and Will Allwood as Chair. Congratulations both, and many thanks to you, and to Karl and Andy for serving in these roles.

The symposium will be discussed at the next board meeting.

Communications

We have new mailing lists. The board can be reached at SMN-BOARD@JISCMAIL.AC.UK, and an announcements list has been set up: SCOTMETNET-ALL@JISCMAIL.AC.UK. Send your email to LISTSERV@JISCMAIL.AC.UK, with the command "sub scotmetnet-all" in the email. The list is moderated, and your default delivery will be a weekly digest.

Finally, there is SCOTMETNET-EDI@JISCMAIL.AC.UK for our Equality Diversity and Inclusivity group.

Special Issue "Scottish Metabolomics Network Annual Meeting—New Innovations in Metabolomics"

The special issue of Metabolites dedicated to the 2019 Network Symposium has been closed for submissions since Dec 15th, and the issue is now online.

https://www.mdpi.com/journal/metabolites/special_issues/SMN

Martin, S.; Doherty, M.; Salvo-Chirnside, E.; Tammireddy, S.; Liu, J.; Le Bihan, T.; Whitfield, P. "Surviving Starvation: Proteomic and Lipidomic Profiling of Nutrient Deprivation in the Smallest Known Free-Living Eukaryote." *Metabolites* 2020, **10**(7), 273; https://doi.org/10.3390/metabo10070273.

https://www.mdpi.com/2218-1989/10/7/273

Muhamadali, H.; Simoens, K.; Xu, Y.; Nicolai, B.; Bernaerts, K.; Goodacre, R. "Evaluation of Sample Preparation Methods for Inter-Laboratory Metabolomics Investigation of Streptomyces lividans TK24." *Metabolites* 2020, **10**(9), 379; https://doi.org/10.3390/metabo10090379.

https://www.mdpi.com/2218-1989/10/9/379

Blackburn, G.; Hay, J.; Skagen, C.; Paul, E.; Achcar, F.; Wilson, J.; Best, C.; Manson, E.; Burgess, K.; Barrett, M.; Gill, J. "Running on Empty: A Metabolomics Approach to Investigating Changing Energy Metabolism during Fasted Exercise and Rest." *Metabolites* 2020, **10**(10), 399; https://doi.org/10.3390/metabo10100399.

https://www.mdpi.com/2218-1989/10/10/399

Alanazi, S.; Alenzi, N.; Fearnley, J.; Harnett, W.; Watson, D. "Temperate Propolis Has Anti-Inflammatory Effects and Is a Potent Inhibitor of Nitric Oxide Formation in Macrophages." *Metabolites* 2020, **10**(10), 413; https://doi.org/10.3390/metabo10100413.

https://www.mdpi.com/2218-1989/10/10/413

Lecommandeur, E.; Cachón-González, M.; Boddie, S.; McNally, B.; Nicholls, A.; Cox, T.; Griffin, J. "Decrease in Myelin-Associated Lipids Precedes Neuronal Loss and Glial Activation in the CNS of the Sandhoff Mouse as Determined by Metabolomics." *Metabolites* 2021, **11**(1), 18; https://doi.org/10.3390/metabo11010018.

https://www.mdpi.com/2218-1989/11/1/18

Novel tools for evaluating intestinal dysfunction in children and adults with malnutrition disorders

Douglas Morrison, University of Glasgow

Recent MRC Programme Grant success involving the team at SUERC and University of Glasgow in a project to develop new tools to understand how the gut is compromised in children in Low- and Middle-Income Countries where malnutrition and enteropathogen burdens are high. The project will develop multi-omic and stable isotope based tools to characterise gut function in children in Africa and examine how the gut responds in severe cases of malnutrition to nutritional therapy. The multi-disciplinary Programme Grant led by Professor Paul Kelly (QMUL and University of Zambia School of Medicine) builds upon expertise assembled in the Hunger Consortium (https://www.imperial.ac.uk/hunger-project/), a team of internationally leading researchers whose goal is to develop a programme of work to directly address the United Nations Sustainable Development Goal 2: End hunger, achieve food security and improve nutrition, and promote sustainable agriculture.

Frost G, Morrison DJ, Marchesi J, Bourke C, Posma J, Garcia-Perez I, Preston T, Robertson R, Thompson A, Maitland K, Edwards CA, Kelly P (PI) Novel tools for evaluating intestinal dysfunction in children and adults with malnutrition disorders. MRC. £2,875,259.

