

Vijay Raghavendran

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I am a microbial physiologist with a background in bio/chemical engineering with significant research experience. I have an excellent knowledge of fermentation physiology that enabled me to contribute significantly towards improving the first-generation, and second-generation bioethanol processes. I have employed process and metabolic engineering, in conjunction with omics studies to improve the product titres and performance of industrial strains. I have used batch, fed-batch and chemostat cultivation (2-20L bioreactors) to produce biofuels and biopolymers (PHAs, Xanthan, Gellan) using a variety of substrates. I have also developed scaled-down protocols and analytical procedures to accurately mimic industrial processes in the laboratory.

Education

- PhD in Microbial Biotechnology (2001-2005); Technical University of Denmark
- MRes in Biochemical Engineering and Biotechnology (1997-1999); Indian Institute of Technology
- BEng in Chemical Engineering (1993-1997), National Institute of Technology, India

Work/Research experience

Jan 2018 – July 2020 – University of Sheffield – Postdoctoral Research Associate

- Successfully completed a £1m UKRI funded project; carried out **fed-batch fermentation** in a 2L bioreactor with regular and microbubble gassing (N₂ or O₂) to study the effects of **improved mass transfer rates** on the performance of industrial yeasts using a variety of analytical techniques, using a rich medium
- Worked in close collaboration with **Perlemax Ltd**, to implement the **SOP** from a commercial ethanol producer; submitted the work of the manuscript to 'Biotechnology for Biofuels'
- Won BBSRC **funding** (£35K) to test a hypothesis of industrial relevance during yeast fermentation using a cell biological approach; manuscript is written and is ready for submission
- Engaged in a literature review of bacterial cellulose, a versatile biomaterial with diverse applications, as part of the **EU funded POLYBIOSKIN** project
- Engaged in **teaching** (lectures, tutorials), and project supervision of BSc, MSc, and PhD students at the Department of Molecular Biology and Biotechnology; **awarded** a Fellow of the Higher Education Academy (FHEA) in recognition of my contribution towards teaching and learning
- Initiated **collaboration** Bangladesh and Sheffield to address a societal problem emerging from improper disposal of wastewater
- Initiated **cross-disciplinary** collaboration between materials science and molecular biology departments to produce bacterial biopolymers from waste materials
- Delivered **Pint of Science** talk, Pride in Stem talk and an outreach talk for Y12/13 students
- Participated in several departmental **open days** and demonstrated the operation of a bioreactor to prospective students as well as the 17 sustainable development goals listed by the UN
- Delivered an **oral and a poster presentation** of the results from the project in an international yeast conference in Milan (2019)

Nov 2016 - Dec 2017 – Chalmers University of Technology, Sweden – Postdoctoral Research Associate

- Successfully completed a Swedish Energy Agency funded project on batch and hybrid organosolv (OS) pretreatment; assessed the hydrolysability using **commercial enzymes** and fermentability of the released sugars using industrial yeasts for ethanol production in **shake flasks**; worked in close **collaboration** with our partners from Lulea university of Technology with careful planning, maintaining a good lab journal and attention to detail for reproducibility
- Successfully completed a **government funded** project on **engineering yeast cells** with increased **antioxidant** (glutathione) content; **evaluated** the engineered yeast strains for fitness in simultaneous saccharification and fermentation at high solids loadings in a **small-scale laboratory set-up**; **measured** glutathione levels of the recombinants using a fine-tuned **microtitre** assay; required close collaboration with a researcher from Germany who constructed the strains and was previously involved with the project
- Successfully published **three** research papers in peer reviewed biotechnology journals, and a **fourth** one is ready to be submitted
- Delivered a **poster presentation** of the results from the two projects in the **international bioethanol** conference in Brazil (2017)
- **Supervised** four BEng projects and did an outreach talk for high school students
- Part of the **team** that **won** the best **presentation skills** in the end of year research group meeting

Nov 2014 - Oct 2016 – The State University of Campinas, Brazil – Postdoctoral Research Associate

- **Developed** a protocol to mimic the industrial Brazilian sugarcane ethanol process in the laboratory; the protocol is now published in a peer reviewed journal
- **Characterised** the physiology of industrial yeast strains in complex medium and in mineral medium
- **Supervised** BEng and PhD students and did an outreach talk for high school students
- **Delivered** a poster presentation of the results from the projects in an international yeast conference in Portugal (2017)

