

Curriculum Vitae

MICHAEL BUTLER

Address: Cell Technology Group
(work) National Institute for Bioprocessing Research and Training
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Citizenship: British/ Canadian dual citizenship
Birth: Bangor, North Wales, U.K.
Languages: Welsh (fluent); French (intermediate);
Spanish (level 7, University), German (basic).

POST-SECONDARY EDUCATION

1974: PhD in Biochemistry at King's College, University of London, U.K.
(*Studies on the charging of transfer RNA*)
1971: MSc in Chemistry at Waterloo University, Canada
1969: Post-graduate Certificate of Education at Birmingham University, U.K.
1968 BSc (Hons) in Biochemistry, Birmingham University, U.K.

EMPLOYMENT HISTORY/ Professional Experience:

2016- Principal Investigator in Cell Technology at NIBRT, Ireland

2016-2019 Chief Scientific Officer, NIBRT, Dublin, Ireland

2017- Adjunct Professor, University College Dublin

2016- Distinguished Professor Emeritus, University of Manitoba, Canada

2010-2017 Director of MabNet: a national network for monoclonal antibody production

2008-2016 Distinguished Professor, University of Manitoba, Canada

1990- Professor, Department of Microbiology, University of Manitoba, Canada

2004-2005 Sabbatical, industrial consultancies; based in Bangor, N.Wales

2001-2004 Associate Dean of Industrial and Academic Research, Faculty of Science, U of Manitoba

2000-2001 Visiting Professor, Department of Biochemistry, Oxford University, UK

1990-1996 NSERC/ Apotex Industrial Research Chair in Fermentation Technology, U of Manitoba

1985-1990 Principal Lecturer in Biotechnology & director of Biotech. Unit at Manchester Polytechnic

1983 Visiting Scientist, Animal Virus Research Institute, Pirbright, U.K. .

1980-1981 Visiting Research Fellow, Department of Nutrition, Massachusetts Institute of Technology, USA

1978-1985 Senior Lecturer in Biochemistry, Manchester Polytechnic

1974-1978 Lecturer I/II in Biochemistry, Manchester Polytechnic

PRESENT RESEARCH ACTIVITY

Current research is in Mammalian Cell Technology for the production of biopharmaceuticals

(http://home.cc.umanitoba.ca/~butler/Butler_Lab.html). Specific projects include :-

- 1: Glycosylation:** The aim is to be able to control the glycosylation process to produce specific glycoforms. This can be accomplished by (a) genetic engineering (b) nutrient control in bioreactors and (c) enzymic modification.
- 2: Media development:** Chemically-defined formulations are being developed for the maximization of growth and productivity of a range of cell lines. Strategies include fractionation of complex undefined material to identify bioactivity (top-down approach) as well as statistically designed factorial analysis.
- 3: Dielectrophoretic analysis of cells:** The changing electrical properties of cells are being monitored by cytometry as a novel method of following metabolic changes.
- 4 Bioprocess development.** Culture conditions and media formulations are being studied to optimise the production of recombinant proteins.
- 5: Metabolic management/ engineering** is being used to study the energy metabolism of cells with the aim of understanding the intracellular requirements during protein production.
- 6: Cell robustness.** Identification of culture factors that enhance the robustness in agitated culture.
- 7: Viral production** from anchorage-dependent cells (eg; Vero and MRC-5) are being analyzed in microcarrier culture processes to maximize viral productivity.

Further information on this research is included in www.researchgate.net/profile/Michael_Butler and www.mabnet.ca

RESEARCH AWARDS

- 2024: Pharma Industry Awards, Ireland: Winner of Pharma Project of the Year. Optical methods for monitoring bioprocesses
- 2020: Poster Prize Winner: Bioprocessing Summit Europe Mota,L., Xie,Y., O’Flaherty,R. and Butler,M. In vitro glycoengineering in solid and liquid phase: production of hypergalactosylated rituximab with higher binding affinity.
- 2011-2014: President International Soc. for Protein Expression in Animal Cells
- 2010-2016: Scientific Director of MabNet: Strategic network for production of Mabs
- 2014: Best Poster Award: Cell Culture Engineering XIV. Tayi,V., Villacres,C., Liu,B., Coelho,T., Sogayar,M. and Butler,M. The role of glucose- and glutamine-regulated metabolic pathways on glycosylation of a heavy chain monoclonal antibody in CHO cells.
- 2008: Awarded the title of “Distinguished Professor” at the University of Manitoba
- 2004: Winner of the Synergy Award (NSERC) for innovation involving University-Industry collaboration.

RESEARCH ACHIEVEMENTS

- 2019-2024: Developed methods for assessing the criteria for protein hydrolysate activity in culture media
- 2019-2023: Developed & applied rapid methods for glycosylation analysis for Covid-19 and AAV viruses
- 2020-2024: Technology for applying optical methods for monitoring and controlling bioprocesses
- 2017-2024: Established the technology for applying dielectric spectroscopy to monitor bioprocesses
- 2006-2008: Technology developed for production of multiple viruses; reovirus, enterovirus & Dengue
- 2002: Glycoproteomics: The identification of novel forms of a congenital disorder of glycosylation by proteomics. Identification of metabolic control of protein glycosylation in cell culture.
- 2001: The development of a set of serum-free media formulations which are being commercialized by Biogro Technologies, Inc.
- 1999: The development of an effective scalable bioprocess for recombinant erythropoietin production. This has been transferred to a pilot scale for manufacture.
- 1996: The establishment of a low cost and robust production system for antibody production. This is presently being commercialised.
- 1996: The establishment of serum-free medium for anchorage-dependent cells used for viral vaccine production
- 1987- I developed an understanding of the metabolism of hybridomas which has led to the development of control strategies to maximise the productivity of monoclonal antibodies in commercial operations.

- 1986-1987 a strategy was developed for the growth of cell lines in non-ammoniagenic growth medium. This results in significant increases in cell yield.
- 1982-1983: I identified ammonia as the major toxic factor in the limitation of productivity in high density cell cultures. This toxic metabolic by-product is now recognised as the primary factor in limiting final cell yields in many processes.
- 1980: I developed the first perfusion system to be used for the continuous culture of anchorage-dependent cells on microcarriers. This resulted in an increase in cell yield of almost x10 compared to previously used batch cultures. This is now being used as a standard technique for the industrial production of viral vaccines.

INDUSTRIAL COLLABORATION

2010- 2016 Directed the collaboration of 10 Canadian companies through MabNet

2007-2010: Collaboration with National University & National Health Research Institute, Taiwan on dengue vaccine production.

2004: The NSERC Synergy Award was received for innovative research involving University-Industry collaboration (with Cangene Corporation).

2004: Member of Scientific Advisory Board for Serologicals corporation

2003- Member and theme leader of Cellnet, which is a funded network research program involving collaboration between 6 Canadian Universities and 7 commercial or non-academic partners.

2001-2004: President of Biogro Technologies Inc, a cell culture media development company

1996-2011 Collaboration supported by a series of CRD/Research Partnership program grants involving Cangene Corporation and NSERC. This involves the design of bioprocesses to be developed commercially for recombinant protein production

1990-1996: Industrial Research Chair at the University of Manitoba was a fixed-term salaried research programme jointly funded by the national research council (NSERC), the University and industrial companies - Apotex Fermentation and Rh Pharmaceuticals (now Cangene)

1996- Some of my research program is subsidised by services offered on a commercial basis to industry or other university laboratories. These services include automated amino acid analysis by HPLC and monoclonal antibody preparation and purification.

1987-1990: At Manchester Polytechnic a major part of my research was sponsored by an industrial consortium organised as the Animal Cell Technology Club by the Biotechnology Directorate of SERC. This involved a consortium of 6 academic groups and 6 industrial groups (ICI, Wellcome, Celltech, Glaxo, Porton & Beecham) who met at regular intervals to promote a specific research programme. Research funding also received directly from single companies for specific projects and contracts.

Industrial Consultancies: LH Fermentation (1990-1993), Gibco (1991), Biomira (1993), Amersham Biosciences (1996-2001), Vallee/Brazil (1995 & 2003), SmithKline Beecham (1997-1998), Bayer (1998), Merck (2000, 2014), GeneMedix (2003), Industry Canada/ Federal Government (2003), M&K Engineering (2004), Serologicals (2004), Serono (2004), BayerHealthcare (2004) ML Laboratories (2004), Genzyme (2005), Pfizer (2007), Novartis (2009), Spimaco(2009), Taylor-Wessing (2011), Coherus Biosciences (2014), Dechert (2015), Abbvie/ Wilmerhale (2015), Patterson Belknap (2015-2018).