Give peas a chance!

Douglas Morrison, University of Glasgow

In a cross-disciplinary collaboration involving research teams across nutrition, plant genetics and food structure and processing using a combination of metagenomic, metabolomic and stable isotope labelling techniques, a recent paper in *Nature Food* involving the team at SUERC has shown how a natural genetic mutation in the common green pea (Pisum sativum L.) changes the way that starch is digested in the small intestine which improves overall glucose homeostasis.

The natural genetic mutation in a gene coding for a starch branching enzyme changes the way in which starch is assembled within the pea to create a higher degree of resistant starch (a type of starch that is less easily digested to glucose in the small intestine and is available to be broken down by the gut microbiota). Stable isotope labelled wild type and mutant peas were fed to volunteers in a clinical trial to demonstrate that the peas with the genetic mutation resulted in lower glucose production in the small intestine and greater production of microbial metabolites in the large intestine, both of which supported acute improvements in glucose homeostasis. A longer study with the same (but unlabelled) peas demonstrated that the genetic variant pea led to lower glucose availability in the small intestine, resulting in acutely lower blood glucose levels following a meal with the peas. This important work demonstrates that development of naturally bred crop varieties with higher resistant starch content can have meaningful impacts on human health.

Petropoulou K, Salt LJ, Edwards CH, Warren FJ, Garcia-Perez I, Chambers ES, Alshaalan R, Khatib M, Perez-Moral N, Cross KL, Kellingray L, Stanley R, Koev T, Khimyak YZ, Narbad A, Penney N, Serrano-Contreras JI, Charalambides MN, Blanco JM, Seoane RC, McDonald JAK, Marchesi JR, Holmes E, Godsland IF, Morrison DJ, Preston T, Domoney C, Wilde PJ, Frost GS. Altering starch digestion using crop genetics to improve glucose homeostasis in humans. Nat Food 1, 693–704 (2020) https://doi.org/10.1038/s43016-020-00159-8

