

Curriculum Vitae

MICHAEL BUTLER

Address: Cell Technology Group
(work) National Institute for Bioprocessing Research and Training
Fosters Avenue, Dublin 4, Ireland

Address: 28 Maes Berea, Bangor, North Wales, UK LL57 4TQ (home)
Telephone: +353 1 215 8101 (w)
E.mail: michael.butler@nibrt.ie; butler@cc.umanitoba.ca
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-ammoniogenic 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 Cell Line Engineering. Session chair. Bioprocessing Summit Europe, CHI, Barcelona March 2025
- 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

- Dielectric spectroscopy to monitor cells in a bioreactor. Bioprocess International Europe, Hamburg, Germany May 2025
- How Protein Glycosylation can be Monitored and Controlled in a Bioreactor. 2nd Annual Bioprocessing & Biologics Forum. Leadvent, Amsterdam April 2025
- Non-invasive Methods for Monitoring Bioprocesses, Bioprocessing Summit Europe, Cambridge Healthtech Institute, Barcelona March 2025
- 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 Autonoma 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 Internacional 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 Knect365 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 Biotecnología, 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-ammoniaogenic 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, Leticia 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, Leticia 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, Leticia 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, Leticia 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, Leticia 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, Leticia 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

Impact Factor: Google Scholar: h-index 54 Citations 10,444; ResearchGate: h-index 49 Citations 7,086

2025

Yongjing Xie and Michael Butler, Compositional profiling of soy protein hydrolysates by high resolution liquid chromatography - mass spectrometry and chemometric analysis. Food Chemistry 2025; 487:144756. doi: 10.1016/j.foodchem.2025.144756.

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 Mol Biol. 2025; 2853:249-263. Springer Nature doi: 10.1007/978-1-0716-4104-0_16. PMID: 39460925.

Elizabeth Matthews, Neha Tushar Dalvi and Michael Butler. Reduction of high mannose glycoforms from monoclonal antibodies by affinity chromatography using a recombinant prokaryotic lectin. Journal of Biotechnology submitted May 26th 2025

Yongjing Xie and Michael Butler. *Mammalian Cell Processes* In Fundamentals of Industrial Biotechnology Eds: Ralf Takors, Dirk Weuster-Botz, and Brian Pfleger publ Springer Nature, Switzerland in press 2025

2024

Kovacs E, Arzang B, Salimi E, Butler M, Bridges GE, Thomson DJ. Light-Emitting Diode Array with Optical Linear Detector Enables High-Throughput Differential Single-Cell Dielectrophoretic Analysis. Sensors (Basel). 2024 Dec 18;24(24):8071. doi: 10.3390/s24248071. PMID: 39771806; PMCID: PMC11679556

Arzhang B, Lee J, Kovacs E, Butler M, Salimi E, Thomson DJ, Bridges GE. Combined Dielectric-Optical Characterization of Single Cells Using Dielectrophoresis-Imaging Flow Cytometry. Biosensors (Basel). 2024 Nov 27;14(12):577. doi: 10.3390/bios14120577

Michael Butler and Elham Salimi "Canada-Ireland collaboration provides a boost to bioprocess innovation" Canadian Science Policy Centre (CSPC) Innovation Magazine. October 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. 0International Microwave Biomedical Conference IMBioC, Montreal, Canada, June 2024 doi: 10.1109/IMBioC60287.2024.10590120

Salimi E, Absalan S, Robitaille J, Montes J, Butler M, Thomson D, Bridges G. Sensitivity of bulk electrical impedance spectroscopy (bio-capacitance) probes to cell and culture properties: Study on CHO cell cultures. *Biotechnol Prog.* 2024 Dec 26:e3519. doi: 10.1002/btpr.3519. Epub ahead of print. PMID: 39723484.

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* **14**, 25372 October 2024 doi.org/10.1038/s41598-024-76125-2

Xie, Yongjing, and Michael Butler. "N-Glycomic Profiling of Capsid Proteins from Adeno-Associated Virus Serotypes." *Glycobiology (Oxford)*,. 2024 Mar 19;34(1):cwad074. doi: 10.1093/glycob/cwad074.

2023

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

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

2021

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, Leticia 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, Leticia 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.

Kyle W. Anderson, Kerry Scott, Ioannis L. Karageorgos, Elyssia S. Gallagher, Venkata S. Tayi, Michael Butler, and Jeffrey W. Hudgens. Dataset from HDX-MS Studies of IgG1 Glycoforms and Their Interactions with the FcγRIa (CD64) Receptor. *Journal of Research of the National Institute of Standards and Technology* Vol 126; 126010: 2021 doi.org/10.6028/jres.126.010

Afshar,S., Fazelkhah,A., Braasch,K., Salimi,E., Butler,M., Thomson,D. and Bridges,G. Full Beta-Dispersion Region Dielectric Spectra and Dielectric Models of Viable and Non-Viable CHO Cells, *IEEE Journal of Electromagnetics, RF and Microwaves in Medicine and Biology*, 5(1) 70-77: 2021 doi: 10.1109/JERM.2020.3014062.

2020

Pilatti, L., Mancini Astray, R., Rocca, M. P., Barbosa, F. F., Jorge, S., Butler, M., & de Fátima Pires Augusto, E. Purification of rabies virus glycoprotein produced in *Drosophila melanogaster* S2 cells: An efficient immunoaffinity method *Biotechnol Prog.* 2020;e3046. doi:10.1002/btpr.3046

Róisín O’Flaherty, Adam Bergin, Evangelia Flampouri, Leticia Martins Mota, Ismael Obaidi, Andrew Quigley, Yongjing Xie, and Michael Butler Mammalian Cell Culture for production of Recombinant Proteins: A review of the critical steps in their biomanufacturing. *Biotechnology Advances* 43, 10755 doi.org/10.1016/j.biotechadv.2020.107552.

Neha Mishra, Maureen Spearman, Lynda Donald, Helene Perreault and Michael Butler. Comparison of two glycoengineering strategies to control the fucosylation of a monoclonal antibody. *J Biotechnol* 324S: 100015, 2020 <https://doi.org/10.1016/j.btec.2020.100015>

Fazelkhah, A, Afshar, S,, Durham, N., Salimi, E., Butler, M. , Bridges, G. and Thomson D. Parallel Single Cell Optical Transit Dielectrophoresis Cytometer. *Electrophoresis* 2020, 41, 720–728

Donald LJ, Spearman M, Mishra N, Komatsu E, Butler M, Perreault H. Mass spectrometric analysis of core fucosylation and sequence variation in a human-camelid monoclonal antibody. *Mol Omics.*;16(3):221-230. 2020 doi: 10.1039/c9mo00168a.

2019

Ghaffari N, Jardon MA, Krahn N, Butler M, Kennard M, Turner RFB, Gopaluni B, and Piret JM Effects of cysteine, asparagine or glutamine limitations in CHO cell batch and fed-batch cultures. *Biotechnol Prog.* 2019 Dec 10:e2946. doi: 10.1002/btpr.2946.

A. Fazelkhah, S. Afshar, N. Burham, E. Kovacs III, M. Butler, E. Salimi, G. Bridges, and D. Thomson " Optical Transit Dielectrophoresis Cytometer for Single Cell Analysis." IEEE Sensors Conference, October 2019.

Michael Butler, Adam Bergin, Katrin Braasch and Elham Salimi . The case for re-evaluating cell viability in bioprocesses. *Bioprocess International* 17 (11-12) December 2019

S. Afshar, A. Fazelkhah, E. Salimi, M. Butler, D. J. Thomson, G.E. Bridges, Dielectric spectrum of viable and apoptotic CHO cells over the entire B-dispersion range measured using DEP cytometry, *Sensors and Actuators B*, submitted 2019

Afshar, S., Fazelkhah, A., Salimi, E., Butler, M., Thomson, D. and Bridges, G. In-flow dielectrophoresis sensor for measuring the dielectric spectrum of single cells: application to starvation induced apoptosis. *IEEE Sensors* 2019. DOI: 10.1109/SENSOR43011.2019.8956709

D'Eall, C., Pon, R.A., Rossotti, M.A., Krahn, N., Spearman, M., Callaghan, D., van Faassen, H., Hussack, G., Stetefeld, J., Butler, M., Durocher, Y., Zhang, J., Henry, K.A. and Tanha, J. Modulation of antibody-dependent cellular cytotoxicity of EGFR-specific heavy-chain antibodies through hinge engineering. *Immunology and Cell Biology* 97(6):526-537; 2019

Afshar, S., Salimi, E., Fazelkhah, A., Braasch, K., Mishra, N., Butler, M., Thomson, D. and Bridges, G. Progression of change in membrane capacitance and cytoplasm conductivity of cells during controlled starvation using dual-frequency DEP cytometry. *Analytica Chimica Acta* 1059:59-67; 2019

Fazelkhah, A., Afshar, S., Braasch, K., Salimi, E., Butler, M., Bridges, G. and Thomson D. Cytoplasmic Conductivity as a Marker for Bioprocess Monitoring: Study of Chinese Hamster Ovary Cells under Nutrient Deprivation and Reintroduction. *Biotechnology & Bioengineering* 116: 2896-2905; 2019. doi: 10.1002/bit.27115

Ting-Hsuan Chen , Wen-Chun Liu, Chia-Ying Lin , Chia-Chyi Liu, Jia-Tsong Jan, Maureen Spearman , M Butler and Suh-Chin Wu. Glycan-masking hemagglutinin vaccines produced in CHO cells against multi-clade/subclade H5N1 avian influenza virus infections. *Biotech Bioeng* 116(3):598-609; 2019.

2018

Bridges, G., Cabel, T., Afshar, S., Salimi, E., Thomson, D.J. and Butler, M. Microwave near-field detection of single biological cells and nanoparticles. Conference: 2018 18th International Symposium on Antenna Technology and Applied Electromagnetics (ANTEM) DOI: 10.1109/ANTEM.2018.8572975

Fazelkhah, A., Braasch, K., Afshar, S., Salimi, E., Butler, M., Bridges, G. and Thomson, D. 2018. Quantitative Model for Ion Transport and Cytoplasm Conductivity of Chinese Hamster Ovary Cells. *Scientific Reports* 8(1) 17818

Afshar, S., Fazelkhah, A., Salimi, E., Butler, M., Thomson, D.J., and G. E. Bridges, G.E. Dielectric Properties of Single Cells Subjected to Heat Shock Using DEP Cytometry. *IEEE Transactions on Microwave theory and techniques* 66(12) ; 5933-5940; 2018

Elham Salimi , Katrin Braasch , Azita Fazelkhah , Samaneh Afshar , Bahareh Saboktakin Rizi , Kaveh Mohammad , Michael Butler, Greg E. Bridges , Douglas J. Thomson Single Cell Dielectrophoresis Study of Apoptosis Progression Induced by Controlled Starvation. *Bioelectrochemistry* 124: 73-79: 2018
doi.org/10.1016/j.bioelechem.2018.07.003

Afshar S, Fazelkhah A, Salimi E, Thomson D, Bridges G and Butler M. Change in the dielectric response of single cells induced by nutrient deprivation over a wide frequency range. *IEEE MTT-S International Microwave Symposium Digest*. 872-875: 2017. DOI: 10.1109/MWSYM.2017.8058720

2016

S. Afshar, E. Salimi, K. Braasch, M. Butler, D. Thomson, and G. Bridges, "Multi-Frequency DEP Cytometer Employing a Microwave Interferometer for Dielectric Analysis of Single Cells" *IEEE Transactions on Microwave Theory and Techniques*, vol. 64(3), pp. 991-998; 2016

Maureen Spearman, Sarah Chan, Vince Jung, Vanessa Kowbel, Meg Mendoza, Vivian Miranda and Michael Butler. Components of yeast (*Saccharomyces cervisiae*) extract as defined media additives that support the growth and productivity of CHO cells. *J Biotechnol* 233, 139-142: 2016

E. Salimi, K. Braasch, M. Butler, D. J. Thomson, and G. E. Bridges. Dielectric model for Chinese hamster ovary cells obtained by dielectrophoresis cytometry. *Biomicrofluidics* 10(1); 1-15 (2016)

Wen-Chun Liu , Yu-Li Lin , Maureen Spearman , Pei-Yun Cheng , Michael Butler, Suh-Chin Wu. Influenza hemagglutinin glycoproteins with different N-glycan patterns activate dendritic cells in vitro. *J.Virology* 90(13): 6085–6096: 2016.