MAJOR RESEARCH GRANTS

2022-2024	Enterprise Ireland / Canty2 Application of advanced optical systems for monitoring and control of mammalian cell bioprocesses, €265,108
2022-2024	Enterprise Ireland / GlycoSelect. Enhanced control of critical quality attributes of mAbs by glycoengineering. €249,098
2022-2024	Enterprise Ireland / Kerry/Valitacell Quality control and functional determination of protein hydrolysates. €303,233
2020-2022	Agilent. Glycoanalysis and Glycoengineering Studies. €377,000
2019-2021	Enterprise Ireland / Canty. Development of a robust optical system for on-line real-time analysis of mammalian cells during a bioprocess. €185,273
2019-2020	Science Foundation Ireland/TIDA Production of single structural forms of monoclonal antibodies by solid-state chemoenzymatic transformation . €99,000

2018-2020	Enterprise Ireland / Kerry. Identification of bioactivity in protein hydrolysates as supplements to mammalian cell culture. €406,968
2016-2023	NSERC Discovery grant. Control strategies for mammalian cell bioprocesses in the production of glycosylated biopharmaceuticals. \$210,000
2011-2016.	NSERC Discovery grant. The control of glycosylation of recombinant proteins in mammalian cell culture. \$150,000
2016	Faculty of Science Interdisciplinary/New Directions Research Collaboration. \$10,000
2014-2015:	Repligen (sponsored research). The development of serum-free media for anchorage-dependent mammalian cells. \$26,000
2010	NSERC/Engage. Identification of bioactivity in phytoplankton extracts. \$25,000
2010-2016	NSERC strategic network for the production of single-type glycoform monoclonal antibodies (MabNet). \$5million
2008-2010	The effect of culture media supplements on the productivity and metabolic status of mammalian cell lines. Becton-Dickinson. \$244,000
2008-2009	Ideas to Innovation/ NSERC grant (with C.Moresoli/ Waterloo). The isolation of bioactive peptides for animal cell growth. \$125,000
2006-2011	NSERC Discovery grant. Production of glycoproteins or viruses by mammalian cells in culture.(\$225,000)
2007	Recipient of CNPq grant as visiting Professor to University of Rio de Janeiro, Brazil
2003-2008	Cell Factory Network/ NSERC.\$3million between several Universities
2002-2006	NSERC research grant. Growth and productivity of mammalian cells in agitated cultures. \$167,200
2002	Winnipeg Foundation. Methods to produce robust mammalian cells in bioreactors \$7,500
2000-2004	NSERC/Cangene Collaborative Research & Development grant. The development of a mammalian cell culture process for the production of beta-interferon with consistent glycosylation. \$750,000
2000	Canadian Foundation for Innovation. Manitoba Centre for Proteomics (+9 co-applicants) \$605,242
1998-2002	NSERC research grant. Growth and productivity of mammalian cells in agitated cultures \$97,600
1999-2000	University of Manitoba Research Development Fund. Production of reovirus from a serum-free mammalian cell culture. \$10,000
1998	Amersham Pharmacia Biotech. Development and evaluation of a fluidized-bed Cytopilot for production from mammalian cells. \$35,000
1998	Engineering Foundation, USA/ Cell Technology \$2,500
1998-1999:	Manitoba Health Research Council/ Chemicon. Structural predictors of integrin function: targeted commercializable antibody production. year 2 (with J.Wilkins) \$187,900
1997-1998	MHRC/Chemicon. Structural predictors of integrin function: targeted commercializable antibody production. (with J.Wilkins) \$160,000
1997-1998	ILO/ NSERC Prototype & Experimental Development Fund. The development of a serum-free formulation for growing anchorage-dependent mammalian cells. \$7,500
1996-2000	NSERC/Cangene Collaborative Research & Development grant. The development of a mammalian cell culture process for the production of erythropoietin with consistent glycosylation. \$522,000
1990-1996	NSERC/Apotex Industrial Research Chair in Fermentation Technology. Productivity from mammalian cells at high densities. The grant included salary support over 6 years. \$1,500,000
1996-1997	University of Manitoba Research Development Fund. Large-scale production of selected murine antibodies. \$15,000
1994:	Engineering Foundation, USA/ Cell Technology \$2,000
1992:	NSERC and the University of Manitoba Research Development fund for carbohydrate analysis system. \$35,000
1992:	Univ. Manitoba Research Development fund. \$4,200
1991:	LH fermentation / support for animal cell fermenter \$30,000.
1988-1989	Grants from Celltech and LH Fermentation) for specific projects in animal cell technology.
1987-1990	SERC + Industrial Consortium of 6 major UK biotechnology companies; Research Grant to study the changes in activity of regulatory enzymes during hybridoma cell growth. 117,000 pounds
1987-1990	NAB Research Grant: 1. to develop non-ammoniagenic media for the growth of anchorage-dependent cells on microcarriers. 2. to study glycosyltransferase enzymes in hybridomas. 132,000 pounds

1986-1989	SERC Research Grant to study the growth characteristics of an anti-thyroxine releasing hybridoma. 65,000 pounds
1985-1988	NAB Research Grant to study the relationship between cell growth and antibody release in selected hybridomas. 40,000 pounds
1983	SERC Research Grant for research at the Animal Virus Research Institute, UK, to study the application of microcarrier techniques for the growth of BHK cells in FMD vaccine production. 10,000 pounds
1980-1981	Flow Fellowship for research at MIT to study the use of microcarriers for the growth of animal cells particularly in relation to the use of human diploid fibroblasts for interferon production. \$30,000

UNIVERSITY TEACHING

(University of Manitoba)

General Microbiology 60.211

Biological Energy Transduction 60.454

Membrane and Cellular Biochemistry 60.346

Industrial Microbiology & Industrial Bioprocesses 60.451

Current Topics in Mammalian Cell Culture 60.717

Glycobiology 2.437

(Manchester Metropolitan University)

Enzymology and basic metabolism (BSc Biol Sci 2)

Molecular genetics and protein synthesis (BSc Biol Sci

3) Cell biology and genetics (BSc Comb Stud 2/3)

Biochemistry (BSc Comb Stud 2/3)

Biotechnology (BSc Biol Sci 4)

SHORT COURSE TEACHING:

2018: Introduction to Cell Culture - Training Seminar. Cambridge Healthtech, San Diego, USA

2014: Course on "Animal Cell Biotechnology" (3 weeks) at Universidad de Estado de Morelos (UEAM)

2013: Technology of Mammalian Cell Culture. (1 week) National Institute of Health, Lima Peru

2013: "Glycobiology" 36 h graduate student course at University of Sao Paulo, Brazil

2012: Course on "Animal Cell Biotechnology" (5 weeks) at Universidad de Estado de Morelos (UEAM)

2008 : Workshop : « Alternative Systems for the production of recombinant proteins as biopharmaceuticals.» Third International School on Biopharmaceutical production from animal cell cultures. Federal Universidad de Rio de Janeiro, Brazil.

2007 : Course in « Animal Cell Technology » at Universidade Federal de Rio de Janeiro, Brazil

2006 : Invited lectures for Biochemical Engineering course at Universidad Nacional de Mexico.

1997: Course instruction & organisation: Cultivo de celulas superiores para la clinica y la industria biotecnologica. Centre for Molecular Immunology, Havana, Cuba, November 1997

1996: "Animal cell cultivation" sponsored by Sociedade Brasileira de Microbiologia at the Federal University of Sao Carlos, Brazil

1987-1990: General Biotechnology summer course (Manchester Polytechnic)

A teaching programme in Biotechnology was developed and the course material was incorporated into a 180 page book by the Open University Press - "Animal Cell Technology: Principles and Products." This forms part of the O.U. Press Biotechnology Series.