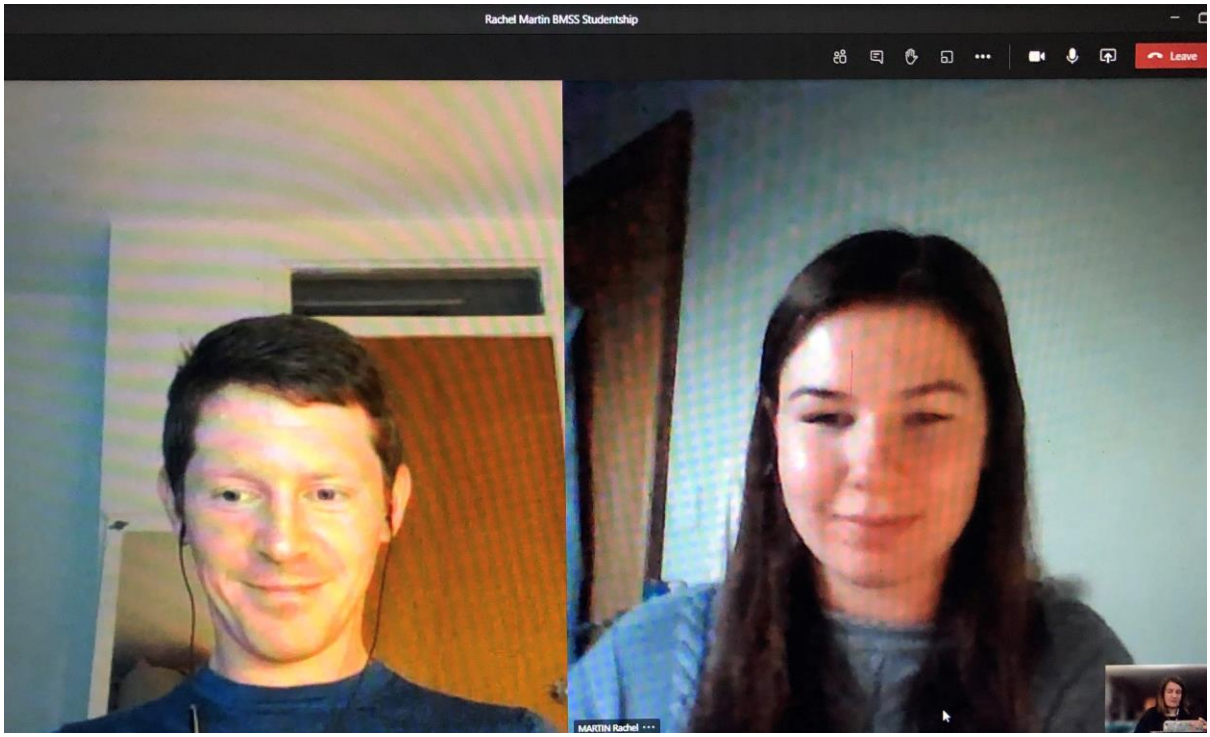
And associated commentary

Gidley, M.J. Give peas a chance. Nat Food 1, 663–664 (2020). https://doi.org/10.1038/s43016-020-00168-7

Edinburgh mass-spec core

Natalie Homer

In July and August we had a BMSS Studentship taken by 4th year undergraduate student Rachel Martin. We had to convert the studentship from an in person to a virtual studentship, where she underwent training in chromatography and mass spectrometry, video calls and tours of the laboratory and many video meetings to describe and update on progress of the method as it was being developed in real time. The project aimed at developing a targeted method for hexapeptides using our new microflow IonKey equipment on the Waters Xevo TQS



Scott with Rachel, taken remotely

CONGRATULATIONS

In august and September Scott Denham and Jo Simpson both achieved their Chartered Scientist status - awarded through the Science Council with their membership body the Institute for Science and Technology.

In November Sphamandla Ntshangase started to work in the Centre for Cardiovascular Sciences as a post-doctoral researcher, focussing on Imaging Mass Spectrometry, and he is also taking over the role of SMN Media Coordinator.

Also in November, Natalie was awarded a certificate for winning the Society for Endocrinology Journal award for the following article. This prize is awarded annually and aims to recognise excellence in endocrine research and practice and a contribution to the wider biomedical and biological sciences field. The paper was marked by a panel on the basis of originality, scientific content, presentation and contribution to the field.

Spaanderman, D., Nixon, M., Buurstede, J., Sips, H., Schilperoort, M., Kuipers, E., Backer, E., Kooijman, S., Rensen, P., Homer, N., Walker, B., Meijer, O., and Kroon, J. (2019). Androgens modulate glucocorticoid receptor activity in adipose tissue and liver. Journal of Endocrinology 240, 1, 51-63, available from: https://doi.org/10.1530/JOE-18-0503

SMN Equality, Diversity and Inclusivity

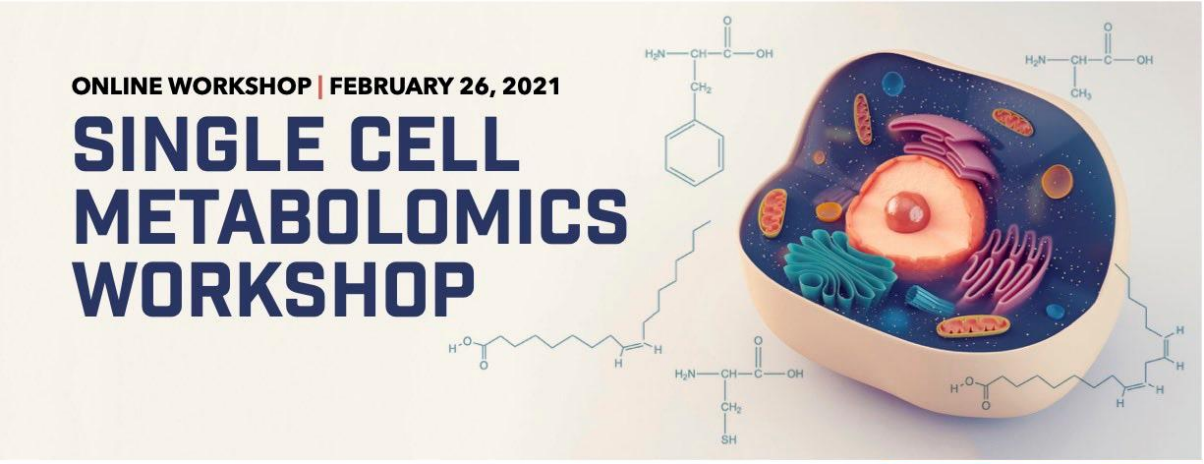
The group plans to meet again in February. Please do get in touch if you have any ideas, complaints, or would like to get involved.