Aug 2006 - Oct 2014 – Brockwood Park School, UK – Teacher of Chemistry

- **Prepared students for A-level chemistry** exams conducted by the UK board of examination (100% pass rate with a median grade of B); some of my students went to study engineering, medicine and dentistry and entrepreneurial training

Dec 2005 – July 2006 – University of Pennsylvania, USA – Postdoctoral Research Associate

- **Investigated the role of mammalian** equivalent of a key yeast protein involved in respiration, under hypoxic conditions using a mouse neuronal stem cells; **subcellular fractionation** was carried out to isolate the nuclear and cytoplasmic proteins and to quantify them using **immuno-Western blotting**
- Isolated the **mitochondria** from various brain fractions of Parkinson's tissue donors, and investigated the mitochondrial activity using a variety of **biochemical assays**; the research paper published in 'Journal of Biological Chemistry' is the highest cited paper in my list of publications

May 2001 - Apr 2002 – Technical University of Denmark, Denmark – Research Assistant

- Extensive measurement of the **yeast redox cofactors NADH and NAD** were done on yeasts deficient in redox metabolism to understand cofactor recycling. Glucose repression mutants were cultivated using **¹³C labelled glucose** in **bespoke batch bioreactors** to study the central carbon metabolism; the research findings were published in the 'Metabolic Engineering' journal and is the second most cited paper in my list of publications

Nov1999 - Apr 2001 – Birla Institute of Scientific Research, India – Junior Research Scientist

- Renewable carbon source (**molasses**) was used in a **fed-batch/intermittent batch** process to improve the productivity of the biopolymer **gellan**. Gellan produced was tested for its efficacy as a gelling agent in **plant tissue culture**

Teaching & Students' Supervision

- 2019** - **Supervised** a **B.Sc. student** who assessed the performance of yeast strains overexpressing the oleate biosynthetic gene, The University of Sheffield, U.K.
- **Supervised three M.Sc.** students who assessed the ethanol production capabilities of industrial yeast strains engineered for improved viability using the mimicked Brazilian ethanol process, The University of Sheffield, U.K.
- **Second examiner** for three MSc students that involved marking, moderating, and conducting the viva voce, The University of Sheffield, U.K.
- **Co-taught** the module MBB 303/603 'Cell as Factories' for third-year B.Sc. and M.Sc. students (a total of 50 students) including assessment, The University of Sheffield, U.K.
- 2018** - **Co-taught** the module MBB 303/603 'Cell as Factories' for third-year B.Sc. and M.Sc. students (a total of 50 students) including assessment, The University of Sheffield, U.K.
- **Assessed 12 group** (30 students, 6 groups) presentations for first- and second-year B.Sc. students, The University of Sheffield, U.K.
- **Conducted** the 'Maths for biologists' **tutorial** consisting of 12 students, The University of Sheffield, U.K.
- 2017** - **Supervised** four bachelor's students in biotechnology (Chalmers University of Technology, Göteborg, Sweden), five months' project supervision: 'Evolve or perish: A hot tale of yeast upon ALE (Adaptive Laboratory Evolution)'
- 2016** - **Supervised** Ms Laura Meirelles, B.Sc. student (Faculty of Food Engineering, University of Campinas, Brazil), nine months' supervision: 'To develop a cost-effective system for high throughput anaerobic cultivations'
- **Delivered** three Ph.D. lectures (Introduction to Bio-refinery, Mass and energy balances and Sustainable chemicals from microbial cell factories) in the bio-energy programme, at the University of Campinas, Brazil, including assessment
- 2015** - **Delivered** a lecture, in an undergraduate course on industrial chemistry, entitled 'Yeast-based cell factories at University of São Paulo, Brazil'
- 2015** - Delivered a guest lecture at the Department of Nanotechnology, Sri Ramakrishna Engineering College, Coimbatore, India on 'Bio-based production of fuels and chemicals from yeast-based bio-refineries'
- 2009** - **Taught** Microsoft Excel to school administration employees, Brockwood Park School, U.K.
- 2006 – 2014** AS and A-level chemistry including coursework, Brockwood Park School, Bramdean, U.K.