SOCIETY MEMBERSHIP:

Biochemical Society, European Society for Animal Cell Technology, Canadian Society of Microbiology, Canadian Society of Chemical Engineering, International Society for Protein Expression (founding member and President 2011-2013), Executive Committee of ESACT (2009-2011)

GRADUATE STUDENT THESES SUPERVISED

- Leticia Martins Mota. Chemoenzymatic *in vitro* glycoengineering in liquid and in solid phase to produce defined IgG glycoforms. PhD 2022

- Adam Bergin, The use of Process Analytical Technologies to examine the viability of CHO cells. PhD 2022
- Neha Mishra. Improving monoclonal antibody quality and efficacy: Studies on a camelid heavy-chain monoclonal antibody. PhD 2020
- Carina Villacres. The effect of nutrient depletion and media supplementation on the productivity and quality of monoclonal antibodies. PhD 2018
- Viridiana Ureña Ramírez Development of reduced serum-free media for MRC-5 and Vero cells using definitive screening design MSc 2017
- Natalie Krahn. Using biophysical characterization to begin to understand the onset, diagnosis, and treatment of cancer. PhD 2017 (co-supervised with J.Stetefeld)
- K.Braasch. Dielectric and precursor analysis to study metabolic effects on CHO cell viability and antibody glycosylation. PhD 2015
- B.Dionne. The Study of Culture Redox Potential's Effect On Glycosylation and Production of Monoclonal Antibodies In Mammalian Cell Cultures. PhD 2014
- B.Liu The availability of glucose to CHO cells affects the intracellular lipid-linked oligosaccharide distribution, site occupancy and the N-glycosylation profile of a monoclonal antibody. MSc 2014
- K.Sunley The adaptation of Chinese Ovary cells to hypothermic temperatures increases yields of monomeric recombinant interferon-beta. PhD 2009
- T.Tharmalingam. The effect of Pluronic and microcarriers on the growth, recombinant protein production and glycosylation of CHO cells. PhD 2008
- J. Rodriguez. The development of a cell culture process for the production of human beta interferon. PhD 2007
- A.Burgener A bioprocess to produce reovirus: serum-free media development and the relationship between intracellular nucleotide levels and virus production. PhD 2005
- H.Gehbeh The effect of the non ionic surfactant Pluronic F68 on mammalian cells in culture. PhD 2002
- V.Restelli Analysis of glycosylation profiles in recombinant erythropoietin MSc 2002
- J.P.Kunkel The effect of dissolved oxygen concentration on monoclonal antibody glycosylation in serum-free continuous culture. PhD 2001 (co-supervised with J.Jamieson)
- M. Yang Ammonium effects on CHO cell growth, metabolism, erythropoietin production and glycosylation. PhD 2000
- N. Barnabé The relationship between intracellular nucleotides and hybridoma cell culture productivity and viability. PhD 1998
- E.R. Broadhurst The effect of L-glutamate on growth of CC9C10 hybridomas. MSc 1997
- A.D.Christie The use of glutamate and dipeptides as substitutes for glutamine in animal cell cultures. PhD 1997
- M. Berry "Optimisation of Vero cell growth and productivity in microcarrier cultures" PhD 1996
- B.Y-C. Ng "The optimization of physical parameters for attachment and growth of Vero cells on Cytodex 1 and Cultispher G microcarriers" MSc 1995
- D.Petch "A metabolic analysis of glucose and glutamine utilization in hybridoma CC9C10" MSc 1994
- T.E. Sayer "The development of serum-free media for the growth of animal cells in culture" PhD 1993.
- L. Fitzpatrick "Glucose metabolism in murine hybridoma cells" MPhil 1992.
- M.E. Costello "Growth and productivity of hybridoma cell lines *in vitro*" PhD 1991.
- R.H. Thomas "The adaptation of anchorage-dependent mammalian cells to glutamine-free medium" PhD 1991.
- T.E. Hassell "The growth of anchorage-dependent cells in microcarrier culture using non-ammoniogenic substrates" PhD 1988.
- A. Hall "Mechanism of copper tolerance in the marine fouling alga *Ectocarpus siliculosus*" M. Phil. 1979.

Post-doctoral Fellows supervised

2021-Laura Breen
 2022- James Flynn
 2021-Yongjing Xie
 2021-Sandra Roche
 2011-2015 Venkata Tayi
 2001-2006: Maureen Spearman
 1997-2000: Ming-Dong Wang
 1996-1997: Gwen Harder

1995-1996: William Yang
1991-1995: David Jan
1986-1990: Helen Jenkins
1981-1984: Carter Badsha

EXTERNAL EXAMINER: to PhD theses at University of Sydney, Australia (1993), University of British Columbia (1996), University of Waterloo (1998), University of Montreal (2000), Ecole Polytechnique (2006 & 2008), University of Singapore (2008), University of Calgary (2009, 2011), University of Queensland (2011), University of Manchester (2012), University of Magdeburg, Germany (2014), Dublin City University (2014), University College Dublin (2014), University of Queensland (2015), University of Manchester (2017), University of Oxford (2019), University of Magdeburg, Germany (2020), Dublin City University (2020); Sheffield University (2021); University of British Columbia (2022), University College Dublin (2023), University of Sheffield (2023).

ADMINISTRATIVE/ MANAGEMENT EXPERIENCE (University of Manitoba)

As Associate Dean of Research (2000-2004) my responsibility was to promote and develop strategic plans for research within the 9 departments of the Faculty. This included writing an annual research plan, co-ordinating institutional applications for funding and presenting reports when required. I chaired several key committees including a faculty research committee, informational systems committee and promotion committees. I also advised on individual grant applications and facilitated collaboration between research groups.

Member of the following committees :

- Science Library Committee (1994-1999)
- Promotions Committee (1991/ 1995/ 1996): to consider internal staff promotions
- Biological Sciences Re-structuring Committee (1992-1994): to consider strategies for university re-organisation of existing biological departments.
- Graduate Student and Program Review Committee (member 1994-1997; chair 1997-2004)
- Graduate student advisory Committees (Chemistry, Medical Microbiology; 1995-)
- Faculty Endowment Committee (1998-2000)
- PhD/MSc Examination Committees (Chemistry, Medical Microbiology, Pharmacy)
- Selection panel for Executive Director of University Commercialization Services
- Multiple committees associated with role as Associate Dean

(Manchester Metropolitan University)

- I directed the Biotechnology Unit at Manchester Polytechnic (5 years). This involved the establishment of laboratory facilities (4,000 sq ft) for both bacterial and animal cell cultures.
- I established a Fermentation Technology Group at Manchester to co-ordinate research activity within this area. The group consisted of 15 post-graduate/ post-doctoral research workers + 5 academic staff.
- Course tutor for an HND course in Applied Biology (3 years) and for the BSc in Combined Studies (2 years).
- Departmental Research Tutor and Coordinator (3 years). My role was to ensure that all graduate students progressed satisfactorily through their research programme and to coordinate the research activity.
- Radioactivity Safety Officer (3 years).
- Member (10 years) & Chairman (3 years) of Dept Research Committee.
- Member (3 years) of Faculty Research Committee.
- Member of course committees for BSc (Biol. Sci.) and BSc (Comb. Studies)
- Course leader (1 year) for Biological Sciences of the Combined Studies BSc .

International and National Scientific Committees/ Boards

- President of International Society for Protein Expression (2011-2013)
- Scientific Advisory Committee for IBC Conferences on “Cell line development and Engineering” (2011, 2012, 2016).
- European Society for Animal cell Technology (ESACT) Executive Committee 2009-2011
- ESACT Scientific Committee for 2011 meeting Vienna
- Alberta Ingenuity Fund for New Faculty, Edmonton, Canada 2009

- Organizer of 6 workshops. Cell Culture Engineering meeting, Coolom, Australia 2008
- Member of Scientific Committee for 13th Intl. IUPAC-sponsored Biotechnology symposium Dalian, China 2008
- Chair of review panel for Science Foundation of Ireland (SFI) in Dublin, September 2006
- Advisory Committee for Cell Culture Engineering meetings, 2006 & 2008
- Organizing committee for International Meet of “Protein Expression in Animal Cells (PEACe)” Crete (2005)
- Member of scientific board for IBC Life Sciences, San Diego (2003), Berlin (2004), Boston (2004).
- Scientific Advisory Board of Serologicals Corp (2004)
- International Evaluation Panel for the Centre of Bioprocessing in Stockholm, Sweden (November 2003)
- Group leader of Biotechnology sector representation at the Brasil-Canada discussion on Opportunities for Cooperation in Technology Innovation organised by the Dept Foreign Affairs, Canadian Federal Government in Sao Paulo, Brazil (November 2003).
- Co-chair of session in European Soc Animal Cell Technology to be held in Granada, Spain May 2003.
- Organising committee for 6th international meeting of “Protein Expression in Animal Cells (PEACe)” Mont Tremblant, Quebec, Canada Sept 2003.
- National Science Foundation (NSF)/ Small Business Initiatives in Research (SBIR) Biotechnology panel, Washington USA (2002)
- NSERC Advisory Committee on University-Industry Grants, National grant selection Ottawa (2001-2006).
- Research Advisory Committee of the National Research Council Biotechnology Institute, Montreal (2000)
- Connaught Biotechnology Studentship Awards Committee (1999-)
- Medical Research Council/ Regional Partnership Steering Committee (1999-)
- Manitoba Health Sciences Research Council Studentship Committee (1992-95)