If like to join the EDI group and make a difference, or need support, you can confidentially contact us on SCOTMETNET-EDI@JISCMAIL.AC.UK

Book of the quarter: *NeuroTribes: The Legacy of Autism and How to Think Smarter About People Who Think Differently* by Steve Silberman– available from many libraries, online bookshops, and as an audiobook. Read more about this book:

https://www.goodreads.com/book/show/22514020-neurotribes

Events



The Precision Medicine Task Group of the **Metabolomics Society** in partnership with other organizations and interest groups is organizing a virtual workshop on Single Cell Metabolomics, to be held on **Friday February 26, 2021 10 AM - 13.00 pm EST**.

ALL PARTICIPANTS ARE WELCOME TO REGISTER FOR FREE.

To register, please email Lisa Howerton at lisa.howerton@duke.edu

Omics at single cell resolution has expanded very rapidly, most obviously in genomics/transcriptomics. However, this approach lacks direct analysis of function, such as cellular metabolism. Most tissues are fundamentally heterogeneous at the cellular level, and heterogeneity is a hallmark of several pathologies including cancer.
The Workshop will comprise invited talks and a general open discussion forum.

AREAS OF INTEREST INCLUDE:

- Intrinsic technical problems and current status
- Coverage
- Imaging based methods (MS, microdissection, optical, other)
- Prospects for stable isotope tracing at single cell resolution
- Emerging approaches and applications

SPEAKERS

- Thomas Hankemeier & Ahmed Ali, *University of Leiden*
- Jonathan Sweedler, *University of Illinois Urbana-Champaign*
- Nimmi Ramanujam, *Duke University*
- Ian Gilmore, *National Physical Laboratory, London*
- Shawn Davidson, *Princeton University*
- Discussion Session

ORGANIZED BY:

- Andrew N. Lane, *University of Kentucky*
- Mioara Larion, *National Institutes of Health*
- Jennifer Kirwan, *Berlin Institute of Health*
- Rima F Kaddurah-Daouk, *Duke University School of Medicine*

Scottish Metabolomics Network Papers

Denham, S.G.; Just, G.; Kyle, C.J.; Richardson, J.; Lee, P.; Simpson, J.P.; Gifford, R.M.; Andrew, R.; Reynolds, R.M.; Homer, N.Z. Automated Supported Liquid Extraction for the analysis of a panel of 12 endogenous steroids in human plasma by LC-MS/MS. Preprints 2020, 2020110551 (doi: 10.20944/preprints202011.0551.v1).

Effects of Obesity And Insulin on Tissue-Specific Recycling Between Cortisol And Cortisone in Men. Anderson AJ, Andrew R, Homer NZM, Hughes KA, Boyle LD, Nixon M, Karpe F, Stimson RH, Walker BR. J Clin Endocrinol Metab. 2020 Dec 3:dgaa896. doi: 10.1210/clinem/dgaa896. Online ahead of print. PMID: 33270115

Synaptic signalling in a network of dopamine neurons: what prevents proper intercellular crosstalk? Chen Y, Kunath T, Simpson J, Homer N, Sylantyev S. FEBS Lett. 2020 Oct;594(20):3272-3292. doi: 10.1002/1873-3468.13910. Epub 2020 Aug 30. PMID: 33073864

Hutka M, Kadam P, Van Saen D, Homer NZM, Onofre J, Wallace WHB, Smith LB, Stukenborg JB, Goossens E, Mitchell RT.
Cancers (Basel). 2020 Sep 30;12(10):2830. doi: 10.3390/cancers12102830. PMID: 33008013 Free PMC article.

Volatomic analysis identifies compounds that can stratify non-alcoholic fatty liver disease. Sinha R, Lockman KA, Homer NZM, Bower E, Brinkman P, Knobel HH, Fallowfield JA, Jaap AJ, Hayes PC, Plevris JN. JHEP Rep. 2020 Jun 15;2(5):100137. doi: 10.1016/j.jhepr.2020.100137. eCollection 2020 Oct. PMID: 32775974

Hutka M, Kadam P, Van Saen D, Homer NZM, Onofre J, Wallace WHB, Smith LB, Stukenborg JB, Goossens E, Mitchell RT.' Fertility Preservation in Childhood Cancer: Endocrine Activity in Prepubertal Human Testis Xenografts Exposed to a Pubertal Hormone Environment' Cancers (Basel). 2020 Sep 30;12(10):2830.