S. Afshar, E. Salimi, K. Braasch, M. Butler, D. J. Thomson, G. E. Bridges In-flow Dielectric Characterization of Single Biological Cells Using a Wideband DEP Cytometer *Microwave Symposium (IMS) 2016 IEEE MTT-S International*, pp. 1-4, 2016

S. Afshar, E. Salimi, K. Braasch, M. Butler, D. Thomson, and G. Bridges, "Two-frequency dielectrophoresis analysis of viable/non-viable single CHO cells employing a microwave cytometer", *Biomedical Wireless Technologies Networks and Sensing Systems (BioWireless) 2016 IEEE Topical Conference on*, pp. 70-73, 2016

2015

Katrin Braasch, Bahareh S Rizi, Elham Salimi, Gregory Bridges, Douglas J Thomson, Michael Butler. The differential polarizability of CHO cells can be used to monitor changes in metabolism *BMC proceedings* 12/2015; 9(SUPPL 9):P47 DOI: 10.1186/1753-6561-9-S9-P47

Céline Raymond, Anna Robotham, Maureen Spearman, Michael Butler, John Kelly, Yves Durocher Production of IgGs with a human-like sialylation in CHO cells. *BMC proceedings* 12/2015; 9(Suppl 9):O3. DOI:10.1186/1753-6561-9-S9-O3

Blondeel,EJM, Braasch,K., McGill,T., Chang,D., Engel,C., Spearman,M, .Butler M. and Aucoin,MG. Tuning a MAb Glycan Profile in Cell Culture: Supplementing N-acetylglucosamine to Favour G0 Glycans without Compromising Productivity and Cell Growth. *Journal of Biotechnology* 214: 105-112: 2015.

Gomes de Oliveira, A.G., Roy,R., Raymond,C., Bodnar, E., Tayi,V., Butler,M., Durocher,Y., Perreault,H. A systematic study of glycopeptide esterification for the semi-quantitative determination of sialylation in antibodies. *Rapid Communications in Mass Spectrometry* 29(19) 1817-1826: 2015.

Bodnar E, Nascimento T, Girard L, Komatsu E, Lopez P, Gomes de Oliveira A, Roy R, Smythe T, Zogbi Y, Spearman M, Tayi,V., Butler,M., and Perreault,H.. An integrated approach to analyze EG2-hFc monoclonal antibody N-glycosylation by MALDI-MS. *Can J Chem*. 93(7):754-763: 2015.

Villacrés C, Tayi VS, Lattová E, Perreault H, Butler M. Low glucose depletes glycan precursors, reduces site occupancy and galactosylation of a monoclonal antibody in CHO cell culture. *Biotechnol J*. 10(7) 1051-1066 (2015)

Venkata S. Tayi and Michael Butler. "Isolation and quantification of N-glycans from Immunoglobulin G antibodies for quantitative glycosylation analysis." *Journal of Biological Methods* 2(2):e19. doi: 10.14440: 2015

Raymond C, Robotham A, Spearman M, Butler M, Kelly J, Durocher Y. Production of α 2,6-sialylated IgG1 in CHO cells. *MAbs*. 7(3):571-83: 2015.

Spearman,M. and Butler,M. Glycosylation in Cell Culture. Chapter 9 of *Cell Engineering* vol. 9, p237-258: *Animal Cell Culture* (ed. Al-Rubeai,M) publ. Springer 2015.

Butler,M. Serum and protein free media. Chapter 8 of *Cell Engineering* vol. 9, p223-236: *Animal Cell Culture* (ed. Al-Rubeai,M) publ. Springer 2015.

Kaveh Mohammad, Katrin Braasch, Elham Salimi, Ashlasha Bhide, Bahareh Saboktakin Rizi, Michael Butler, Gregory Bridges and Douglas Thomson. A Compact Microwave Frequency Reflectometer with attoFarad Sensitivity: a Path towards an Integrated Dielectrophoresis Cytometer. *Sensor and Actuators* 232: 132-140: 2015

Braasch,K., Villacr s,C. and Butler,M. "Evaluation of Quenching and Extraction Methods for Nucleotide/ Nucleotide Sugar Analysis" In Chapter 24 *Glyco-engineering*; (Ed: A. Castilho); *Methods in Molecular Biology* series 1321: 361-72. doi: 10.1007/978-1-4939-2760-9_24. publ Springer Science (New York) 2015

Tayi,V. and Butler,M. Physiology and metabolism of animal cells for production. In *Animal Cell Biotechnology and Biologics Production* (eds: Hauser,H. and Wagner, R.) 301-325: 2015

Salimi, E., Braasch, K., Butler, M., Thomson, D.J., Bridges, G.E. .Dielectric properties of CHO cells obtained using a microwave interferometer based dielectrophoresis cytometer. *USNC-URSI Radio Science Meeting* · DOI: 10.1109/USNC-URSI.2015.7303610; 2015

S. Afshar, E. Salimi, K. Braasch, M. Butler, D. Thomson, and G. Bridges Multi-frequency DEP cytometer employing a microwave interferometer for the dielectric analysis of micro-particles. *IEEE MTT-S International Microwave Symposium*. DOI: 10.1109/MWSYM.2015.7167035 2015

Bodnar E, Raymond C, Lopez PG, et al. Mass spectrometric analysis of products of metabolic glycan engineering with azido-modification of sialic acids *Anal Bioanal Chem*. 2015;407(30):8945-8958. [published correction appears in *Anal Bioanal Chem*. 2015 Dec;407(30):9191-3].

2014

Rizi, B. S, Braasch, K, Salimi, E, Mohammad, K, Delkhah, SA,,Sandstorm,T,, Butler,M, Bridges, G, Thomson, D, Monitoring dielectric changes in Chinese hamster ovary cells during induction of apoptosis by Oligomycin using a dielectrophoretic (DEP) cytometer, *Micro TAS Conference publication*, 2014.

Rizi, B.S., Braasch,K., Salimi,E., Butler,M., Bridges,G.E. and Thomson,D.J. Monitoring the dielectric response of single cells following mitochondrial adenosine triphosphate synthase inhibition by oligomycin using a dielectrophoretic cytometer. *Biomicrofluidics* 8(6) 064114: 2014.

Salimi, E., Braasch, K., Butler, M., Thomson, D.J., Bridges, G.E.. Dielectrophoresis study of electroporation effects on Chinese hamster ovary cells. *Conference Paper – 16th International Symposium on Antenna Technology and Applied Electromagnetics*. 2014

Spearman,M., Bodnar,E., Perreault,H. and Butler,M. Glycosylation Analysis of CHO-produced Glycoproteins. *Pharmaceutical Bioprocesses* 2(5): 449-468: 2014.

Spearman M, Lodewyck C, Richmond M, Butler M. The bioactivity and fractionation of peptide hydrolysates in cultures of CHO cells. *Biotechnol Prog*. 30(3):584-93: 2014.

Butler M, Spearman M. The choice of mammalian cell host and possibilities for glycosylation engineering. *Curr Opin Biotechnol.* 30, 107-112: 2014.

Soroush Nasser, Navid Ghaffari, Katrin Braasch, Mario A. Jardon, Michael Butler, Malcolm Kennard, Bhushan Gopaluni and James M. Piret "Increased CHO cell fed-batch monoclonal antibody production using the autophagy inhibitor 3-MA or gradually increasing osmolality." *Biochemical Engineering Journal* 91: 37-45: (2014)

Hengameh Aghamohseni, Kaveh Ohadi, Maureen Spearman, Natalie Krahn, Murray Moo-Young, Jenö M. Scharer, Mike Butler and Hector M. Budman "Effects of Nutrient Levels and Average Culture pH on the Glycosylation Pattern of Camelid-humanized Monoclonal Antibody" *J. Biotechnol.* 186: 98-109: 2014

Liu, B., Spearman, M., Doering, J., Lattova, E., Perreault, H. and Butler, M. "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." *J. Biotechnol* 170: 17-27 2014

Rahul Sadavarte, Maureen Spearman, Natalie Okun, Michael Butler, Raja Ghosh, "Purification of chimeric heavy chain monoclonal antibody EG2-hFc using hydrophobic interaction membrane chromatography: An alternative to protein-A affinity chromatography." *Biotechnol Bioeng.* 111(6):1139-49: 2014

Butler M, Spearman M, Braasch K. Monitoring cell growth, viability, and apoptosis. *Methods Mol Biol* 1104:169-92. 2014

2013

Salimi, W, Braasch, K, Jung V, Butler, M, Thomson, DJ and Bridges, GE. Measurement of electroporation induced changes in the dielectric response of single cells. *Proceedings of 17th International Conference on Miniaturized Systems for Chemistry and Life Sciences* pp1033- 1035 ; 2013, Freiburg, Germany

Bo Liu, Carina Villacres-Barragan, Erika Lattova, Maureen Spearman, Michael Butler. Differential effects of low glucose on the macroheterogeneity and microheterogeneity of glycosylation in CHO-EG2 camelid monoclonal antibodies. *BMC Proceedings* 2013, 7(Suppl 6):P112.

Shih-Chang Lin, Jia-Tsong Jan, Ben Dionne, Michael Butler, Ming-Hsi Huang, Chung-Yi Wu, Chi-Huey Wong, Suh-Chin Wu. "Different immunity elicited by recombinant H5N1 hemagglutinin proteins containing paucimannose, high-mannose, or complex type N-glycans." *Plos One* 8(6):e66719. doi: 10.1371 : 2013

Butler M. Serum-free media: standardizing cell culture systems. *Pharm. Bioprocess.* 1(4), 1-4 (2013).