MEETING CHAIR

- Cell Culture and Upstream Processing. Session chair. Bioprocess International Europe, Vienna April 2024
- Accelerating Analytical Development. Session chair in Bioprocessing Summit CHI Boston August 2023
- Optimizing Upstream Processing. Session chair in Bioprocessing Summit Europe, CHI, Barcelona March 2023
- Glycoengineering of Biopharmaceuticals session chair, GlycoBiotec2023, Max Planck Society Meeting, Berlin
- BioProcess International Session chair “Upstream Processing” Boston 2022
- ESACT session chair “Cellular Mechanisms of protein synthesis, processing & secretion” Vienna May 2011
- BioProcess International Session chair “Recovery and Purification” Nice April 2011
- 9th Conference on Protein Expression in Animal Cells. Chair of Session “Post translational modification” Jackson Hole, Wyoming USA 2009
- Society of Industrial Microbiology meeting, Chair of Session “Recent Development in Animal Cell Culture Technologies” Toronto Aug 2009
- Chair and convener of discussion panel on “Advances in media development” in IBC meeting on Antibody Development and Production Conference on in March, 2009 Carlsbad, California.
- Chair of organizing committee; Conf. of “Protein Expression in Animal Cells (PEACe)” in Brazil (2007)
- Cell Culture Engineering X. Chair of session “Protein Quality/ Immunogenicity” Whistler, Canada (2006)
- Chair of session on “Stem cells” in “Protein Expression in Animal Cells (PEACe)” conference Crete (2005)
- Transmissible Spongiform Encephalopathies. IBC Life Sciences Conference. Chair of session on “Developing animal-free cell culture media” Washington (2004)
- Cell Culture and Upstream Processing. IBC Life Sciences Conference. Chair of multiple sessions. Berlin (2004)
- Cell Culture Engineering IX. Chair of session “Post-translational modifications” Cancun, Mexico (2004).
- Cell Culture and Upstream Processing. IBC Life Sciences Conference. Chair of session “Cell culture media development and optimization” San Diego (2003)
- European Soc Animal Cell Technology. Chair of session “Cellular Mechanisms” Granada, Spain (2003)
- Protein Expression in Animal Cells: Chair of Session “Cell Engineering” Mont-Tremblant, Quebec (2003)
- Cell Culture Engineering VIII : Chair in Medium Development and Production Issues. Colorado (2002).
- International Conference in Modern Biotechnology (Havana 1999): Chair of (a) Workshop on New applications of animal cell technology and (b) Oral session on Production of therapeutic biomolecules.

SELECTION OF INVITED LECTURES

- Introduction To Upstream Manufacturing. Bioprocessing International, Boston, September 2024
- Cell Line monitoring – imaging cells without stains. at Bioprocess International, Boston, September 2024
- Control and modification of protein glycosylation during a bioprocess. Bioprocessing Tours 2024, Tours, France, Sept 2024
- Rapid Glycan Analysis of the Capsid Proteins from COVID-19 and AAV Viruses. Bioprocess International Europe, Vienna April 2024
- Biocapacitance as an Analytical Tool to Monitor Cell Growth and Metabolic Status. Cambridge Healthtech Institute, Boston August 2023
- Non-invasive methods for monitoring bioprocesses. Global Engage Conference, Castleknock May 2023
- Analysis of Covid Spike Protein Variants with a Novel Fluorescent Label. Bioprocess International Europe, Amsterdam May 2023
- Monitoring Morphological and Dielectric Properties of Cells During a Bioprocess. Bioprocessing Summit Europe, Cambridge Healthtech Institute, Barcelona March 2023
- High-throughput glycosylation profiling applied to the analysis of Covid-19 virus evolution and changes in human serum following infection. GlycoBiotec2023, Max Planck Society Meeting, Berlin January 2023
- Use of Capacitance and High Resolution Optical Measurements as a Way of Continuous Monitoring of a Bioprocess BPI Fall Digital Week Live Session November 2022
- Formulation of Cell Culture Media for Bioprocess. Universidad Autonomia del Estado Morelos course “Animal Cell Technology” October 2022
- Use of Capacitance and High Resolution Optical Measurements as a way of Continuous Monitoring of a Bioprocess. Bioprocessing International, Boston, September 2022
- Glycosylation profiling using a novel high-throughput method and high-sensitivity derivatives. Cambridge Healthtech Institute, Boston August 2022
- Real time monitoring of cell viability during a bioprocess at the 3rd Global Bioprocessing, Bioanalytics and ATMP Manufacturing Congress, May 2022, Castleknock Hotel, Dublin.
- Optical and Dielectric Technologies for Continuous Monitoring of Bioprocesses. Bioprocessing Summit Europe, Cambridge Healthtech Institute, Barcelona March 2022
- High-Resolution Optical and Dielectric Methods for Monitoring Cells in a Bioprocess. 15th PEACe Conference (virtual). Protein Expression in Animal Cells September 2021
- Early Detection of Viability Loss of Producer Cells in a Bioprocess. Cell Culture & Cell Line Optimization Bioprocessing Summit, Cambridge Healthtech Institute, Boston, USA August 2021
- High-Resolution Optical and Dielectric Methods for Monitoring Cells in Bioprocesses. APC Seminar Series May 2021
- Novel methods for continuous monitoring of cell viability. 4th Annual Bioprocessing Summit Europe. Barcelona March 2021
- Quality Control and Monitoring or Manufacturing Innovation - Glycoengineering of Monoclonal Antibodies based on a Solid-State Process. 8th Biologics Manufacturing Asia March 2021
- High-Resolution Optical and Dielectric Methods for Monitoring Cells in Bioprocesses. 3rd Bioprocessing Summit Europe (Virtual), Barcelona, Cambridge Healthtech Institute, July 2020
- Growth of Biopharma in Ireland and its future direction. Agilent Pharma & Biopharma Technology Forum. Killenard, County Laois, Ireland December 2019
- Monitoring and control of mammalian cell cultures: batch or continuous. (A.Bergin & M.Butler), Pfizer, Grange Castle, Dublin, October 2019
- Optimised in vitro expansion of mesenchymal stem cells. Takeda, Grange Castle, Dublin, September 2019
- Controlling Glycosylation of Antibodies during a Bioprocess. Protein Expression in Animal Cells (PEACe), Rhode Island, USA, September 2019
- Enzymatic transformation of antibodies to obtain single glycoforms. Enzyme Engineering XXV, Whistler, British Columbia, Canada, September 2019
- Common strategies for the development of serum-free media formulations for high productivity in mammalian cells Cambridge Healthtech Institute; Bioprocessing Summit Boston, August 2019

- On-Line and Off-Line Monitoring of Cells for Growth and Productive Capacity during a Bioprocess. Cambridge Healthtech Institute; Bioprocessing Summit Boston, August 2019
- Monitoring mammalian cell growth and metabolism at high densities. World Biopharm Forum. Driving value through intensified bioprocessing. Oxford June 2019
- Monitoring cell growth and metabolic state by optical imagery and dielectric spectroscopy. CMC Strategic Forum. CASSS meeting, Seville, Spain, May 2019
- Monitoring cell growth and metabolic state by optical imagery and dielectric spectroscopy BioITG Research Showcase. BiopharmaChem Skillnet, Dublin, Ireland April 2019
- Controlling Glycosylation of Antibodies during Processing. Cambridge Healthtech Institute; Biotherapeutics Analytical Summit, Alexandria, Virginia, USA . March 2019.
- Monitoring the metabolic state and productive capacity of cells during a bioprocess. Cambridge Healthtech Institute; Bioprocessing Summit Europe, Lisbon, Portugal, March 2019
- Bioprocess strategies to control product glycosylation in mammalian cells Waterside Conference, Norfolk, Virginia November 2018
- On-line and Off-line monitoring of CHO cell health in a bioreactor to allow for early identification of cell death. Valerie Fitzgerald, Adam Bergin and Michael Butler. Bioproduction Congress, KNet365, Dublin October 2018
- Control of antibody glycosylation during the upstream or downstream stages of a bioprocess. Bioproduction Congress, KNet365, Dublin October 2018
- Opportunities for Modification of Glycan Structures at Various Stages During a Bioprocess. Bioprocess International Conference Boston September 2018
- Opportunities for Modification of Glycan Structures at Various Stages During a Bioprocess` Simposio de Produccion y Regulacion de Biofarmacos, Instituto Biomedical UNAM, Mexico May 2018
- Curso International sobre cultivo de celulas de mamifero y la produccion de biofarmacos (3 lectures) Instituto Biomedical UNAM, Mexico May 2018
- Dielectric Monitoring of Mammalian cells in a Bioreactor. Instituto de Biotecnologia, UNAM, Mexico May 2018
- Modification of glycosylation of antibodies during the upstream or downstream stages of a bioprocess. Cambridge Healthtech. Bioprocessing Summit Europe, Lisbon, Portugal March 2018
- Introduction to Cell Culture (6 lectures). PepTalk Protein Science Cambridge Healthtech.Institute, San Diego, USA January 2018
- Reducing glycoprotein heterogeneity in a mammalian cell bioprocess. Animal Cell Technology Industry Platform (ACTIP), Nantes, France November 2017
- Methods for Product Quality Monitoring and Controlling Glycosylation. Cell Culture & Upstream Process Development Session of . BioProduction 2017 Knet365 Conference Dublin October 2017
- Dielectric Monitoring of Mammalian cells in a Bioreactor. Protein Expression in Animal Cells (PEACe) Valencia, Spain September 2017
- Strategies for the control of glycosylation during the production of a recombinant protein. Cambridge Healthtech 9th Annual Optimizing Cell Line Development. Boston August 2017
- Monitoring the electrical profile of cells during a bioprocess. NICB/ Dublin City University June 2017
- Dielectric Monitoring of Mammalian cells in a Bioreactor. Bioprocess International Summit, Amsterdam April 2017
- Predictions of glycosylation profiles from cell engineering and bioprocess control. Cambridge Healthtech Biotherapeutics Analytical Summit, Bethesda Maryland USA March 2017
- The influence of cultivation conditions on glycosylation. GlycoBiotec. Harnack Haus, Berlin. February 2017
- Dielectric monitoring of mammalian cells in a bioreactor. Bioproduction Congress, Citywest, Dublin Oct 2016
- The use of a novel single cell dielectrophoretic (DEP) cytometer to monitor changes in CHO cell metabolism. IBC Bioprocessing International, Boston USA October 6th 2016
- Cell density monitoring in cell culture – a comparison of different methods. Aber Instruments Conference. Guest lecture Aberystwyth, Wales, September 20th 2016
- Cell density monitoring in cell culture – a comparison of different methods. Keynote lecture at Workshop on Biomass Measurements. Worcester, Mass, USA June 2016
- The control of antibody glycosylation during a production process. Cell line development & engineering conference. IBC LifeSciences, San Francisco June 2016

