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Glyco(proteo)mic workflows for cancer biomarker discovery

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Curriculum Vitae

Alan Bernard Moran was born on April 22nd 1993 in Dublin, Ireland. He attended the course of Biomedical and Biomolecular Sciences at University College Dublin (UCD) where he obtained his Bachelor of Science (BSc) degree, majoring in Genetics, in 2015. As part of his final year, Alan worked at the UCD Conway Institute of Biomolecular and Biomedical Research in the laboratory of Dr. Peadar Ó Gaora under the supervision of Dr. Lisa Rogers where he focused on improving bioinformatic workflows for the detection of positive selection in verotoxigenic *E. coli*. Following this, Alan obtained a diploma in Pharmaceutical Technology (Bioprocessing and Healthcare) from the Technological University Dublin in 2016. In the same year, Alan became employed at the National Institute for Bioprocessing Research and Training (NIBRT) as an Analytical Scientist in the Contract Research team. It was at NIBRT, under the supervision of Dr. Brian Morrissey and Patrick Jennings, where he was first introduced to the wonders of glycobiology and mass spectrometry (MS).

Motivated by his newfound curiosity in glycomics and MS, Alan moved to Leiden, The Netherlands in 2017 as a PhD candidate and Marie Curie Early Stage Researcher. He joined the Leiden University Medical Center and Center for Proteomics and Metabolomics under the supervision of Prof. Dr. Manfred Wuhrer and Dr. Guinevere Lageveen-Kammeijer. Here, he focused on developing a capillary electrophoresis-MS approach for detecting and quantifying intact prostate-specific antigen (PSA) proteoforms which could serve as new biomarkers aiming at prostate cancer patient stratification. Furthermore, as part of the European Industrial Doctorate, Alan spent 18 months at Ludger Ltd., UK in the laboratory of Dr. Daniel Spencer with the support of Dr. Richard Gardner. Here, Alan worked on a released *N*-glycan and sialic acid derivatization assay followed by LC-MS in order to identify specific glycomic signatures in the sera from colorectal cancer patients.

As part of the Horizons 2020 Marie Skłodowska-Curie Actions consortium, GlySign, Alan also had the opportunity to take part in a multidisciplinary and intersectoral training programme. He worked alongside the other GlySign researchers in order to organize two workshops aimed at sharing their experience on the topic of “industrial-

academic mobility” with Bachelors and Masters students. Furthermore, between 2018 – 2019, Alan presented his research at three international conferences and symposia.

Since 2021, Alan has been working at Janssen Vaccines and Prevention, Leiden in the Bacterial Vaccines department as part of the Analytical Development group headed by Dr. Chakkumkal Anish. As an Associate Scientist, Alan is contributing the knowledge of glycomics and MS that he gained during his PhD in order to develop new vaccines to fight antimicrobial resistance.

PhD Portfolio

Mandatory Courses

- PhD introductory meeting 2017
- Basic methods and reasoning in biostatistics 2018
- BROK course – regulations for conducting clinical research in the Netherlands 2020

Additional Courses and Workshops

- Time and self-management for PhDs (*Leiden University, The Netherlands*) 2017
- Personal Effectiveness (*GlyCoCan workshop, LUMC, The Netherlands*) 2018
- High-throughput data processing of MALDI-TOF-MS data (*GlyCoCan workshop, LUMC, The Netherlands*) 2018
- Storytelling and Stagecraft for Scientists (*GlyCoCan workshop, LUMC, The Netherlands*) 2018
- Business Process and Quality Management (*GlySign workshop, Ludger Ltd., UK*) 2018
- Biologicals, Biotechnology & Quality Management (*GlySign workshop, LUMC, The Netherlands*) 2018
- Fundamentals of capillary electrophoresis (*LUMC, The Netherlands*) 2018
- Glycan analysis workshop (*Ludger Ltd., UK*) 2019
- Intellectual property rights and technology transfer (*GlySign workshop, Genos Ltd., Croatia*) 2019
- Industrial-academic mobility workshop (*GlySign workshop, Genos Ltd., Croatia*) 2019
- Statistics for Research workshop (*Oxford Brookes University, UK*) 2020
- Industrial-academic mobility workshop (*GlySign workshop, LUMC, The Netherlands*) 2020
- Ace The Deck presentation training (*www.acethedeck.com*) 2020

Congress Attendance and Oral or Poster Presentations

- 12th Jenner Glycobiology and Medicine Symposium (*Dubrovnik, Croatia*) 2017
- 11th Mass Spectrometry School in Biotechnology and Medicine (MSBM) – **Poster presentation** (*Dubrovnik, Croatia*) 2017
- NVMS spring meeting (*Amsterdam, The Netherlands*) 2017
- NVMS fall meeting (*Delft, The Netherlands*) 2017