Michael Butler "From the mold in Dr Florey's coat to blockbuster drugs." *Pharmaceutical Bioprocessing* 1(1) 3-5: 2013

Katrin Braasch, Marija Nikolic-Jaric, Tim Cabel, Elham Salimi, Greg E. Bridges, Doug J. Thomson, Michael Butler (2013) The changing dielectric properties of CHO cells can be used to determine early apoptotic events in a bioprocess. *Biotechnol Bioeng.* 110(11): 2902-14.

Marija Nikolic-Jaric, Tim Cabel, Elham Salimi, Ashlesha Bhide, Katrin Braasch, Michael Butler, Greg E. Bridges and Douglas J. Thomson. Differential electronic detector to monitor apoptosis using dielectrophoresis-induced translation of flowing particles (DEP cytometry). *Biomicrofluidics* 7(2): 2401 DOI:10.1063/1.479322, 2013

Do Yun Kim, Muhammad Arshad Chaudhry, Malcolm L. Kennard¹, Mario A. Jardon, Katrin Braasch, Ben Dionne, Michael Butler, and James M. Piret "Fed-Batch CHO Cell t-PA Production and Feed Glutamine Replacement to Reduce Ammonia Production" *Biotechnology Progress* 29(1):165-75: 2013

Elham Salimi, Marija Nikolic-Jaric, Tim Cabel, Katrin Braasch, Vincent Jung, Michael Butler, Douglas Thomson, and Greg E. Bridges “Microfluidic Device for Simultaneous Pulsed Electric Field Electroporation and Dielectrophoresis Studies of Single Biological Cells” Instrumentation and Measurement Technology IEEE International DOI: 10.1109/I2MTC.2013.6555448: 2013

Elham Salimi, Marija Nikolic-Jaric, Tim Cabel, Katrin Braasch, Vincent Jung, Michael Butler, Douglas Thomson, and Greg E. Bridges. Electroporation and dielectrophoresis of single cells using a microfluidic system employing a microwave interferometric sensor. 2013 IEEE MTT-S International Microwave Symposium Digest (MTT) DOI: 10.1109/MWSYM.2013.6697715; 2013

B. S. Rizzi, A. Bhide, T. Cabel, M. Nikolic-Jaric, E. Salimi, K. Braasch, M. Butler, G. E. Bridges, and D. J. Thomson, “Semi-automated Detection of Single Cell Signatures from a Dielectrophoretic Cytometer”, Proceedings of the International Instrumentation and Measurement Technology Conference, DOI: 10.1109/I2MTC.2013.6555581 2013.

2012

A.Meneses Acosta and M.Butler ”Anticuerpos Monoclonales: Bases, Desarrollo y Aplicaciones” Farmacia Sudamericana 16(1) 2012

M.Butler “The business of Monoclonal Antibody production” Biotechnology Focus 15(10) 24-26 November 2012

M.Butler “MabNet: A strategic Canadian program to develop production technologies for monoclonal antibodies” Biotechnology Focus 15(5) 11-12 May 2012

Butler, M and Meneses-Acosta,A. Recent advances in technology supporting biopharmaceutical production from mammalian cells. Applied Microbiology and Biotechnology 96:885–894: 2012

Lee,HC, Butler,M and Wu,SC. Using recombinant DNA technology for the development of live-attenuated dengue vaccines. Enzyme and Microbial Technology. 51: 67-72: 2012

Jardon, MA, Sattha,B.,Braasch,K., Leung,AO, Côté, HCF, Butler,M., Gorski,SM and Piret,JM “Inhibition of Glutamine-Dependent Autophagy Increases t-PA Production in CHO Cell Fed-batch Processes” Biotech Bioeng 109(5) 1228–1238, 2012

2011

Tharmalingam T,Sunley,K, Spearman M and Butler M. Enhanced production of human recombinant proteins from CHO cells grown to high densities in macroporous microcarriers. Molecular Biotechnology 49(3) 263-276: 2011

Maureen Spearman, Ben Dionne, and Michael Butler “The Role of Glycosylation in Therapeutic Antibodies” In *Antibody Expression and Production*, Cell Engineering 7,p 251-292 (M. Al-Rubeai ;ed.), publ. Springer Science+Business Media B.V. 2011

Sarah Murrell, Suh-Chin Wu and Michael Butler. Dengue virus and the development of a vaccine. Biotechnology Advances 29: 239-247, (2011)

2010

David J. Harvey, Jaak Jaeken, Mike Butler, Alison J. Critchley, Pauline M. Rudd and Raymond A. Dwek “Fragmentation of negative ions from *N*-linked carbohydrates, Part 4. Fragmentation of complex glycans lacking substitution on the 6-antenna” J of Mass Spectrometry 45(5) 528-535: 2010

Rodriguez J, Spearman M, Tharmalingam T, Sunley K, Lodewyckx C, Huzel N and Butler M. High productivity of human recombinant beta-interferon from a low-temperature perfusion culture. J.Biotechnol.. 150: 509–518 2010.

Sunley,K., and Butler,M. “Strategies for the enhancement of recombinant protein production from mammalian cells by growth arrest” *Biotechnology Advances* 28(3) 385-394: 2010.

Butler, M.,Sparling, R.and Court,D. “The energy metabolism of bacterial, fungal and animal cells used for industrial production.” *Encyclopedia of Industrial Biotechnology, Bioprocess, Bioseparation, and Cell Technology.* (Ed. MC. Flickinger) publ. Wiley 2010.

2009

Butler, M. and Perreault, H. 2009. Protein Glycosylation: Methods for Determination. *Encyclopedia of Industrial Biotechnology.* 1–16.

Durocher, Y and Butler, M Expression Systems for therapeutic glycoprotein production. *Critical Opinions in Biotechnology.* 20(6): 700-707 2009

Nikolic-Jaric,M., Romanuik, SF,,Ferrier,GA,_ Bridges,GE, Butler,M,Sunley,K, Thomson,DJ and Freeman,MR “Microwave Frequency Sensor for Detection of Biological Cells in Microfluidic Channels” *Biomicrofluidics* 3 (3), p034103-10315 (2009).

Butler, M. “Mammalian cell lines and glycosylation: a case study.” In *Biopharmaceuticals: post translational modifications* (Ed: G.Walsh) publ. Wiley VCH 2009.

2008

Sunley, K., Tharmalingam,T. and Butler,M. (2008) CHO cells adapted to hypothermic growth produce high yields of recombinant beta-interferon. *Biotech Progress* 24(4): 898-906.

Tharmalingam, T.Sunley, K. and Butler,M. (2008) High yields of monomeric recombinant beta-interferon from macroporous microcarrier cultures under hypothermic conditions. *Biotech Progress* 24(4): 832-838.

Butler,M. “Post translational modification of recombinant proteins” (Portuguese) for “Tecnologia do Cultivo de Celulas Animais: de Biofarmacos a Terapia Genetica” (Ed. E.Augusto) 2008 Editora Roca

Tharmalingam, T., Ghebeh, H., Wuerz, T and Butler,M. . (2008) Pluronic enhances the robustness and reduces the cell attachment of mammalian cells. *Molecular Biotechnology* 39(2), 167-77.

Amable, P and Butler,M. Cell metabolism and its control in culture In Castilho et al (Eds) “Animal Cell Technology: from Biopharmaceuticals to Gene Therapy” Taylor & Francis 2008

Butler,M. “Post translational modification of recombinant proteins” In Castilho et al (Eds) “Animal Cell Technology: from Biopharmaceuticals to Gene Therapy” Taylor & Francis 2008

Liu C-C, Lee S-C, Butler M, Wu S-C (2008) High genetic stability of dengue virus propagated in MRC-5 cells as compared to the virus propagated in vero cells. *PLoS ONE* 3(3): e1810.

2007

Chia-Chyi Liu, Wei-Cheng Lian, Michael Butler, Suh-Chin Wu. (2007). High immunogenic enterovirus 71 strain and Its production using serum-free microcarrier Vero cell culture. *Vaccine.* 25(1):19-24.

Majid, F.A,A. Butler M.and.Al-Rubeai M (2007). Glycosylation of an immunoglobulin produced from a murine hybridoma cell line: the effect of culture mode and the anti-apoptotic gene, bcl-2. *Biotechnol Bioeng.* 97(1): 156-169..

Butler, M. and Spearman, M. "Cell counting and viability measurements" in *Animal Cell Biotechnology Methods and Protocols* (ed: Ralf Poertner) Humana Press March 2007 .

Spearman, M., Rodriguez, J. Huzel, N., Sunley, K. and Butler, M.(2007) Effect of Culture Conditions on Glycosylation of Recombinant beta-Interferon in CHO Cells. In "Animal Cell Technology: From target to market" (Smith, R. ed.) European Society for Animal Cell Technology 17, 200-203.

2006

Butler, M. Optimisation of the cellular metabolism of glycosylation for recombinant proteins produced by mammalian cell systems. *Cytotechnology* 50: 57-76 2006

Burgener, A. and Butler, M. "Medium development" for "Cell Culture Technology for Pharmaceutical and Cell-based Therapies" (eds. Ozturk & Hu) pp 41-79 CRC Press 2005.

Burgener, A., Coombs, K. and Butler, M. (2006). Intracellular ATP and total adenylate concentrations are critical predictors of reovirus productivity from Vero cells. *Biotech Bioeng* 94 (4): 667-679.

Restelli, V, Wang, M-D, Huzel, N, Ethier, M, Perreault, H and Butler, M. (2006). The effect of dissolved oxygen on the production and the glycosylation profile of recombinant human erythropoietin produced from CHO cells. *Biotech Bioeng* 94 (3): 481-494.

2005

Butler, M. Animal cell cultures: recent achievements and perspectives in the production of biopharmaceuticals. (2005) *Applied Microbiology and Biotechnology* 68: 283-291.

Butler, M. Biomanufacturing: the key to success in biotechnology (2005). *Biotechnology Focus* 8(3): 10-12.

Rodriguez, J., Spearman, M., Huzel, N. and Butler, M. (2005) Enhanced production of monomeric interferon- β by CHO cells through the control of culture conditions. *Biotechnology Progress* 21(1) 22-30.

2004

Spearman, M., Rodriguez, J., Huzel, N. and Butler, M. (2004) Production and glycosylation of recombinant beta-interferon in suspension and Cytopore microcarrier cultures of CHO cells. *Biotechnology Progress* 21(1) 31-39

2003

Butler, M., Quelhas, D., Critchley, A.J., Carchon, H., Hebestreit, H.F., Hibbert, R.G., Vilarinho, L., Teles, E., Matthijs, G., Schollen, Argibay, P., Harvey, D.J., Dwek, R.A., Jaeken, J. and Rudd, P.M. 2003 Detailed glycan analysis of serum glycoproteins of patients with congenital disorders of glycosylation indicates the specific enzyme defect and, coupled with proteomics, provides an insight into pathogenesis. *Glycobiology* 13: 601-622.

Ethier, M., Saba, J.A., Spearman, M., Krokhin, O., Butler, M., Ens, W., Standing, K.G. and Perreault, H. 2003. Application of the StrOligo algorithm for the automated structure assignment of complex N-linked glycans from glycoproteins using tandem mass spectrometry. *Rapid Communications in Mass Spectrometry* 17 (24): 2713-2720.