- Strategies for the control of glycosylation of a chimeric human-llama antibody. Bioteherapeutics Analytical Summit, CambridgeHealthtech. Bethesda, Maryland, USA March 2016.
- The control of glycosylation during monoclonal antibody production. Conference on "Biomanufacturing challenges of immunotherapy", Havana, Cuba November 2015
- The control of glycosylation during biopharmaceutical production. Canadian Society of Chemical Engineering Meeting, Calgary October 2015
- The differential polarizability of CHO cells can be used to monitor changes in metabolism. Canadian Society of Chemical Engineering Meeting, Calgary October 2015
- Modeling of Glycosylation - Predicting Profiles of Glycosylation from Metabolic Data. Bioprocessing International, IBC Conference Boston October 2015
- **The Impact of Glycosylation on the Functionality and Production of Biopharmaceuticals.** BD Biosciences/IBC conference La Jolla, September 2015.
- The design of cell culture media for the production of high quality biopharmaceuticals. Cambridge Healthtech Inst, Bioprocessing Summit, Boston August 2015
- Mab production in CHO cells and the impact of process parameters and conditions on their glycosylation. ESACT meeting workshop "From Glycoscience to Glycotechnology" Barcelona May 2015
- The production of antibodies with a restricted glycosylation profile. IBC Meeting Biopharmaceutical Development, Huntington Beach, USA March 2015
- Monoclonal antibodies: Strategies for biomanufacture of clinically potent products. Asociación Farmacéutica Mexicana. Meeting in Mexico City Nov 2014
- Cell density monitoring in cell culture - a comparison of different methods. Webinar sponsored by Aber Instruments Ltd, Oct 2014
- Strategies to control the glycosylation of a protein in a cell bioprocess. Symposium on manufacturing monoclonal antibodies. Canadian Chemical Engineering Society meeting Niagara, Ontario Oct 2014
- Control of Glycosylation Profiles in Mammalian Cell Bioprocesses. Institute for Bioscience & Biotechnology Research, University of Maryland, Oct 2014
- How antibodies production's productivity and quality can benefit from glycosylation and metabolic engineering. Cell Culture World Congress, Boston, USA Sept 2014
- Control of glycosylation in mammalian cell bioprocesses. Boston Glycobiology Discussion Group. Boston College, Sept 2014
- Control of Glycosylation in Cell Bioprocesses for protein or virus production. Presentation given at Nanobio Conference, Brisbane, Protein Expression Workshop (PEWS), Melbourne, Monash University, Melbourne and Ludwig Institute for Cancer Research, Melbourne, Australia, July 2014
- The efficient manufacture of monoclonal antibodies with a defined quality of glycosylation Bioprocess International Cell Culture and Upstream Processing. Prague, April 2014
- Metabolic parameters that affect the glycosylation profile of a monoclonal antibody. Cell Culture Engineering XIV Quebec City, May 2014
- "The control of antibody glycosylation profiles" : PEACe 11th Conference on Protein Expression in Animal Cells. Kananaskis, Alberta, September 2013
- "Control of Glycosylation Profiles in Cell Bioprocesses" : GTCBio conference "Protein Expression, Purification and Characterization." San Diego October 2013
- "A novel dielectrophoretic (DEP) cytometer to monitor CHO cultures": IBC's 10th BioProcess International Boston, September 2013
- "A novel dielectrophoretic (DEP) cytometer to monitor CHO cultures" : Bioprocessing Summit. *Cambridge Healthtech Inst* Boston, August 2013
- "The control of antibody glycosylation profiles" multiple lectures at University Sao Paulo, Depts Chemistry, Biotechnology, IPN and University of Sao Jose, Brazil May 2013
- "Monoclonal Antibodies Network (MabNet)" Alliance Coordinating Office (ACO) of the Canadian HIV Vaccine Initiative Annual Meeting 2013 : Moving an HIV Vaccine from Lab to Clinic: the Importance of Industry Engagement Vancouver April 2013
- "The control of antibody glycosylation profiles": IBC LifeSciences *Biopharmaceutical Development and Production* Huntington Beach, California, USA, February 2013
- "The control of antibody glycosylation profiles" multiple lectures at University Sao Paulo, Depts Chemistry, Biotechnology, IPN and University of Sao Jose, Brazil

- “The control of antibody glycosylation profiles”: IBC LifeSciences *Biopharmaceutical Development and Production* Huntington Beach, California, USA, February 2013
- The development of animal cell culture processes for biopharmaceutical production. Quorum Congress Instituto de Monterrey/Queretaro, Mexico. October 2012
- Cell density monitoring in bioreactor culture. Aber Instruments, Wales October 2012
- Control of glycosylation profiles in cell bioprocesses. Informa Life Sciences’ 7th Annual Conference on: *Post-translational modification*. Berlin, Germany September 2012
- Biosimilar: Analysis of erythropoietin. Informa Life Sciences’ Annual Conference. *Importance of PTM analysis for Biosimilars*. Berlin, Germany September 2012
- Control of glycosylation profiles in cell bioprocesses. Conference on *Optimizing Cell Culture Technology*. Cambridge Healthtech Institute, Boston, USA August 2012
- The use of peptide hydrolysates as non-animal components in serum-free media. Cambridge Healthtech Institute, *Optimized Media: achieving super soup* Boston, USA August 2012
- Control of glycosylation in animal cell bioprocesses. IBC 8th Conference on *Cell line development and engineering*. San Francisco June 2012
- Monitor and control of mammalian cell bioprocesses to obtain consistently glycosylated proteins. Universidad Nacional Autonoma Mexico (UNAM) Biomedical Institute, Mexico City May 2012.
- Monitor and control of glycosylation in mammalian cell bioprocesses. UAEM Universidad Autónoma de Morelos March 2012
- Monitor and control of glycosylation in mammalian cell bioprocesses. Cambridge Healthtech Institute, Boston, USA August 2011
- Integrating and downstream processing: the production of proteins with a restricted glycoform profile. BioProcess International Conference, Nice April 2011
- Controlling PTMs via cell culture. Informa Life Sciences Brussels Sept 2010
- Characterization and control of protein glycosylation in cell bioprocesses protein glycosylation in cell bioprocesses Cambridge Healthtech Institute, San Diego April, 2010
- Insights into relationship between protein expression and glycosylation profile. IBC Meeting “Recombinant Protein & Complex Biologic Development & Production.” Carlsbad, CA March 2010
- Strategies for enhanced productivity of a hydrophobic recombinant protein.. 9th Conference on Protein Expression in Animal Cells. Jackson Hole, Wyoming USA 2009
- The control of glycosylation in mammalian cell bioprocesses. IBC meeting on Post-translational modification, Prague September 2009
- Control of glycosylation in bioreactors. Lonza Biologics plc., UK September 2008
- Cell metabolism and its control in culture. Third International School on Biopharmaceutical production from animal cell cultures. Federal Universidad de Rio de Janeiro, Brazil. July 2008
- Effects of Cell Culture Conditions on Glycosylation. IBC Life Sciences conference on Cell line development and Engineering. San Diego. California, June 2008
- Biopharmaceuticals: production to high yields and good quality. *International Symposium: Challenges in Pharmaceutical Research*. Universidad Autonoma del Estado de Morelos (March 2008).
- What causes altered glycosylation in mammalian cells ? A study in glycomics. Pfizer Missouri (June, 2007)
- The effect of culture conditions on the glycosylation of proteins secreted by mammalian cells. IBC Life Sciences conference on Post-translational modification, Prague (Nov 2007).
- Four lectures at Brazilian Universities: Rio de Janeiro, Campinas and Sao Paulo (Feb/March 2007)
- Rational methods of developing cell culture media. IBC Life Sciences conference on Cell line development and Engineering. La Jolla, California, June 2007
- Glycomics as a means to characterize Congenital Disorders of Glycosylation. Dept Pathology, University of Manitoba (December 2006)
- Current methods for determining glycosylation. Bioprocess International. IBC Life Sciences Conference. San Francisco (November 2006)
- The effect of culture conditions on the glycosylation of proteins secreted by mammalian cells. Seminario de Instituto de Biotecnologia, Universidad Nacional de Mexico (November, 2006)