- NLab discussion (*LUMC, Leiden, The Netherlands*) 2017
- CHAINS conference; **Poster presentation** (*Veldhoven, The Netherlands*) 2017
- Mass Spectrometry: Applications to the Clinical Lab (MSACL) – **Oral presentation** (*Salzburg, Austria*) 2018
- Global CESI-MS symposium – **Oral presentation** (*Leiden, The Netherlands*) 2019
- EuroCarb XX – **Oral presentation** (*Leiden, The Netherlands*) 2019
- Glycoanalytics webinar, European Glycoscience Community – **Oral presentation (invitation)** (*www.euroglyco.com*) 2021
- Protein Metrics Webinar – **Oral presentation (invitation)** (*www.proteinmetrics.com*) 2023
- Analytical Glycosciences webinar, European Glycoscience Community – **Oral presentation (invitation)** (*www.euroglyco.com*) 2023

Awards and Grants

- MSACL young investigator travel grant 2018

List of Publications

- (1) **Moran, A. B.**; Domínguez-Vega, E.; Nouta, J.; Pongracz, T.; de Reijke, T. M.; Wuhrer, M.; Lageveen-Kammeijer, G. S. M. Profiling the Proteoforms of Urinary Prostate-Specific Antigen by Capillary Electrophoresis – Mass Spectrometry. *Journal of Proteomics*. **2021**, 238. DOI: 10.1016/j.jprot.2021.104148.
- (2) Ward, S. E.; Sullivan, J. M. O.; **Moran, A. B.**; Spencer, D. I. R.; Gardner, R. A.; Sharma, J.; Fazavana, J.; Monopoli, M.; McKinnon, T. A. J.; Chion, A.; Haberichter, S.; Donnell, J. S. O. Sialylation on O-Linked Glycans Protects von Willebrand Factor from Macrophage Galactose Lectin-Mediated Clearance. *Haematologica*. **2022**, 107 (3). DOI: 10.3324/haematol.2020.274720.
- (3) **Moran, A. B.**; Gardner, R. A.; Wuhrer, M.; Lageveen-Kammeijer, G. S. M.; Spencer, D. I. R. Sialic Acid Derivatization of Fluorescently Labeled N-Glycans Allows Linkage Differentiation by Reversed-Phase Liquid Chromatography–Fluorescence Detection–Mass Spectrometry. *Analytical Chemistry*. **2022**, 94 (18), 6639–6648. DOI: 10.1021/acs.analchem.1c02610.
- (4) Melo Diaz, J. M.; **Moran, A. B.**; Peel, S. R.; Hendel, J. L.; Spencer, D. I. R. Egg Yolk Sialylglycopeptide: Purification, Isolation and Characterization of N-Glycans from Minor Glycopeptide Species. *Organic and Biomolecular Chemistry*. **2022**, 20 (24). DOI: 10.1039/d2ob00615d.
- (5) **Moran, A. B.**; Domínguez-Vega, E.; Wuhrer, M.; Lageveen-Kammeijer, G. S. M. Software-Assisted Data Processing Workflow for Intact Glycoprotein Mass Spectrometry. *Journal of Proteome Research*. **2023**, 22 (4), 1367–1376. DOI: 10.1021/acs.jproteome.2c00762.
- (6) **Moran, A. B.**; Elgood-Hunt, E.; van der Burgt Y. E. M.; Wuhrer, M.; Mesker W. E.; Tollenaar, R. A. E. M.; Spencer, D. I. R.; Lageveen-Kammeijer, G. S. M. Serum N-glycosylation RPLC-FD-MS Assay to Assess Colorectal Cancer Surgical Interventions. *Biomolecules*. **2023**, 13 (6), 896. DOI: 10.3390/biom13060896.

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A PhD is a journey filled with many ups and downs. At moments it felt like climbing the highest mountain peak, watching the sun rise. Yet at times it felt more like being in the middle of a terrible storm. Fortunately, I received fantastic support and I am thankful to everybody that offered me a word of advice and encouragement.

From my days at NIBRT, I am grateful to Brian and Paddy who took me on as a fresh-faced graduate and sparked my interest in glycobiology and mass spectrometry. To Roisin, thank you for your advice about pursuing a PhD.

I was lucky to have several supervisors from whom I learned different and essential lessons for being a scientist. I would like to thank my promoter Prof. Dr. Manfred Wuhrer for giving me the opportunity to complete a PhD in the CPM. You greatly impacted my scientific and personal growth and always took on the role which I needed; teacher, coach, and also motivator. To my co-promotor Dr. Guinevere Lageveen-Kammeijer, I truly appreciate your optimism and dedication. You guided me through every step of the way and now I can stand on my own two feet thanks to your leadership. I am also grateful to Dr. Daniel Spencer – Daniel, your forward-thinking greatly helped the completion of this thesis and your compassion was particularly helpful during times of self-doubt. I would also like to thank Dr. Theo de Reijke for great discussions about the application of our work.

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