2002

Saba, JA., Kunkel, J.P., Jan, D.CH., Ens, W.E., Standing, K.G., Butler, M., Jamieson, J.C. and Perreault, H. 2002 "A study of IgG glycosylation in monoclonal and polyclonal species by electrospray and matrix-assisted laser desorption/ionization mass spectrometry" *Anal Biochem.* 305: 16-31.

Restelli, V. and Butler, M. 2002 "The effect of cell culture parameters on protein glycosylation" Cell Engineering Vol 3: Glycosylation (Al-Rubeai ed.) pp. 61-92 publ. Kluwer, Dordrecht.

Butler, M. 2002. "Genetic engineering of hybridomas." In Encyclopedia of Physical Sciences and Technology. (ed. R.A.Meyers) Volume 7: 427-443 publ. Academic Press.

Yang, M. and Butler, M. 2002. Effects of ammonia and glucosamine on the heterogeneity of erythropoietin glycoforms. Biotechnology Progress. 18: 129-138.

Wang M-D, Yang, M., Huzel, N. and Butler, M. 2002 Erythropoietin production from CHO cells grown by continuous culture in a fluidized-bed bioreactor Biotech Bioeng 77:194-203.

Ghebeh, H., Gillis, J. and Butler, M. 2002. Measurement of the cell surface hydrophobicity of cultured mammalian cell lines. J. Biotechnol. 95: 39-48.

2001

Barnabé, N., Butler, M. and Hasinoff, B.B. 2001 "The effect of the catalytic topoisomerase II inhibitor dexrazane (ICRF-187) on CC9C10 hybridoma viability and productivity" Cytotechnology 37: 107-117:

Burgener, A., Patrick, M., Coombs, K., Moffatt, D., Huzel, N. and Butler, M. 2001. "The modification of a serum-free media formulation for the production of reovirus and the growth of Vero, MRC-5, MDCK and BHK cells" In "Animal Cell Technology: From target to market" (Lindner-Olsson, E, Chatzissavidou, N. and Lullau, E. eds.) European Society for Animal Cell Technology 17, 200-203.

2000

Butler, M., Burgener, A., Patrick, M., Berry, M., Moffatt, D., Huzel, N., Barnabé, N. and Coombs, K. 2000. Application of a serum-free medium for the growth of Vero cells and the production of reovirus Biotech. Progress 16(5): 854-858.

Yang, M. and Butler, M. 2000. The effect of ammonia on the glycosylation of human recombinant erythropoietin in culture Biotech. Progress 16(5): 751-759.

Yang, M. and Butler, M. 2000. Enhanced erythropoietin heterogeneity in a CHO culture is caused by proteolytic degradation and can be eliminated by a high glutamine level. Cytotechnology 34 (1-2): 83-99.

Barnabé, N. and Butler, M. 2000 The effect of glucose and glutamine on the intracellular nucleotide pool and oxygen uptake rate of a murine hybridoma. Cytotechnology 34 (1-2): 47-57.

Kunkel, J.P., Jan, D.C.H., Butler, M. and Jamieson, J.C. 2000. Comparisons of the glycosylation of a monoclonal antibody produced under nominally-identical cell culture conditions in two different bioreactors. Biotechnol. Progress 16 (3), 462-470.

Yang, M. and Butler, M. 2000. Effects of ammonia on CHO cell growth, erythropoietin production and glycosylation. Biotech. Bioeng. 68: 370-380.

Butler M., Kunkel J, Jan D., Huzel N. and Jamieson J.. (2000) The glycosylation of immunoglobulin (IgG) in bioreactors. Biotechnologia Aplicada , 17(3): 191.

Broadhurst, E.R. and Butler, M. 2000. The inhibitory effect of glutamate on the growth of a murine hybridoma is caused by competitive inhibition of the x_c^- transport system required for cystine utilization. Cytotechnology 32: 45-61.

Butler, M. 2000 "Equipment and laboratory design for cell culture" In: Encyclopedia of Cell Technology (Spier R.E. ed.)

pp. 680-691 publ. J.Wiley, NY

Butler, M. 2000 "Measurement of cell viability " In: Encyclopedia of Cell Technology (Spier R.E. ed.) pp. 887-891 publ. J.Wiley NY

1999

Butler, M., Huzel, N., Barnabé, N., Gray, T. and Bajno, L. 1999. Linoleic acid improves the robustness of cells in agitated cultures. *Cytotechnology* 30 (1-3): 27-36.

Berry, J.M., Barnabé, N., Coombs, K. M. and Butler, M. 1999. Production of reovirus type-1 and type-3 from Vero cells grown on solid and macroporous microcarriers. *Biotech. Bioeng.* 62 (1): 12-19.

Butler, M. 1999. Cell counting and viability measurements. pp. 131-144 in *Methods in Molecular Biology* (ed. N.Jenkins). Humana Press, New Jersey.

Wang, M.D., Yang, M. Huzel N. and Butler, M. 1999. "Erythropoietin production from CHO cells grown in a fluidized-bed bioreactor with macroporous beads" In "Products from cells; cells as products" (Bernard, A, Griffiths, B., Noe, W. and Wurm, F. eds.) European Society for Animal Cell Technology 16, 307-309.

Christie, A. and Butler, M. 1999. The adaptation of BHK cells to a non-ammoniagenic glutamate-based culture medium. *Biotech & Bioeng* 64 (3): 298-309.

Butler, M., Sparling, R. and Xiao, X. 1999 "Energy Metabolism, Microbial and Animal Cells" In *Encyclopedia of Bioprocess Technology: Fermentation, Biocatalysis, and Bioseparation* (Ed. M. C. Flickinger and S. W. Drew) Vol. 2, pp 929 - 947.

1998

Ghebeh, H., Handa-Corrigan, A. and Butler, M. 1998. Development of an assay to measure the surfactant, Pluronic F-68 in cell culture medium. *Anal. Biochem.* 262 (1): 39-44.

Kunkel, J.P., Jan, D.C.H., Jamieson, J.C. and Butler, M. 1998. Dissolved oxygen concentration in serum-free continuous culture affects N-linked glycosylation of a monoclonal antibody. *J. Biotechnol.* 62 (1); 55-71.

Barnabé, N. and Butler, M. 1998. The relationship between intracellular UDP-N-acetyl hexosamine nucleotide pools and monoclonal antibody production in a mouse hybridoma. *J. Biotechnol.* 60 (1-2): 67-80.

Butler, M., Huzel, N., Barnabé, N., Bajno, L. and Gray, T. 1998 Intracellular fatty acid composition affects cell yield, energy metabolism and cell damage in agitated cultures. In "New developments and new applications in Animal Cell Technology" (Merten, O-W., Perrin, P. and Griffiths, B. eds.) European Society for Animal Cell Technology 15, 197-203.

1997

Butler, M., Huzel, N. and Barnabé, N. 1997. Unsaturated fatty acids enhance cell yields and perturb the energy metabolism of an antibody-secreting hybridoma. *Biochem J.* 322, 615-623.

Jan, D.C.H., Petch, D., Huzel, N. and Butler, M. 1997. The effect of dissolved oxygen on the metabolic profile of a murine hybridoma grown in serum-free medium in continuous culture. *Biotech. Bioeng.* 54 (2), 153-164.

Berry, J.M., Huebner, E. and Butler, M. 1997. Cell productivity is overestimated by the crystal violet nuclei counting technique. In *Animal Cell Technology: From vaccines to genetic medicine.* (Carrondo, J.T., Griffiths, B. and Moreira, J.L.P. eds.) European Society for Animal Cell Technology 14, 461-466.

Butler, M. and Huzel, N. 1997. Optimisation of the fatty acid composition of a hybridoma enhances Mab production and perturbs energy metabolism. In "Animal Cell Technology: From vaccines to genetic medicine" (Carrondo, J.T., Griffiths, B. And Moreira, J.L.P. eds.) European Society for Animal Cell Technology 14, 657-662.

Jan, D.C.H., Petch, D.A., Huzel, N. and Butler, M. 1997. The metabolic profile of a murine hybridoma grown in serum-free medium at various oxygen concentrations. In "Animal Cell Technology: From vaccines to genetic medicine" (Carrondo, J.T., Griffiths, B. And Moreira, J.L.P. eds.) European Society for Animal Cell Technology 14, 791-796.

1996

Berry, J.M., Huebner, E. and Butler, M. 1996. The crystal violet nuclei staining technique leads to anomalous results in monitoring mammalian cell cultures. *Cytotechnology* 21 (1), 73-80.

Ng, Y-C., Berry, J.M. & Butler, M. 1996. Optimisation of physical parameters for cell attachment and growth on macroporous microcarriers. *Biotech. Bioeng* 50 (6), 627-635.

Butler, M. and Chu, C.C. 1996. "Cell culture and biotechnology" In 'Cell Biology' 2nd edition (eds. Smith, C.A. and Wood, E.J.) pp. 87-110 publ. Chapman & Hall, London.

Petch, D. and Butler, M. 1996. The effect of alternative carbohydrates on the growth and antibody production of a murine hybridoma. *Applied Biochem. and Biotech.* 59 (1): 93-104.

1995

Butler, M. and Huzel, N. 1995. The effect of fatty acids on hybridoma cell growth and antibody productivity in serum-free cultures. *J. Biotechnol.* 39, 165-173.

Butler, M. and Huzel, N. 1995. The effect of unsaturated fatty acids on the growth, metabolism and productivity of a murine hybridoma. In "Animal Cell Technology: developments towards the 21st century" (Beuvery, E.C., Griffiths, J.B. and Zeijlemaker, W.P. eds.) European Society for Animal Cell Technology. 13, 125-129.

1994

Christie, A. and Butler, M. 1994. Glutamine-based dipeptides are utilized in mammalian cell culture by extracellular hydrolysis catalyzed by a specific peptidase. *J. Biotechnol.* 37, 277-290.

Butler, M. and Christie, A. 1994. Adaptation of mammalian cells to non-ammoniagenic media. *Cytotechnology* 15, 87-94.

Barnabe, N. and Butler, M. 1994. Effect of temperature on nucleotide pools and monoclonal antibody production in a mouse hybridoma. *Biotech. Bioeng.* 44, 1235-1245.

Petch, D. and Butler, M. 1994. A profile of energy metabolism in a murine hybridoma: glucose and glutamine utilization. *J. Cell Physiol.* 161, 71-76.

Christie, A. and Butler, M. 1994. Growth and metabolism of a murine hybridoma in cultures containing glutamine-based dipeptides. *Focus* 16.1, 9-13.

Christie, A. and Butler, M. 1994. The effect of glutamine-containing dipeptides on the growth and productivity of a hybridoma. In "Animal Cell Technology: products of today, prospects for tomorrow" (Spier, R.E., Griffiths, J.B. and Berthold, W. eds.) European Society for Animal Cell Technology. 12, 164-166.