- What causes altered glycosylation in mammalian cells ? A study in glycomics. Manitoba Centre for Proteomics (April 2006).
- The effect of micro-nutrients on cellular productivity and metabolism in serum-free media. Bioprocess International. IBC Life Sciences Conference. Berlin (April 2005)
- The effect of micro-nutrients on cell metabolism in serum-free media. Transmissible Spongiform Encephalopathies. IBC Life Sciences Conference. Washington (2004).
- The effect of culture conditions on the glycosylation of proteins secreted by mammalian cells. 3rd Conference on Recombinant Protein Production. Tavira, Portugal (November 2004)
- The effect of culture conditions on the glycosylation of proteins secreted by mammalian cells. Cell Culture and Upstream Processing. IBC Life Sciences Conference. Boston (October 2004)
- The effect of culture conditions on the glycosylation of proteins secreted by mammalian cells. Cell Culture and Upstream Processing. IBC Life Sciences Conference. Berlin (September 2004)
- “Opportunities in animal cell technology” Meeting for collaboration between Brazil-Canada, Sao Paulo, 2003
- Culture parameters that cause perturbations in the glycosylation of proteins secreted by mammalian cells. 6th Conference on Protein Expression in Animal Cells. Mont Tremblant, Quebec 2003
- Protein glycosylation is controlled by cell culture conditions. American Chemical Soc, New Orleans, March 2003
- Culture parameters that cause perturbations in the glycosylation of proteins secreted by mammalian cells. Canadian Society of Chemical Engineering. Vancouver, Oct 2002
- Recombinant protein production from mammalian cells grown in the Cytopilot fluidized bed bioreactor. Amersham Biosciences seminars, Piscataway, Philadelphia & New York, Nov 2001
- Congenital Disorders of glycosylation. Dept Biochemistry, Oxford University July 2001
- Congenital Disorders of glycosylation School of Biological Sciences, University of Kent August 2001
- Erythropoietin production from mammalian cells grown in the Cytopilot fluidized bed bioreactor "The solution to your bioprocessing equation". Amersham/Pharmacia Biotech. Montreal & Toronto October 2000
- Parameters that affect the glycosylation of products from mammalian cell culture Biotechnology Research Institute, NRC, Montreal, Canada June 2000.
- “Nutrient requirements for the growth of mammalian cells in culture” and “Development of serum-free media for the growth of Vero cells and production of reovirus”. Merck Co., Westpoint, May 2000
- New drugs for the future: Biotechnology leads the way into the next millennium. On the Edge lecture series. University of Manitoba, April 2000
- Production of reovirus from microcarrier cultures of Vero cells. American Chemical Society, San Francisco, March 2000
- The importance of micro-nutrients to mammalian cell productivity in serum-free cultures. Bayer. San Francisco, February 2000
- The glycosylation of immunoglobulin IgG in bioreactors 8th Int. Conf. Modern Biotechnology, Havana Cuba December 1999 and at Centro Immunologia Molecular (CIM), Havana
- Production of a recombinant glycoprotein from the Cytopilot-mini fluidized bed bioreactor. Seminar : "The solution to your bioprocessing equation". Amersham/Pharmacia Biotech. New Jersey November 1999
- Factors that may affect the glycosylation of an immunoglobulin (IgG). Canadian Federation of Biological Societies, Winnipeg, June 1999.
- Parameters that affect the glycosylation of IgG. American Chem. Soc., Boston Aug. 1998
- Metabolic parameters associated with the cellular production of monoclonal antibodies. Dept. Chemical Engineering, University of Waterloo, Canada May 1998.
- Glycosylation: an important process during protein secretion in mammalian cell culture systems. Colloquium for Bioprocess Engineering, Birmingham, UK 1998
- Fatty acids enhance the robustness of mammalian cells in agitated cultures. Cell Culture Engineering VI Engineering Foundation Conference, San Diego USA, 1998.
- Intracellular fatty acid composition affects cell yield, energy metabolism and cell damage in agitated cultures. European Society for Animal Cell Technology, Tours, France, 1997
- The productivity of mammalian cells in bioreactors. Dept. Immunology, Univ. Manitoba 1997.
- Recent advances in animal cell culture processes National Symposium of Fermentation, Sao Carlos, Brazil, 1996.
- Fatty acids enhance antibody yields and perturb the energy metabolism of a hybridoma grown in serum-free media.

- American Inst. Chemical Eng, Florida, 1995
- The metabolic management of animal cells used in biotechnology. Department of Biochemistry, University College of North Wales, Bangor, 1994.
- Metabolic Management in Animal Cell Technology. Biotechnology Research Institute, NRC, Montreal, Canada 1994.
- Adaptation of mammalian cells to non-ammoniagenic media. Cell Culture Engineering IV Engineering Foundation Conference, San Diego USA, 1994.
- The productivity of mammalian cells in culture. Cancer Inst., Univ. Manitoba, 1994
- The metabolism of mammalian cells in large-scale processes. Department of Biological Sciences, Manchester Metropolitan University, UK. 1993.
- The fermentation of BHK cells for Foot-and-Mouth vaccine production. Symposium for FMD vaccine production sponsored by the Brazilian National Council of Research (CNPq), Sao Paulo, Brazil, 1993.
- The fermentation of animal cells. Vallee S.A., Sao Paulo, Brazil, 1993
- The energy metabolism of mammalian cells used in large-scale production processes. Dept. Biochem., Univ. Manitoba, 1992
- Developments in animal cell culture techniques. Canadian Society for Microbiology, London, Ontario 1991.
- Energy metabolism of animal cells in culture. Celltech Ltd., Slough 1990.
- Animal Cell Technology: products from culture. LH Fermentation Ltd, Maidenhead, 1989.
- Animal Cell Technology. Biotechnol. School, Central London Polytechnic, 1989.
- Animal Cell Culture. the Biochemical Society, Aberystwyth University, 1987.
- Growth factors, serum-free media: conference on 'Advanced Techniques in Animal Cell Culture' at Surrey University, 1987.
- The use of microcarriers in the culture of anchorage-dependent animal cells Institute of Chemical Engineers conference at UMIST 1986.
- The nutritional requirements of hybridoma cells: Soc. Chem. Industr. London, 1986.
- Large scale animal cell culture.: Biotechnol Centre, Cranfield Inst. Technol, 1985.
- Vaccines and other biologicals from animal cell culture.: British Assoc. for Advancement of Science at University of Strathclyde, 1985.