- 2004** **Taught** undergraduate students in a three weeks' lab course on 'Fermentation technology', at DTU, Denmark
- 2003** **Supervised** Mr Jacinto Sarmentero Estrada, M.sc. student (Erasmus student from Spain), 20-point project: 'Over-expression of hexose transporters in *Saccharomyces cerevisiae* for improved xylose transport', DTU, Denmark
- 2002** **Supervised** Mr Eric Bonaccorsi, PhD student, University of São Paulo, Brazil - Three-month supervision: 'Metabolic network analysis of *Trichoderma reesei*', DTU, Denmark
- 2000** **Supervision** of three summer training students at BISR, Jaipur, India, on 'Gellan production from *Sphingomonas paucimobilis*'
- 1998** Teaching Assistant in the fermentation laboratory course at IIT New Delhi, India

Honours and Awards

- 2019 GCRF pump priming grant £7K (co-investigator; 25% contribution) to reduce water pollution from rice processing industries in Bangladesh (The University of Sheffield)
- 2019 **Awarded** Innovation and Knowledge Exchange funding (The University of Sheffield) of £35K to investigate the role of organelles during alcoholic fermentation
- 2016 **Awarded** travel grant worth 3000 USD by FAPESP and The Biochemical Society, to attend the Physiology of yeasts and filamentous fungi conference in Lisbon, Portugal
- 2014 *Programa Nacional de Pós Doutorado (PNPD) - Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES)* Scholarship for Postdoctoral Research in Brazil
- 2004 Awarded travel grant from the Genetics Society of America and the Otto Mønstedts Fond, Denmark, to attend the Yeast Genetics Meeting at Seattle, U.S.A.
- 1997 Awarded GATE Scholarship for the master's studies
- 1997 Ranked third in a class of 32 students in B.Eng.
- 1997 Awarded Best B.E. final year project
- 1993 Obtained Merit Scholarship in the 1st and 2nd semester in BEng

Peer-reviewed publications

- 17 **Raghavendran V**, Marx C, Olsson L, Bettiga M. The protective role of intracellular glutathione in *Saccharomyces cerevisiae* during lignocellulosic ethanol fermentation. (2020) To be submitted to *AMB Express*
- 16 **Raghavendran V**, Asare E, Roy, I. Bacterial cellulose: biosynthesis, production, and applications. (2020) *Advances in Microbial Physiology*
- 15 **Raghavendran V**, Webb JP, Carton ML, Springthorpe V, Larson TR, Hines M, Mohammad H, Zimmerman WB, Poole RK, Green J. A microbubble-sparged yeast propagation-fermentation process for bioethanol production. (2020) *Biotechnology for Biofuels*
- 14 Bermejo PM, **Raghavendran V**, Gombert AK. Neither 1 G nor 2 G fuel ethanol: setting the ground for a sugarcane-based biorefinery using an iSUCCELL yeast platform. (2020) *FEMS Yeast Research*
- 13 da Costa BLV, **Raghavendran V**, Franco LFM, Chaves Filho AB, Yoshinaga MY, Miyamoto S, Basso TO, Gombert AK. Forever panting and forever growing: physiology of *Saccharomyces cerevisiae* at extremely low oxygen availability in the absence of ergosterol and unsaturated fatty acids. (2019) *FEMS Yeast Research*
- 12 Matsakas L, **Raghavendran V**, Yakimenko O, Persson G, Olsson E, Rova U, Olsson L, Christakopoulos P. (2018) *Bioresource Technology*
- 11 **Raghavendran V**, Nitsos C, Matsakas L, Rova U, Christakopoulos P, Olsson L. A comparative study of the enzymatic hydrolysis of batch organosolv pretreated birch and spruce biomass. (2018) *AMB Express*
- 10 Matsakas L, Nitsos C, **Raghavendran V**, Yakimenko O, Persson G, Olsson E, Rova U, Olsson L, Christakopoulos P. A novel hybrid organosolv: steam explosion method for the