1993

Fitzpatrick,L. Jenkins,H.A. and Butler,M. 1993. Glucose and glutamine metabolism of a murine B-lymphocyte hybridoma grown in batch culture. *Applied Biochem. and Biotech.* 43, 93-116.

Cole,C.R., Smith,C.A. and Butler,M. 1993. Specific activities of glycosyltransferase enzymes vary with monoclonal antibody productivity in murine hybridomas. *Biotech. Lett.* 15(6) 553-558.

McDermott,R.H. and Butler,M. 1993. Uptake of glutamate, not glutamine synthetase, regulates adaptation of mammalian cells to glutamine-free medium. *J. Cell Sci.* 104(1) 51-58.

1992

Jenkins, H.A., Butler, M. and Dickson, A.J. 1992. Characterization of the importance of glutamine metabolism to hybridoma cell growth and productivity. *J. Biotechnol.* 23, 167-182.

Butler, M. 1992. "Serum-free media for neuronal cell culture" pp. 55-75 In 'Cell Lines in Neurobiology: A practical approach' (Wood, J.N. ed). Oxford University Press

Jenkins, H.A., L. Fitzpatrick, and M. Butler. 1992. Energy metabolism of murine hybridomas. In "Animal Cell Technology: Developments, processes and products" (Spier, R.E., Griffiths, J.B. and MacDonald,C. eds.) European Society for Animal Cell Technology. 11, 243-247.

1991

Butler, M. and A. Barnett. 1991. "Cell culture and biotechnology" In 'Molecular Biology and Biotechnology' (eds. Smith, C.A. and Wood, E.J.) pp. 213-234 Chapman & Hall, London.

Hassell, T., S. Gleave and M. Butler. 1991. Growth inhibition in animal cell culture: the effect of lactate and ammonia. *Appl. Biochem. Biotech.* 30(1), 29-41.

Butler, M. 1991. "The characteristics and growth of cultured cells" 1-25 In 'Mammalian Cell Biotechnology: A practical approach' (Butler, M. ed). Oxford University Press.

Butler, M., T. Hassell, C. Doyle, S. Gleave, and P. Jennings. 1991. The effect of metabolic by products on animal cells in culture. In "Production of Biologicals from Animal Cells in Culture" (Spier, R.E., Griffiths, J.B. and Meigner, B. eds.) European Society for Animal Cell Technology, 10, 226-228.

Thomas, R.H., H.A. Jenkins and M. Butler. 1991. Adaptation of anchorage-dependent cells to glutamine-free medium. In "Production of Biologicals from Animal Cells In Culture" (Spier, R.E., Griffiths, J.B. and Meigner, B. eds) European Society for Animal Cell Technology 10, 276-278.

1990

Doyle, C. and M. Butler. 1990. The effect of pH on the toxicity of ammonia to a murine hybridoma. *J. Biotechnol.* 15, 91-100.

Hassell, T. and M. Butler. 1990. Adaptation to non-ammoniagenic medium and selective substrate feeding lead to enhanced yields in animal cell cultures. *J. Cell Sci.* 96, 501-508.

Butler, M. 1990. The use of animal cell and tissue culture in biotechnology. *The Genetic Engineer and Biotechnologist* 10, 13-15.

1989

Butler, M. and H. Jenkins. 1989. Nutritional aspects of growth of animal cells in culture. J. Biotechnol. 12, 97-110.

1988

Butler, M. 1988. A comparative review of microcarriers available for the growth of anchorage-dependent animal cells." pp. 284-303 In Animal Cell Biotechnology, vol. 3 (eds Griffiths, B. and Spier, R.E.) Academic Press.

Butler, M. 1988. "Processes with animal cell and tissue cultures" pp. 249-316 In Biotechnology: A comprehensive treatise, vol. 6b (eds Rehm, H.J. and Reed, G.) VCH Verlag.

1987

Butler, M., T. Hassell, and A. Rowley. 1987. "The use of microcarriers in the culture of anchorage-dependent animal cells" pp. 64-74 In Plant and Animal Cells: process possibilities (eds. Webb, C. and Mavituna, F.) Ellis Horwood.

Butler, M. 1987. Growth limitations in microcarrier cultures. Advances in Biochemical Engineering 34, 57-84.

Sayer, T., M. Butler, and A. MacLeod. 1987. The attachment of MDCK cells in three types of microcarriers in different serum-free media In "Modern Approaches to Animal Cell Technology" (Spier, R.E. and Griffiths, J.B. eds.) European Society of Animal Cell Technology 9, 264-279.

Hassell, T., I. Allen, A. Rowley, and M. Butler. 1987. The use of a glutamine-free media for the growth of three cell lines in microcarrier culture. In Modern Approaches to Animal Cell Technology (Spier, R.E. & Griffiths, J.B. eds.) European Society of Animal Cell Technology. 9, 245-263.

Butler, M. 1987. Animal Cell Biotechnology vols 1 & 2, Spier & Griffiths (eds.) Book review. Vaccine 5(4) 323

1986

Butler, M. 1986. "Serum-free media" pp. 91-108 In Mammalian Cell Technology (ed. W.G. Thilly) Butterworths.

1980-85

Butler, M. 1985. "Growth limitations in high density microcarrier cultures" Developments in Biological Standardization. (European Society for Animal Cell Technology) 60: 269-280.

Butler, M. and R.E. Spier. 1984. The effects of glutamine utilisation and ammonia production on the growth of BHK cells in microcarrier cultures. J. Biotechnol. 1: 187-196.

Butler, M. 1983. Biotechnology - making micro-organisms work for man. Esso magazine 127: 16-19.

Butler, M., T. Imamura, J. Thomas, and W.G. Thilly. 1983. High yields from microcarrier cultures by medium perfusion. J. Cell Sci. 61: 351-363.

Butler, M., and W.G. Thilly. 1982. MDCK microcarrier cultures: Seeding density effects and amino acid utilization. In Vitro 18: 213-219.

Butler, M., A.E.J. Haskew, and M.M. Young. 1980. Copper tolerance in the green alga, *Chlorella vulgaris*. Plant, Cell and Environment 3, 119-126.

1973-79

Hall, A., A.H. Fielding, and M. Butler. 1979. Mechanism of copper tolerance in the marine fouling alga, *Ectocarpus siliculosus* - evidence for an exclusion mechanism. Marine Biology 54: 195-199.

Butler, M. and J.B. Capindale. 1975. Assimilation of citric acid and adipic acid by the blue-green alga, *Anabaena variabilis*. Can. J. Microbiol. 21: 1372-1378.

Butler, M., A. Darbre and H.R.V. Arnstein. 1975. Amino acids attached to transfer ribonucleic acid *in vivo*. Biochem. J. 150: 419-432.

Butler, M., and A. Darbre. 1974. Determination of amino acids by gas-liquid chromatography with the nitrogen-sensitive thermionic detector. J. Chromatogr. 101: 51-56.

Butler, M., A. Darbre, and H.R.V. Arnstein. 1973. Analysis of amino acids attached to transfer ribonucleic acid by means of gas-liquid chromatography. Biochem. Soc. Trans. 1: 610.

Conference Abstracts and Posters

Behnam Arzhang, Justyna Lee, Emerich Kovacs, Michael Butler, Elham Salimi, Douglas J Thomson, Greg Bridges E. Integrating Optical Scattering and Dielectrophoresis in a Flow Cytometer for Particle Classification. Microscopic Society of Canada, June 2025

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

Laura Breen, James Flynn, Adam Bergin, Evangelia Flampouri, Elham Salimi, Michael Butler Loss of Cell Viability is Tracked by Decreased Cytoplasmic Conductivity. Cell Culture Engineering XVIII, Cancun, Mexico April 2023

Laura Breen, James Flynn, Ciarán Dunne, Colin Dalton, Evangelia Flampouri, Adam Bergin, Tod Canty and Michael Butler. *Advanced cell culture analysis of count, viability and health by dynamic imaging using AI*. Recent Advances in Fermentation Technology” November 2022.

Laura Breen, Adam Bergin, Evangelia Flampouri, James Flynn and Michael Butler. Non-invasive, novel optical and dielectric methods to detect changes in cell metabolism during a bioprocess 27th ESACT Meeting, Lisbon, Portugal 2022

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

Zsuzsanna Kovács, Yongjing Xie, Barbara Adamczyk, Fiona Reidy, Fionnuala M. Mcauliffe, Pauline M. Rudd, Michael Butler, Mary Wingfield Procainamide fluorescent labeling for identification of low abundant non-invasive glycan biomarkers 68th Annual Meeting of the Society for Reproductive Investigation (SRI) Boston (virtual) July 2021

Butler, M. Biologics World Nordics (3rd), *High-Resolution Optical and Dielectric Methods for Monitoring Cells in Bioprocesses* Copenhagen (Virtual) October 2020

Butler, M. Cambridge Healthtech Institute. *High-Resolution Optical and Dielectric Methods for Monitoring Cells in Bioprocesses*. 3rd Bioprocessing Summit Europe (Virtual), Barcelona, July 2020.

Letícia Mota, Yongjing Xie, Roisin O’Flaherty and Michael Butler In Vitro Glycoengineering in Solid and Liquid Phase: Production of Hypergalactosylated Rituximab with Higher Binding Affinity. 3rd Bioprocessing Summit Europe (Virtual), Barcelona, Cambridge Healthtech Institute, July 2020 (Poster Prize Winner).

S. Afshar , A. Fazelkhah , K. Braasch , J. Dietrich , M. Butler , E. Salimi , D. Thomson and G. Bridges. Wideband DEP-Measured Dielectric Spectrum of Single Cells and Effect of Nucleus. *URSI GASS 2020, Rome, Italy, 29 August - 5 September 2020*.

Adam Bergin and Michael Butler Online and offline monitoring of CHO cell health in a bioreactor to allow for early identification of cell death. 26th ESACT Meeting, Copenhagen, Denmark 2019

Letícia Mota, Roisin O’Flaherty and Michael Butler *In-Vitro* Glycoengineering of single glycoform IgG in Solid and Liquid Phase. 26th ESACT Meeting, Copenhagen, Denmark 2019

Andrew Quigley, Ismael Obaidi and Michael Butler Bioactive Components From Hydrolysates For Media Supplements 26th ESACT Meeting, Copenhagen, Denmark 2019

Michael Butler, Katrin Braasch, Elham Salimi, Samaneh Afshar , Gregory Bridges and Douglas Thomson. Dielectric monitoring of mammalian cells in a bioreactor. Cell Culture Engineering meeting, Tampa, Florida, USA May 2018

Michael Butler and Venkata Tayi. Solid Phase Enzymic Remodelling to produce Single Glycoform Antibodies 25th ESACT Meeting, Lausanne, Switzerland 2017

J.Hudgens, I.Karageorgos, ES. Gallagher, K.Bauer, T.Venkata and M.Butler. Mapping effects of glycosylation structure upon the dynamics of IgG1κ-FcγRIa receptor binding with hydrogen-deuterium mass spectrometry. Keystone Conference USA 2017

Neha Mishra, Maureen Spearman, Lynda J Donald, Helene Perreault, Michael Butler. Comparison of two glycoengineering methods aimed at reducing fucosylation of a camelid heavy-chain monoclonal antibody. Protein Expression in Animal Cells (PEACe) Valencia, Spain September 2017

S. Afshar, E. Salimi, A. Fazelkhah, M. Butler, and G.E. Bridges, D.J. Thomson, “ Lens less single cell cytometer with dielectrophoresis detection”, *MicroTAS*, Savannah, October 2017.