Hurst EA, Homer NZ, Mellanby RJ.' Vitamin D Metabolism and Profiling in Veterinary Species' Metabolites. 2020 Sep 15;10(9):371. doi: 10.3390/metabo10090371.

Bode, E. F., Markby, G. R., Boag, A. M., Martinez-Pereira, Y., Corcoran, B. M., Farquharson, C., Sooy, K., Homer, N., Jamieson, P. M., & Culshaw, G. J. (2020). Glucocorticoid metabolism and the action of 11 beta-hydroxysteroid dehydrogenase 2 in canine congestive heart failure. Veterinary journal (London, England) 258, 105456.

Denver, N, Homer NZ, Andrew R, MacLean AM 'Estrogen metabolites in a small cohort of patients with idiopathic pulmonary arterial hypertension; Pulmon Circulation 2020

Boag AM, Brown A; Koenigshof A; Homer NZ; Sooy K, Jamieson PM 'Glucocorticoid metabolism in critically ill dogs Domest Anim Endocrinol, (2020) 72

Zhang T, Bauer C, Newman AC, Uribe AH, Athineos D, Blyth K, Maddocks ODK. Polyamine pathway activity promotes cysteine essentiality in cancer cells. Nat Metab. 2020 Oct;2(10):1062-1076. doi: 10.1038/s42255-020-0253-2. Epub 2020 Aug 3. PMID: 32747794.

Sadiku, P., Willson, J.A., Ryan, E.M., Sammut, D., Coelho, P., Watts, E.R., Grecian, R., Young, J.M., Bewley, M., Arienti, S., Mirchandani, A.S., Sanchez Garcia, M.A., Morrison, T., Zhang, A., Reyes, L., Griessler, T., Jheeta, P., Paterson, G.G., Graham, C.J., Thomson, J.P., Baillie, K., Thompson, A.A.R., Morgan, J.-M., Acosta-Sanchez, A., Dardé, V.M., Duran, J., Guinovart, J.J., Rodriguez-Blanco, G., Von Kriegsheim, A., Meehan, R.R., Mazzone, M., Dockrell, D.H., Ghesquiere, B., Carmeliet, P., Whyte, M.K.B., Walmsley, S.R., n.d. Neutrophils Fuel Effective Immune Responses through Gluconeogenesis and Glycogenesis. Cell Metabolism.
https://doi.org/10.1016/j.cmet.2020.11.016

Matos, M.*, Anastácio, J.D.*, Allwood, J.W.*, Carregosa, D., Sungurtas, J., McDougall, G.J., Menezes, R., Matias, A.A., Stewart, D., Nunes dos Santos, C. (2020). Assessing the intestinal permeability and anti-inflammatory potential of sesquiterpene lactones from chicory. Nutrients 2020, 12(11), 3547; https://doi.org/10.3390/nu12113547 *equal contributing authors

Allwood, J.W., Gibon, Y., Osorio, S., Araújo, W.L., Vallarino, J.G., Pétriacq, P., Moing, A. (2020). Developmental metabolomics to decipher and improve fleshy fruit quality. Advances in Botanical Research, Academic Press, https://doi.org/10.1016/bs.abr.2020.09.016.

Allwood, J.W., Evans, H., Austin, C., McDougall, G. (2020). Extraction, Enrichment, and LC-MSn-Based Characterization of Phlorotannins and Related Phenolics from the Brown Seaweed, Ascophyllum nodosum. Marine Drugs 18: 448.

Moing, A., Allwood, J.W., Aharoni, A., …., Hall, R.D.; Schaffer, A.A. (2020). Comparative Metabolomics and Molecular Phylogenetics of Melon (Cucumis melo, Cucurbitaceae) Biodiversity. Metabolites 10: 121.

Okamoto, H., Ducreux, L.J.M., Allwood, J.W., Hedley, P., Gururajan, V., Wright, A., Terry, J.M. Taylor, M.A. (2020). Light regulation of chlorophyll and glycoalkaloid biosynthesis during tuber greening of potato S. tuberosum. Frontiers in Plant Science 11: 753.

Industry news

Check out these webinars from Shimadzu https://www.shimadzu.co.uk/webinars

Acknowledgements

PHOTOGRAPHS:

1. All photos in this issue from Natalie Homer

Thanks to everyone for your contributions. Any corrections or last-minute updates for the web version, let me know jimi.wills@ed.ac.uk.