WEBINARS:

- Cell density monitoring in cell culture -a comparison of different methods. Delivered by M.Butler and sponsored by *Aber Instruments Ltd.* (Oct 2014). www.aber-instruments.co.uk/news/view/cell-density-monitoring-in-cell-culture-webinar
- *Glycoanalysis and glycoengineering of monoclonal antibodies* (M.Butler; April 2nd 2020) sponsored by Agilent
- *Cell Viability: Is there a case for its re-evaluation in bioprocesses?* (M.Butler; April 28th 2020) sponsored by Medicine Maker
- *Cell Viability* (M.Butler, May 25th 2020) sponsored by Universidad de Morelos, Mexico
- BioPharma- Asia: *High-Resolution Optical and Dielectric Methods Monitoring Cells in Bioprocesses.* <https://biopharma-asia.com/webinars/high-resolution-optical-and-dielectric-methods-monitoring-cells-in-bioprocesses/> (M.Butler October 2020)
- Advanced Instruments webinar: *Using osmolality as a process parameter to optimise qMAb.* April 2021
- NIBRT/Aber webinar *Extracting additional information from frequency scanning using dielectric spectroscopy* (Adam Bergin, M.Butler & Aditya Bhat) October 2021
- Glycan Analysis Forum sponsored by *Agilent Technologies* that included an international panel of leaders in the field of glycobiology. 2022
- James Flynn, Thaïs McNamara & Michael Butler. "Osmolality Analysis in Bioprocessing: From Theory to Practice" webinar organised by Advanced Instruments November 2023

On-line Application Notes (Available on-line on Agilent web-site)

Yongjing Xie, Letícia Martins Mota, Michael Butler, (NIBRT) Yasho Nandini Singh and Aled Jones, (Agilent). High-throughput N-Glycans Profiling of Monoclonal Antibodies EG2-hFc and Rituximab using AdvanceBio Gly-X N-Glycan Prep with InstantPC kit. March 2022

Yongjing Xie, Letícia Martins Mota, Michael Butler, (NIBRT), Bethan Morgan, Aled Jones, (Agilent). A Workflow for Rapid Sample Preparation and Exoglycosidase Characterization of N-Glycans in Antibodies. March 2022

Yongjing Xie, Letícia Martins Mota, Michael Butler, NIBRT, YashoNandini Singh, Bethan Morgan, Aled Jones, Agilent High-throughput Human Serum and immunoglobulin G N-Glycome Profiling with AdvanceBio Gly-X InstantPC Technology for biomarker discovery. March 2022

Yongjing Xie, Letícia Martins Mota, Michael Butler, Yasho Nandini Singh and Aled Jones. Comparison of AdvanceBio Gly-X 2-AB express and InstantPC for released N-glycans LC-fluorescence profiling from NISTmAb

Yongjing Xie, Letícia Martins Mota, Michael Butler, (NIBRT), Bethan Morgan, Aled Jones, (Agilent) An Innovative Workflow for Rapid Sample: Preparation and exoglycosidases characterization of N-Glycans in antibody

Yongjing Xie, Letícia Martins Mota, Michael Butler, YashoNandini Singh and Aled Jones. Comparison of AdvanceBio Gly-X 2-AB express and InstantPC for released N-glycans LC-fluorescence profiling from NISTmAb

Yongjing Xie, Michael Butler. Quantitative N-glycosylation comparison of SARS-CoV-2 spike proteins produced from different mammalian cell expression systems with the Agilent AdvanceBio Gly-X InstantPC Technology. July 2022

Yongjing Xie, Michael Butler. Quantitative N-glycosylation profiling of angiotensin converting enzyme 2 (ACE2) receptor for SARS-CoV-2 with the Agilent AdvanceBio Gly-X InstantPC Technology. July 2022

PATENTS

1: Tayi, V. and Butler, M. Methods to produce single glycoform monoclonal antibodies. University of Manitoba. US Patent US11821017B2. Priority 2014-02-18; Filed 2020-01-07; Granted 2023-11-21; Published 2023-11-21. Expiration: 2035-02-19

2: Tayi, V. and Butler, M Methods to produce single glycoform monoclonal antibodies. University of Manitoba. EU patent EP3108004A1 Filed 2015-02-18. Granted: 2019-02-20 Expiration: 2035-02-18

3: D. Thomson, G. Bridges, M. Butler, M. Nikolic-Jaric, E. Salimi, T. Cabel, S. Rzeszowski, G. Ferrier, K. Braasch, "Split-sensor Dielectrophoretic/Magnetophoretic cytometer" patent application to USA (2014 filed by University of Manitoba. Application No. 20150090592.

4: A one year US provisional patent (2002) was filed for the University of Manitoba: "Method for enhancing protein production" B.Hasinoff, N. Barnabe, M.Butler

5: A one year US provisional patent application was filed for the University of Manitoba in July 1996 incorporating two inventions: (a) "Serum-free formulation for growing anchorage-dependent mammalian cells" M.Butler & J.M.Berry (b) "Optimization of physical parameters for cell attachment and growth on macroporous microcarriers." M.Butler, J.M.Berry & Y-C, Ng. International Patent Cooperation Treaty patent filed for invention (a) above (1997)

Patent cases

1: Patent application appeal: Sept 15th 2015 in Washington Patent Office for Dechert representing Abbvie. The appeal was successful with the patent granted.

2: Court Deposition: December 14th 2016 and April 2018 (New York) and court testimony (Boston, January 2018) for Patterson, Belknap Webb and Tyler representing Janssen as plaintiff vs Celltrion

3: London Court July 2019; engaged by Bird&Bird in case of Takeda vs Roche on Glycosylated antibodies

4: Court Deposition on-line March 7th 2023 for Morrison & Foerster on Natalizumab case representing Sandoz vs Biogen

5: Court Deposition. London . October 2023 for Morrison & Foerster on Denosumab representing Sandoz vs Amgen

6: **Court testimony.** New Jersey. November 2023 for Morrison & Foerster on Denosumab representing Sandoz vs Amgen. This will lead to Sandoz's launch in 2025 of the first biosimilar of denosumab for the treatment of osteoporosis and bone cancer.

COMPANY: A research spin-off company (Biogro Technologies Inc) was established in September 2001. The company holds the intellectual property rights for the production of a number of serum-free media formulations for the growth of commercially important mammalian cell lines. M.Butler was the co-founder.

EDITOR:

- (1) The Encyclopedia of Cell Technology: J.Wiley Biotechnology Series published 2000
- (2) Biotechnology Advances, Elsevier (1999-)
- (3) Editorial Board: Biotechnology and Bioengineering (2003-)
- (4) Editorial Board of Open Biotechnology Journals, Bentham Science publ. (2006-)
- (5) Comprehensive Biotechnology. Volume 1 "Science behind biotechnology", 2nd edition Elsevier (2008) and 3rd edition (2019)

PUBLICATIONS

BOOKS

Castilho, L., Moraes, A., Augusto, E. & Butler, M. (Eds) 2008. "Animal Cell Technology: from Biopharmaceuticals to Gene Therapy" 21 Chapters 518 pages publ. Taylor & Francis.

Butler, M. (Ed) 2007 Cell Culture and Upstream Processing. 187 pages publ. Taylor & Francis.

Butler, M. 2004 Animal Cell Culture and Technology 2nd edition 256 pages publ. Bios Scientific, Oxford.

Butler, M. 1996. Animal Cell Culture and Technology 114 pages Oxford University Press

Butler, M. and M.M. Dawson (eds). 1992. Cell Culture: Labfax 268 pages publ. Bios Scientific, Oxford.

Butler, M. (Ed.) 1991. Mammalian Cell Biotechnology: A Practical Approach 245 pages; Oxford Univ. Press.

Butler, M. 1987. "Animal Cell Technology: Principles and Products" 180 pages Open University Press.

Peer Reviewed publications

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2024

Emerich Kovacs, Behnam Arzang, Elham Salimi, Michael Butler, Greg E. Bridges, Douglas J. Thomson. Light emitting diode array with optical line detector enables high throughput differential single cell dielectrophoretic analysis. Sensors. Submitted November 2024

Behnam Arzhang, Justyna Lee, Emerich Kovacs, Michael Butler, Elham Salimi, Douglas J Thomson and Greg E Bridges. Combined Dielectric-Optical Characterization of Single Cells using DEP-Imaging Flow Cytometry. Biosensors submitted September 2024

Michael Butler and Elham Salimi "Canada-Ireland collaboration provides a boost to bioprocess innovation" Canadian Science Policy Centre (CSPC) Innovation Magazine. October 2024

Yongjing Xie and Michael Butler, Compositional profiling of soy protein hydrolysates by high resolution liquid chromatography - mass spectrometry and chemometric analysis. Food Chemistry submitted Sept 16th 2024

Breen L, Flynn J, Bergin A, Flampouri E, Butler M. Single cell analysis of Chinese hamster ovary cells during a bioprocess using a novel dynamic imaging system. Biotechnol Prog. 2024 Apr 13:e3469. doi: 10.1002/btpr.3469.

Flynn J, Breen L, Narayanan S, Butler M. Measurement and control of foam generation in a mammalian cell culture. Biotechnol Prog. 2024 Mar 12:e3450. doi: 10.1002/btpr.3450.