Michael Butler and Venkata Tayi Solid phase enzymic re-modelling to produce single glycoform antibodies. 25th ESACT meeting, Lausanne, Switzerland May 2017

A. Fazelkhah, K. Braasch, S. Afshar, E. Salimi, M. Butler, G. Bridges, and D. Thomson ” Determination of Ion Channel and Pump Fluxes for Chinese Hamster Ovary Cells using Rubidium Uptake Measurement.” Presented in Biophysical Meeting, February 2017.

Natalie Krahn, Cal D'Eall, Rob Pon, Martin Rossotti, Greg Hussack, Maureen Spearman, Debbie Callaghan, Jörg Stetefeld, Michael Butler, Yves Durocher and Jamshid Tanha Designing a camelid/human heavy-chain antibody with enhanced antitumour activity. 25th ESACT meeting, Lausanne, Switzerland May 2017

Ioannis Karageorgos; Kerry Bauer; Venkata Tayi; Michael Butler and Jeffrey Hudgens Hydrogen Deuterium Exchange Mass Spectrometry (HDX-MS) as a tool to map FcγRs interactions with specific mAb-glycoforms. ASMS Sanibel conference. 2016

Butler, M. The control of glycosylation during biopharmaceutical production. 64th Canadian Chemical Engineering Society meeting Calgary September 2015

Natalie Krahn , Maureen Spearman¹ , Markus Meier , July Dorion-Thibaudeau , Gregory De Crescenzo , Yves Durocher, Michael Butler and Jörg Stetefeld A Camelid Heavy Chain Monoclonal Antibody Displays Unique FcγRI Binding Properties. .64th Canadian Chemical Engineering Society meeting Calgary September 2015

Villacres,C and Butler,M. Effect of media components on the increasing the incorporation of N-glycolylneuraminic acid. 64th Canadian Chemical Engineering Society meeting Calgary September 2015

Mishra,N and Butler, M. Effect of redox potential on glycosylation. Elucidating the intracellular redox status of glycosylation machinery. 64th Canadian Chemical Engineering Society meeting Calgary September 2015

Braasch, K, Butler,M., Salimi,E, Thomson,D and Bridges,G. The differential polarizability of CHO cells can be used to monitor changes in metabolism. 64th Canadian Chemical Engineering Society meeting Calgary September 2015

Ramirez, U, Chan, JJ, Butler,M. and Thulasiraman,P. Serum free media optimization of MRC-5 cells using definitive screening design. 64th Canadian Chemical Engineering Society meeting Calgary September 2015

Blondeel, EJM, Braasch,K, McGill,T, Chang,D, Spearman, M, Butler,M. and Aucoin,M. Tuning a Mab glycan profile in mammalian cell culture. Supplementing N-acetylglucosamine to favour G0 glycans without compromising cell growth. 64th Canadian Chemical Engineering Society meeting Calgary September 2015

Natalie Krahn , Maureen Spearman¹ , Markus Meier , July Dorion-Thibaudeau , Gregory De Crescenzo , Yves Durocher, Michael Butler and Jörg Stetefeld A Camelid Heavy Chain Monoclonal Antibody Displays Unique FcγRI Binding Properties. 12th Protein Expression of Animal Cells (PEACe) meeting San Diego, USA Sept 2015

Neha Mishra and Michael Butler. Effect of Redox Potential on Glycosylation: Elucidating The Intracellular Redox Status of Glycosylation Machinery 12th Protein Expression of Animal Cells (PEACe) meeting San Diego, USA Sept 2015

Carina Villacrés Barragan , Hélène Perreault and Michael Butler. Effect of media components on the increase in the incorporation of the immunogenic N-Glycolylneuraminic acid. 12th Protein Expression of Animal Cells (PEACe) meeting San Diego, USA Sept 2015

James M. Piret, Navid Ghaffari, Mario Jardon, Bhushan Gopaluni, Natalie Krahn, Katrin Braasch and Michael Butler. Effects of Selected Amino Acid Limitations in CHO Cell Fed-Batch Cultures. 12th Protein Expression of Animal Cells (PEACE) meeting San Diego, USA Sept 2015

Natalie Krahn, Maureen Spearman, Markus Meier, July Dorion-Thibaudeau, Gregory De Crescenzo, Yves Durocher, Michael Butler, and Jörg Stetefeld. A Camelid Heavy Chain Monoclonal Antibody Displays Unique FcγRI Binding Properties. 24th ESACT Meeting, Barcelona, Spain 2015

Carina Villacrés; Hélène Perreault and Michael Butler. Controlling the incorporation of the immunogenic N-glycolylneuraminic acid in monoclonal antibodies. 24th ESACT Meeting, Barcelona, Spain 2015

Katrin Braasch, E. Salimi, B. Saboktakin Rizi, DJ Thomson, GE Bridges and M. Butler. The differential polarizability of CHO cells can be used to monitor changes in metabolism. 24th ESACT Meeting, Barcelona, Spain 2015

G.A. Ferrier, M. Nikolic-Jaric, T. Cabel, F. Lin, M. Butler, G.E. Bridges, D.J. Thomson, M.R. Freeman Dielectrophoretic pressing of biological cells into contact with surfaces: a mechanism for biophysical flow cytometry. 14th International Conference on Miniaturized Systems for Chemistry and Life Sciences (MicroTAS), At Groningen, Netherlands (2014)

B. Saboktakin Rizi, K. Braasch, E. Salimi, K. Mohamad, S. Afshar Delkhah, T. Sandstorm, M. Butler, G.E. Bridges, and D.J. Thomson, M. Butler, “Monitoring Dielectric Changes In Chinese Hamster Ovary Cells During Induction of Apoptosis By Oligomycin Using A Dielectrophoretic (Dep) Cytometer”, *MicroTAS*, San Antonio, October 2014.

E. Salimi, K. Braasch, M. Butler, D.J. Thomson, and G.E. Bridges, “Dielectrophoresis Study of Electroporation Effects on Chinese Hamster Ovary Cells”, *16th International Symposium on Antenna Technology and Applied Electromagnetics (ANTEM)*, Victoria, July 2014.

Ben Dionne and Michael Butler The variable glycosylation profiles generated for IgG1 and chimeric camelid antibodies and their modifications through lowered culture redox potential. Cell Culture Engineering XIV Quebec City, May 2014

Venkata Tayi, Carina Villavres-Barragan, Bo Liu, Tatiane Maldonado-Coelho, Mari Cleide Sogayar and Michael Butler. The role of glucose- and glutamine-regulated metabolic pathways on glycosylation of a heavy chain monoclonal antibody in CHO cells. Cell Culture Engineering XIV Quebec City, May 2014

Michael Butler, Bo Liu, Maureen Spearman, John Doering, Carina Villacres-Barragan, Erika Lattova, Helene Perreault. The profile of intracellular lipid-linked oligosaccharides and nucleotide-sugars determine the distribution, site occupancy and n-glycosylation profile of a chimeric human-camelid antibody. Cell Culture Engineering XIV Quebec City, May 2014.

Katrin Braasch, Marija Nikolic-Jaric, Elham Salimi, Teslin Sandstrom, Kaveh Mohammad, Ashlesha Bhide, Bahareh Rizi, Doug Thomson, Greg Bridges, Michael Butler. Exploiting the dielectric properties of CHO cells to monitor apoptotic events in a bioprocess. Cell Culture Engineering XIV Quebec City, May 2014

E. Salimi, K. Braasch, M. Butler, D.J. Thomson, and G.E. Bridges, “Measurement of Electroporation Induced Changes in the Dielectric Response of Single Cells”, *MicroTAS*, Freiburg, October 2013.

E. Salimi; M. Nikolic-Jaric; T. Cabel; K. Braasch; V. Jung; M. Butler; D. Thomson, and G. Bridges, “Electroporation and dielectrophoresis of single cells using a microfluidic system employing a microwave interferometric sensor”, *IEEE MTT-S International Microwave Symposium Digest*, 2013.

E. Salimi; M. Nikolic-Jaric; T. Cabel; K. Braasch; V. Jung; M. Butler; D. Thomson, and G. Bridges, “Microfluidic device for simultaneous pulsed electric field electroporation and dielectrophoresis studies of single biological cells”, *IEEE Instrumentation and Measurement Technology Conference*, pp. 403-406, 2013.

K. Braasch, M. Nikolic-Jaric, T. Cabel, E. Salimi, A. Bhide, B. Rizi, D. Thomson, G. Bridges, M. Butler, "The Changing Dielectric Properties of CHO Cells Can be Used to Determine Early Apoptotic Events in a Bioprocess.", *Protein Expression in Animal Cells – MabNet Symposium, Kananaskis*, Sep. 2013.

Spearman. M., Okun, N., Chan, S. and Butler, M. 2013, Reduction of Fucosylation of Monoclonal Antibody Glycans Using Several Glycosylation Inhibitors, Protein Expression in Animal Cells 11, Kananaskis, Alberta, Canada

Liu, B., Lattova, E., Spearman, M., and Butler, M. 2013 Differential Effects of low glucose on the macroheterogeneity and microheterogeneity of glycosylation in CHO-EG2 camelid monoclonal antibodies, Protein Expression in Animal Cells 11, Kananaskis, Alberta, Canada

Okun, N., Spearman, M., Patel, T., Meier, M., Dorion-Thibaudeau, J., De Crescenzo, G., Stetefeld, J., and Butler, M. 2013, Effect of N-glycosylation on the Structure and Function of a Heavy Chain Monoclonal Antibody, Protein Expression in Animal Cells 11, Kananaskis, Alberta, Canada

Liu, B., Lattova, E., Spearman, M., and Butler, M. 2013 Differential Effects of low glucose on the macroheterogeneity and microheterogeneity of glycosylation in CHO-EG2 camelid monoclonal antibodies, 23rd ESACT Meeting, Lille, France.

Spearman. M., Okun, N., Chan, S. and Butler, M. 2013 Modification of Monoclonal Antibody Glycans Using Glycosylation Inhibitors: effects on production, activity and stability, 23rd ESACT Meeting, Lille, France.

Okun, N., Spearman, M., Patel, T., Meier, M., Dorion-Thibaudeau, J., De Crescenzo, G., Butler, M. and Stetefeld, J. 2013 Effect of N-glycosylation on the Structure and Function of a Heavy Chain Monoclonal Antibody; 1st Annual Protein Structure Function and Malfunction (PSFaM), Saskatoon, Sask.