B. Arzhang, J. Lee, E. Kovacs, M. Butler, E. Salimi, D. J. Thomson, and G. E. Bridges. Effect of Cell Size for In-flow Dielectrophoresis Cytometry-Based Dielectric Characterization. International Microwave Biomedical Conference IMBioC, Montreal, Canada, June 2024 doi: 10.1109/IMBioC60287.2024.10590120

Elham Salimi, Sara Absalan, Julien Robitaille, Johnny Montes, Michael Butler, Douglas Thomson, Greg Bridges... Sensitivity of Bulk Electrical Impedance Spectroscopy (Bio-capacitance) Probes to Cell Dielectric Properties: Study on CHO Cell Cultures. Biotech Progress accepted October 2024

Yongjing Xie and Michael Butler. *Quantitative High-throughput and High-sensitivity Glycoprofile Analysis of Therapeutic Glycoproteins using HILIC-FLD and ESI-MS* In *Heterologous Protein Production in CHO Cells: Methods and Protocols*, Second Edition (Ed: P.Meleady) *Methods in Molecular Biology* series, pp 249-263 publ. Springer Nature 2024 doi.org/10.1007/978-1-0716-4104-0_16

Zsuzsanna Kovács, Yongjing Xie, Barbara Adamczyk, Fiona Reidy, Fionnuala M. McAuliffe, Pauline M. Rudd, Mary Wingfield, Louise Glover, Michael Butler, Radka Saldova. Endometriosis specific vaginal microbiota links to urine and serum N-glycome. *Nature Scientific Reports* In Press October 2024

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Yongjing Xie and Michael Butler. Quantitative profiling of N-glycosylation of SARS-CoV-2 spike protein variants. *Glycobiology* 33(3) 188-202: 2023 doi: 10.1093/glycob/cwad007

Xie, Yongjing, and Michael Butler. "N-Glycomic Profiling of Capsid Proteins from Adeno-Associated Virus Serotypes." *Glycobiology (Oxford)*, 2023, <https://doi.org/10.1093/glycob/cwad074>.

Yongjing Xie and Michael Butler. Multi-attribute analysis of adeno-associated virus by size exclusion chromatography with fluorescence and triple-wavelength UV detection. *Analytical Biochemistry* 680, 15311: 2023 doi.org/10.1016/j.ab.2023.115311

2022

Adam Bergin, John Carvell and Michael Butler. Applications of bio-capacitance to cell culture manufacturing. *Biotechnology Advances* 61: 108048 2022. doi: 10.1016/j.biotechadv.2022.108048

Yongjing Xie Michael Butler and Catherine Kaye The importance of glycan analysis and characterization for Biopharma. *Drug Target Review* October 2022

Ismael Obaidi, Sandra Roche and Michael Butler. Protein hydrolysates and bioactive peptides: A comprehensive review on applications, kinetic and characterisation. Submitted *Biotechnology Advances* Jan 2022

Yongjing Xie and Michael Butler. *Serum N-glycomic profiling can produce potential signatures for diagnosis and surveillance of COVID-19*. *Glycobiology* 32(10): 871-885; Sept 2022 doi: 10.1093/glycob/cwac051

Samaneh Afshar, Behnam Arzhang, Katrin Braasch, Sara Absalan, Emerich Kovacs, Elham Salimi, Michael Butler, Doug Thomson, and Greg Bridges. *DEP Cytometer Measurement of the Effect of Medium Conductivity on Viable and Non-Viable Cell Dielectric Properties* 2022 IEEE MTT-S International Microwave Biomedical Conference (IMBioC) (Suzhou, China, May 16-18, 2022) June 16th 2022 doi: 10.1109/IMBioC52515.2022.9790154

Yongjing Xie and Michael Butler. *Construction of InstantPC derivatized glycan GU database: a foundation work for high-throughput and high-sensitivity glycomic analysis*. *Glycobiology* 2022 Mar 31;32(4):289-303. doi: 10.1093/glycob/cwab128.

Mota L.M., Tayi V.S., Butler M. (2022) Cell Free Remodeling of Glycosylation of Antibodies. In: Davey G.P. (eds) *Glycosylation. Methods in Molecular Biology*, vol 2370. Humana, New York, NY. https://doi.org/10.1007/978-1-0716-1685-7_6

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Kyle W. Anderson, Christina Bergonzo, Kerry Scott, Ioannis L. Karageorgos, Elyssia S. Gallagher, Venkata S. Tayi, Michael Butler, Jeffrey W. Hudgens, HDX-MS and MD simulations provide evidence for stabilization of the IgG1—

FcγRIa (CD64a) immune complex through intermolecular glycoprotein bonds, *Journal of Molecular Biology*, 2021, 167391, ISSN 0022-2836, doi.org/10.1016/j.jmb.2021.167391.

Butler, M and Reichl, U. *Animal Cell Expression Systems* in *Advances in Glycobiotechnology* (eds: E.Rapp & U.Reichl) *Adv. Biochem Eng Biotechnol* 175: 1-36: 2021 doi: 10.1007/10_2017_31

Ismael Obaidi, Letícia Martins Mota, Andrew Quigley and Michael Butler. *Protein hydrolysates prolong CHO cell viability and enhance antibody productivity in bioprocesses*. *Applied Microbiol Biotechnol* **105**, 3115–3129: 2021. doi-org.uml.idm.oclc.org/10.1007/s00253-021-11244-8

Yongjing Xie, Letícia Martins Mota, Adam Bergin, Roisin O’Flaherty, Aled Jones, Beth Morgan and Michael Butler. *High-throughput and high-sensitivity N-Glycan profiling: a platform for biopharmaceutical development and disease biomarker discovery* *Anal Biochem* 2021 Apr 20:114205. doi: 10.1016/j.ab.2021.114205.

Carina Villacrés, Venkata Tayi, Michael Butler. *Strategic feeding of NS0 and CHO cell cultures to control glycan profiles and immunogenic epitopes of monoclonal antibodies*. *J.Biotechnol* 333 49-62: 2021 doi: 10.1016/j.jbiotec.2021.04.005.

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Conference Abstracts and Posters

Sandra Roche, Thaïs McNamara, Michael Butler. Brandon Wrage, Angel Varela-Rohena, Hans Huttinga, Alessandra Prinelli, Eligio Iannetti, Stephanie Davies. Protective Effect of Protein Hydrolysate Supplementation in an Induced Stress Model. Bioprocess. Bioprocessing International, Boston, September 2024

Y.Xie and M.Butler Rapid glycosylation profiling of capsid proteins of COVID-19 and AAV viruses
28th European Society for Animal Cell Technology Meeting, Edinburgh, Scotland, June 2024

B. Arzhang, J. Lee, E. Kovacs, M. Butler, E. Salimi, D. J. Thomson, and G. E. Bridges. Effect of Cell Size for In-flow Dielectrophoresis Cytometry-Based Dielectric Characterization. International Microwave Biomedical Conference IMBioC, Montreal, Canada, June 2024

Laura Breen, James Flynn, Adam Bergin, Evangelia Flampouri and Michael Butler. Single cell analysis of Chinese Hamster Ovary (CHO) cells during a bioprocess using a novel dynamic imaging system. NBRT Research Day May 2024

Yongjing Xie and Michael Butler. Multi-attribute analysis and N-glycomic profiling of Adeno-Associated Viruses. NBRT Research Day May 2024 (Prize winning poster. 2nd)

James Flynn, Laura Breen, Nils Bunte, Michael Butler. Dielectric Capacitance Allows Early Detection of Cell Health Decline in Bioprocesses. Protein Expression in Animal Cells (PEACe) Sitges, Spain September 2023

Thaïs McNamara, Sandra Roche, Michael Butler. Trace metal variability on protein hydrolysate activity for cellular bioprocessing. Protein Expression in Animal Cells (PEACe) Sitges, Spain September 2023

Thaïs McNamara, Sandra Roche, Michael Butler. Analysis of Plant-Based Protein Hydrolysates for BioPharma by ICP-MS. Irish Mass Spectrometry Society in University College Dublin May 10th 2023

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Yongjing Xie and Michael Butler. Construction of InstantPC-derivatized N-glycan GU database for high-throughput and high sensitivity glycosylation profiling. Bioprocessing Summit Europe, Cambridge Healthtech Institute, Barcelona March 2022

Samaneh Afshar, Behnam Arzhang, Katrin Braasch, Sara Absalan, Emerich Kovacs, Elham Salimi, Michael Butler, Doug Thomson, and Greg Bridges DEP Cytometer Measurement of the Effect of Medium Conductivity on Viable and Non-Viable Cell Dielectric Properties. Abstract IEEE International Microwave Biomedical Conference (IMBioC 2022)

Kyle W Anderson; Christina Bergonzo; Kerry Scott; Ioannis L Karageorgos; Elyssia S Gallagher; Venkata S Tayi; Michael Butler; Jeffrey W Hudgens. Hydrogen-deuterium exchange mass spectrometry and MD simulations infer presence of glycan-protein bonds between IgG1 and FcγRIa (CD64a) receptor. American Society for Mass Spectrometry (ASMS) 2021 Philadelphia

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