Carina Villacrés Barragán, Erika Lattova, Bo Liu, Maureen Spearman and Michael Butler "The effect of low glucose and glutamine concentrations on the glycosylation profile of a camelid monoclonal antibody produced in CHO cultures." ESACT meeting. June 2013. Lille, France

Ben Dionne and Michael Butler "Effect of redox potential on antibody glycosylation in mammalian cell cultures" 23rd ESACT 2013 Jun23-26 Lille, France

Ben Dionne and Michael Butler "Effect of redox potential on antibody glycosylation in mammalian cell cultures" PEACE conference Sep22-26, Kananaskis, Alberta, Canada. September, 2013. Kananaskis, Canada (Poster).

Rizi, B.S.; Bhide, A.; Cabel, T.; Nikolic-Jaric, M.; Salimi, E.; Braasch, K.; Butler, M.; Bridges, G.E.; Thomson, D.J., "Semiautomated detection of single cell signatures from a dielectrophoretic cytometer," *Instrumentation and Measurement Technology Conference (I2MTC), 2013 IEEE International*, vol.no., pp.1083,1087, 6-9 May 2013

Katrin Braasch, M. Nikolic-Jaric, T. Cabel, E. Salimi, A. Bhidea, V. Jung, D.J. Thomson, G.E. Bridges and Michael Butler "The changing dielectric properties of CHO cells can be used to determine early apoptotic events in a bioprocess." European Society of Animal cell Technology 2013

Sadavarte, R., Okun, N., Spearman, M., Butler, M. and Ghosh, R. "Separation and analysis of chimeric heavy chain monoclonal antibodies by membrane chromatography" Can Soc Chem Eng abstract 2012

Nasseri, SS, Braasch, K, Butler, M., Jardon, M, Gopaluni, B and Piret, J "Hyper-osmolality and autophagy inhibition increased monoclonal antibody production" Can Soc Chem Eng abstract 2012

Braasch K., Nikolic-Jaric M., Butler M., Thomson D.J, Bridges G.E. "The Changing Dielectric Properties of CHO Cells Can Be Used to Determine Early Apoptotic Events in a Bioprocess" Can Soc Chem Eng abstract 2012

Spearman, M., Okun, N., Chan, S., and Butler, M. "Modification of Monoclonal Antibody Glycans Using Glycoprotein Processing Inhibitors: effects on production, activity and stability." Can Soc Chem Eng abstract 2012

Bo Liu, Maureen Spearman and Mike Butler “Effects of Cell Culture Conditions on Lipid-Linked Oligosaccharide intermediates of Glycosylation of a monoclonal antibody” Can Soc Chem Eng abstract 2012

Carina Villacrés, and Michael Butler “Effect of low glucose and glutamine concentrations on the glycosylation of the camelid monoclonal antibody CHO EG2”. Can Soc Chem Eng abstract 2012

Ben Dionne and Michael Butler “Effect of redox potential on monoclonal antibody glycosylation in mammalian cell cultures.” Can Soc Chem Eng abstract 2012

Venkata S Tayi, Natalie Okun and Michael Butler “Effect of all-trans-retinoic acid on the productivity and glycosylation of a heavy chain monoclonal antibody produced from chinese hamster ovary cells” Can Soc Chem Eng abstract 2012

Marija Nikolic-Jaric, Elham Salimi, Tim Cabel, Katrin Braasch, Michael Butler, Greg E. Bridges and Douglas J. Thomson. Dielectrophoretic (DEP) cytometer: label-free electronic sensing of physiological changes in cells. Proceedings of MicroTas 2012

Spearman, M., Jung, V., Liu, B. and Butler, M. Extracts of Phytoplankton Support Growth and Productivity of Recombinant CHO Cells Cell Culture Eng XIII, 2012 Scottsdale, Arizona, USA

Katrin Braasch, M. Nikolic-Jaric, T. Cabel, E. Salimi, V. Ureña Ramírez, A. Froese, V. Jung, D.J. Thomson, G.E. Bridges and Michael Butler. The changing dielectric properties of CHO cells can be used to determine early apoptotic events in a bioprocess. Cell Culture Eng XIII, 2012 Scottsdale, Arizona, USA

Ben Dionne, Michael Butler. Effect of a media reducing agent on monoclonal antibody assembly and glycosylation in NS0 cell culture. Cell Culture Eng XIII, 2012 Scottsdale, Arizona, USA

Spearman, M., Jung, V., Liu, B., Braasch, K. and Butler, M. “Extracts of Phytoplankton Support Growth and Productivity of Recombinant CHO Cells” European Soc Animal Cell Tech 2011

Butler, M “Strategies for the production of single glycoform monoclonal antibodies” Can Soc Chem Eng (61) 2011

Chan, S, Spearman, M, Jung, V, Kowbel, V and Butler, M. “Analysis of bioactivity in yeast lysates for supplementation of mammalian cell culture media” Can Soc Chem Eng (61) 2011

Liu, B, Butler, M and Spearman, M. “Effect of cell culture media on lipid-linked oligosaccharide composition in CHO-EG2 cells” Can Soc Chem Eng (61) 2011

Piret, JM, Jardon, MA, Nasser, SS, Stichling, N, Cheng, X, Satthi, B, Leung, AO, Braasch, K, Butler, M, Cote HCF and Gorski, SM “Autophagy increases protein production in CHO cell fed-batch processes” Can Soc Chem Eng (61) 2011

Braasch, K, Villacres, C and Butler, M. “Evolution of different quenching and extraction methods used for nucleotide/ nucleotide sugar analysis” Can Soc Chem Eng (61) 2011

Spearman, S, Chan, S and Butler, M. “Modification of monoclonal antibody glycans using glycoprotein processing inhibitors” Can Soc Chem Eng (61) 2011

Coelho, TM, Carreira, ACO, Butler, M and Sogayar, MC “Comparative study of recombinant equine chorionic gonadotropin (eCG) expressed in three different cell lineages: Correlation between glycosylation and biological activity” Can Soc Chem Eng (61) 2011

Dionne, B and Butler, M “Effect of intracellular redox environment on monoclonal antibody assembly and glycosylation in NS0 cell culture” Can Soc Chem Eng (61) 2011

Spearman, MA, Jung,V, Liu, B and Butler, M “Extracts of phytoplankton support growth and productivity of recombinant CHO cells” Can Soc Chem Eng (61) 2011

Dionne,B and Butler,M “The Effect of Redox Potential on Glycan Profiles of IgG1 Produced in NS0 Cell Culture.” Can Soc Chem Eng (60) 2010

Braasch,K and Butler,M “Profiling of N-glycosylation and intracellular nucleotide / nucleotide sugar pools in CHO t-PA fed-batch cultures.” Can Soc Chem Eng (60) 2010

Butler, M, Meeting Report “International Bioanalytical Congress, Informa Life Sciences’ Meeting, Brussels “Post – translational modifications” September 29th 2010 published on-line in ThomsonReuters Pharma.

Mario A. Jardon, Kelsey C. Marshall, Beheroze Sattha, Amy O. Leung, Katrin Braasch, Michael Butler, Hélène C.F. Côté, Sharon M. Gorski and James M. Piret “Investigation of Cellular Factors Influencing Productivity in CHO Cell Fed-Batch Processes: Glutamine Metabolism and Autophagy” Cell Culture Engineering XII Conference Banff, Alberta 2010

Do Yun Kim, Muhammad A. S. Chaudhry, Mario A. Jardon, Katrin Braasch, Ben Dionne, Michael Butler, and James M. Piret “Fed-batch optimization using DOE and a 24-well arrayed bioreactor system increased t-PA production to > 2.5 g/L” Cell Culture Engineering XII Conference Banff, Alberta 2010

Spearman, M., Sunley,K., Tharmalingam T., Rodriguez,J and Butler,M “Strategies for enhanced productivity of a hydrophobic recombinant protein” Cell Culture Engineering XII Conference Banff, Alberta 2010

Graham A. Ferrier, Marija Nikolic-Jaric, Szymon Rzeszowski, Tim Cabel, Saravanan Nandagopal, Francis Lin, Michael Butler, Greg E. Bridges, Douglas J. Thomson and Mark R. Freeman “Dielectrophoretic pressing of biological cells into contact with surfaces: a mechanism for biophysical flow cytometry” 14th International Conference on Miniaturized Systems for Chemistry and Life Sciences, Netherlands 2010

Kunkel J.P., Jan D.C.H., Yan W.Y., Butler M. and Jamieson J.C.”An optimal dissolved oxygen concentration for maximum galactose content in the Fc N-linked glycans of a monoclonal antibody.” American Association of Pharmaceutical Scientists National Biotechnology Conference, Seattle (2009).

Murrell, S. and Butler, M. “High yields of Vero cells in serum-free media as a basis for dengue virus vaccine production. NSERC Undergraduate Poster Competition. Manitoba 2008.

Romanuik, S.F.,Ferrier, G.A., Thomson, D.J., Bridges, G.E., Sunley, K., Butler, M., Pu, A., Olson, S. and Freeman, M.R. “Characterizing the Manipulation and Detection of Single Biological Cells” CMC Microsystems 2008 Annual Symposium, Ottawa, 2008

Tharmalingam, T.Sunley, K. and Butler,M. Interferon-beta, for the treatment of multiple sclerosis, produced in high yields from macroporous microcarrier cultures under hypothermic conditions. Stem Cells from embryos to ethics. Health research Forum. University of Manitoba, 2008.

Sunley, K., Tharmalingam, T and Butler, M. In situ Imaging of Mammalian Cells within Macroporous Microcarriers. Focus on Microscopy Conference, Osaka-Awaji, Japan 2008

Tharmalingam, T.Sunley, K. and Butler,M. High yields of monomeric recombinant beta-interferon from macroporous microcarrier cultures under hypothermic conditions. Cell Culture Engineering XI Conference, Queensland, Australia 2008.

Rodriguez, J., Spearman, M., Huzel, N., Sunley, K. and Butler, M. Reduced β -interferon aggregation under low temperature conditions in CHO batch and perfusion culture systems. Cell Culture Engineering XI Conference, Queensland, Australia 2008.

Wu S-C, Liu C-C, Lee S-C, Butler M and Lai, C-J. High Genetic Stability of Dengue Virus Propagated in MRC-5

Cells as Compared to the Virus Propagated in Vero Cells. Cell Culture Engineering XI Conference, Queensland, Australia 2008.

Tharmalingam, T., Ghebeh, H., Wuerz, T and Butler, M. Pluronic enhances the robustness and reduces the cell attachment of mammalian cells. Protein expression in Animal cells 8th Meeting 2007

Wu S-C, Liu, C-C, Butler, M. and Lian, W-C. . A comparison of virus propagation, inactivation, and immunogenicity of three enterovirus-71 strains produced in serum-free microcarrier Vero cell culture. Cell Culture Engineering X Conference, Whistler, Canada 2006.

Spearman, M., Rodriguez, J., Huzel, N., Steinfeld, C. and Butler, M. The heterogeneity of glycosylation of human recombinant beta-interferon produced from a transfected CHO cell line is insensitive to culture perturbations. Cell Culture Engineering X Conference, Whistler, Canada 2006.

Tharmalingam T., Spearman, M. and Butler M Enhanced production of recombinant proteins by high density cell entrapment in microcarriers. Cell Culture Engineering X Conference, Whistler, Canada 2006.

Kunkel J.P., Jan D.C.H., Yan W.Y., Butler M. and Jamieson J.C. An Optimum Dissolved Oxygen Concentration for Maximum Galactosylation of Monoclonal Antibody N-Linked Glycans in Serum-Free Continuous Culture, Unattributable to Altered Galactosyltransferase Activity Can Soc Chem Eng 55th Meeting 2005

Tharmalingam T. and Butler M. Enhanced Production of Recombinant Proteins through Growth of CHO Cells in Microcarrier Cultures Can Soc Chem Eng 55th Meeting 2005

Sunley K. and Butler M. Exposure of CHO Cells to Hypothermic Growth Conditions Increases Recombinant Protein Production and Decreases Protein Aggregation Can Soc Chem Eng 55th Meeting 2005

Spearman, M, Rodriguez, J Huzel, N Sunley, K and Butler, M “Enhanced productivity of a recombinant protein with consistent glycosylation by the control of culture conditions” Protein expression in Animal cells 7th Meeting 2005.

Spearman, M., Rodriguez, J. Huzel, N., Sunley, K. and Butler, M. Effect of Culture Conditions on Glycosylation of Recombinant beta-Interferon in CHO Cells. European Society for Animal Cell Technology Meeting, Harrogate, UK 2005

Spearman, MA, Rodriguez, J., Huzel, N and Butler, M Production and glycosylation of recombinant beta-interferon in suspension and Cytopore microcarrier cultures of CHO cells. Can Soc Chem Eng 54th Meet 2004

Tharmalingam, T., Wuerz, T. and Butler, M.. Pluronic enhances the robustness of mammalian cells and reduces surface attachment. Can Soc Chem Eng 54th Meet 2004

Spearman, M., Rodriguez, J., Huzel, N. and Butler, M Production and glycosylation of recombinant beta-interferon in suspension and Cytopore microcarrier cultures of CHO cells Cell Culture Engineering IX Conference, Cancun, Mexico, 2004.

Rodriguez, J., Spearman, M., Huzel, N. and Butler, M. The effect of media additives and dissolved oxygen on human beta interferon (h-b-ifu) expression and production. Cell Culture Engineering IX Conference, Cancun, Mexico, 2004.

Butler, M., Huzel, N. and Burgener, A. Growth factor requirements for specific animal cell lines and the impact of media formulation on cell culture systems. IBC Conference “Cell culture and upstream processing” San Diego, 2003

Burgener, A., Coombs, K. and Butler, M. The significance of intracellular [ATP] to reovirus production. “Protein Expression in Animal Cells (6th PEACe)” , Quebec, Canada 2003.

Rodriguez, J., Huzel, N., Spearman, M., Penner, T. and Butler, M. The effect of media additives on mammalian cell proliferation, glycoprotein expression, stability and glycosylation. Can Soc Chem Eng 53rd Meet 2003

Kunkel, J.P., Yan, W.Y., Butler, M. and Jamieson, J.C. Decreased monoclonal IgG1 galactosylation at reduced dissolved oxygen concentration is not a result of lowered galactosyltransferase activity *in vitro*. Glycobiology 13: 875 (2003)

Ethier, M., Saba, J.A., Spearman, M., Krokhin, O., Butler, M., Ens, W., Standing, K.G. and Perrault, H. Towards high-throughput glycomics: Development of the StrOligo program for automated analysis of N-linked glycans MS/MS spectra for structure determination. American Soc Mass Spectrometry 51st Meet 2003

Butler, M., Huzel, N., Yang, M., Restelli, V and Kunkel, J.P. Protein glycosylation is controlled by cell culture conditions. American Chemical Soc 225th Meet 2003

Butler, M., Huzel, N., Yang, M., Kunkel, J.P. and Restelli, V. Culture parameters that cause perturbations in the glycosylation of proteins secreted by mammalian cells. Can Soc Chem Eng 52nd Meet 2002

Rudd, P.M., Butler, M., Wilson, I.A., Jaeken, J. and Dwek, R.A. Roles for glycosylation in the immune system. Glycobiology (2001) 11: abstract 10

Saba, J.A., Kunkel, J.P., Jan, D.C.H., Ens, W.E., Standing, K.G., Butler, M., Jamieson, J.C. and Perreault, H. A Study of IgG Glycosylation in a Monoclonal Antibody by Electrospray and Matrix-Assisted Laser Desorption/Ionization Mass Spectrometry. Glycobiology (2001) 11 (10) 931-931.

Kunkel, J.P., Jan, D.C.H., Butler, M. and Jamieson, J.C. Comparisons of the glycosylation of a monoclonal antibody produced under nominally identical steady-state conditions in two different bioreactors. Univ. Manitoba Science and Engineering Showcase 2001.

Butler, M.; Berry, J.M.; Burgener, A.; Patrick, M.; Coombs, K. 2000. Production of reovirus from microcarrier cultures of Vero cells.. *Abstracts of papers of the American Chemical Society* 219: U176-U176, Part 1.

Butler, M., Burgener, A., Huzel, N., Patrick, M., Moffatt, D. and Coombs, K. Reovirus production from microcarrier cultures of Vero cells grown in serum-free medium. Can Soc. Microbiol. Winnipeg, June 2000.

Wang, M.D., Restelli, V. and Butler, M. Effects of dissolved oxygen on metabolism and productivity of a HuEPO-producing CHO cell line in bioreactors. Can Soc. Microbiol. Winnipeg, June 2000.

Ghebeh, H. and Butler, M. Protective effect of Pluronic F68 on CHO cells in a bubble-free culture environment. Can Soc. Microbiol. Winnipeg, June 2000.

Yang, M. and Butler, M. Ammonia affects Chinese hamster ovary cell growth, erythropoietin production and glycosylation. Can Soc. Microbiol. Winnipeg, June 2000.

Yang, M. and Butler, M. Analysis of the oligosaccharide structure of human erythropoietin in normal and ammonia-loaded cultures. Cell Culture Engineering VII Engineering Foundation Conference, Santa Fe USA, 2000.

Butler, M., Huzel, N., Barnabe, N., Berry, M., Burgener, A., Moffatt, D., Patrick, M. and Coombs, K. Applications of a serum-free media developed for the growth of Vero cells. Cell Culture Engineering VII Engineering Foundation Conference, Santa Fe USA, 2000.

Kunkel, J.P., Jan, D.C.H., Butler, M. and Jamieson, J.C. 1999. Comparisons of the glycosylation of a monoclonal antibody produced under nominally identical steady-state conditions in two different bioreactors. Glycobiology 9 (10): 1131-1131.

Butler, M., Kunkel, J.P., Jan, D.I.C., Huzel, N., Jamieson, J.C. The glycosylation of immunoglobulin IgG in bioreactors 8th Int. Conf. Modern Biotechnology, Havana Cuba December 1999

Yang, M. and Butler, M. 1999 The effect of ammonia on the glycosylation of erythropoietin in CHO cell culture. *Glycobiology* 9 (10): 1122-1122.

Butler, M. Kunkel, J.P., Jan, D.I.C., Huzel, N., Jamieson, J.C. Factors that may affect the glycosylation of an immunoglobulin (IgG). Canadian Federation of Biological Societies, Winnipeg, June 1999.

Kunkel, J.P., Butler, M. and Jamieson, J.C. 1998. Does dissolved oxygen concentration in cell culture affect IgG glycosylation by influencing the timing and rate of interchain disulfide bond formation?. *Glycobiology* 8(11): 1139-1139.

Kunkel, J.P., Jan, D.I.C., Jamieson, J.C. and Butler, M. 1998. The dissolved oxygen in a culture affects the glycosylation of a monoclonal antibody. GlycoBiotechnology Symposium, Braunschweig, Germany

Butler, M. Glycosylation: an important process during protein secretion in mammalian cell culture systems. Colloquium for Bioprocess Engineering, Birmingham, UK 1998

Butler, M. Fatty acids enhance the robustness of mammalian cells in agitated cultures. Cell Culture Engineering VI Engineering Foundation Conference, San Diego USA, 1998.

Butler, M.; Jan, DCH; Huzel, N; Kunkel, JP; Jamieson, JC. 1998. Hybridomas grown at various levels of dissolved oxygen show altered metabolic profiles and antibody glycosylation.. *Abstracts of papers of the American Chemical Society* 216: U258-U258, Part 1.

Kunkel, J.P., Jan, D.I.C., Jamieson, J.C. and Butler, M. 1997. Dissolved oxygen concentration in serum-free continuous culture affects N-linked glycosylation of a monoclonal antibody: 25th Conf. Soc. for Glycobiology, Long Beach, California, USA

Kunkel, J.P., Jamieson, J.C., Jan, D.I.C. and Butler, M. 1997. Varying dissolved oxygen concentration in continuous culture affects glycosylation of a monoclonal antibody: Determination by HPAEC-PAD and FACE. Can Chem. Soc. (Toronto).

Butler, M. and Huzel, N. 1995. Fatty acids enhance antibody yields and perturb the energy metabolism of a hybridoma grown in serum-free media. A.I.Ch.E. (Florida).

Barnabe, N. and Butler, M. 1993. The effect of thymidine on the growth, productivity and intracellular energy charge of a murine hybridoma. Can. Soc. Microbiol/ Soc. Industrial Microbiol. (Toronto).

Petch, D., Jan, D. and Butler, M. 1993. The metabolic profile of a murine hybridoma grown in serum-free medium at various oxygen concentrations. Can. Soc. Microbiol/ Soc. Industrial Microbiol. (Toronto).

Jenkins, H.A., Bate, A., Butler, M. and Dickson, A.J. 1993. Immunoglobulin gene expression in two related murine hybridomas. European Congress on Biotechnology (Florence).

Butler, M. and Beddows, S. 1992. The effect of culture factors on the rate of cell death of a murine B-cell hybridoma. Abstract for Fed. Eur. Biochem. Soc. Meeting, Dublin.

Jenkins, H., L. Fitzpatrick, C.A. Smith, M. Dawson, and M. Butler. 1989. "Glutamine metabolism in hybridomas." Abstract for Fed. Eur. Biochem. Soc. Meeting, Rome.

Cole, C.R., Smith, C.A. and M. Butler. 1989. "Activities of glycosyltransferase enzymes in hybridomas." Abstract for Fed. Eur. Biochem. Soc. Meeting, Rome.

Sayer, T.E., M. Butler, and A. Macleod. 1987. "The use of Cohn fraction IV-1 for *in vitro* culture of MDCK cells" Proc. 5th Annual Meeting of the British Blood Transfusion Society, Stirling.

Costello, M., M. Butler, D. Gordon, and I. Laing. 1987. "An enzyme-linked immunosorbent assay (ELISA) for anti-thyroxine (Anti-T₄) monoclonal antibody." Int. Symp. on the Clinical Applications of Monoclonal Antibodies, Surrey.

Darbre, A., M. Butler, and H.R.V. Arnstein. 1974. Amino acids attached to transfer ribonucleic acid determined by means of gas-liquid chromatography. Abstr. Fed. Eur. Biochem. Soc. 9: 443.