- efficient fractionation and pretreatment of birch biomass. (2018) *Biotechnology for biofuels*
- 9 da Costa BLV, Basso TO, **Raghavendran V**, Gombert AK. Anaerobiosis revisited: the growth of *Saccharomyces cerevisiae* under extremely low oxygen availability. (2018) *Applied microbiology and biotechnology*
- 8 **Raghavendran V**, Olavarria K, Gombert AK. Elucidating the Importance of Numeracy Skills for Undergraduate Students in Life Sciences Using the Oxygen Requirement in Yeast as an Example. (2018) Preprints- repository; non-peer reviewed
- 7 **Raghavendran V**, Basso TP, da Silva JB, Basso LC, Gombert AK. A simple scaled down system to mimic the industrial production of first-generation fuel ethanol in Brazil. (2017) *Antonie Van Leeuwenhoek*
- 6 Marques WL, **Raghavendran V**, Stambuk BU, Gombert AK. Sucrose and *Saccharomyces cerevisiae*: a relationship most sweet. (2016) *FEMS Yeast Research*
- 5 Devi L, **Raghavendran V**, Prabhu BM, Avadhani NG, Anandatheerthavarada HK. Mitochondrial import and accumulation of alpha-synuclein impair complex I in human dopaminergic neuronal cultures and Parkinson disease brain. (2008) *Journal of Biological Chemistry*
- 4 **Raghevendran V**, Patil KR, Olsson L, Nielsen J. Hap4 is not essential for activation of respiration at low specific growth rates in *Saccharomyces cerevisiae*. (2006) *Journal of Biological Chemistry*
- 3 **Raghevendran V**, Nielsen J, Olsson L. Teaching microbial physiology using glucose repression phenomenon in baker's yeast as an example. (2005) *Biochemistry and Molecular Biology Education*
- 2 **Raghevendran V**, Gombert AK, Christensen B, Kötter P, Nielsen J. Phenotypic characterisation of glucose repression mutants of *Saccharomyces cerevisiae* using experiments with ¹³C labelled glucose. (2004) *Yeast*
- 1 dos Santos, MM, **Raghevendran V**, Kötter P, Olsson L, Nielsen J. Manipulation of malic enzyme in *Saccharomyces cerevisiae* for increasing NADPH availability aerobically on different cellular compartments. (2004) *Metabolic engineering*

Conference & Meetings attended

- 2019 - **Delivered at talk** to undergraduate students in life sciences in **India**
 - Physiology of yeasts and filamentous fungi, 24 – 27 June, Milan, **Italy**
Poster presentation
 - The protective role of glutathione has an upper limit during lignocellulosic ethanol fermentation (main author)
Oral presentation
 - Yeast propagation using microbubbles for sustainable bioethanol production (main author)
 - **Delivered** a talk in Prof. Kristala Prather's group at Department of Chemical Engineering, M.I.T. on 28 Mar, Cambridge, **U.S.A.**
 - Visited Harvard, Cornell and MIT to network with educators on 'Active Learning'. 25-29 Mar, **U.S.A.**
 - **Participant** in the 'Teaching and Learning' conference, 8 Jan, Sheffield **U.K.**
 - **Delivered** a talk at 'Tupton School' on 'Unlocking the carbon treasure held within plants through industrial biotechnology', 14 Mar, Sheffield, U.K.
- 2018 - **Delivered** a talk at 'Out Thinkers', a STEM Pride event organised by LGBTQ+ society on 'Ethanol production from woody biomass', 16 Nov, Sheffield, **U.K.**
 - International Specialized Symposium on Yeasts, ISSY34, Sep 30 – Oct 6, Bariloche, **Argentina**
Poster presentations

- Engineering of a yeast chassis for a 1.5G fuel ethanol bio-refinery. (co-author)
- Noxious anoxia: how is yeast physiology and fitness impacted by severe oxygen limitation? (co-author)
- *Jornadas Sudamericanas de Biología y Biotecnología de Levaduras*, Bariloche, **Argentina**
- Poster presentation**
- Engineering of a yeast chassis for a 1.5G fuel ethanol bio-refinery. (co-author)
- **Delivered** a ‘Pint of Science’ talk on ‘A paradigm shift in the production of ethanol from woody biomass’, 16 May, The Sentinel Brewery, Sheffield, **U.K.**
- 2017 - **Participant** in the 6th Development Conference for Swedish Engineering Education. Sustainable Engineering Education – Quality in the long run, 22 – 23 Nov, Göteborg, **Sweden**
- Brazilian Bioethanol Science and Technology, 16 – 19 Oct, Campos do Jordão, **Brazil**
- Poster presentation**
- Organosolv pretreatment produces an inhibitor-free hydrolysate with superior fermentability at high-solids loadings (main author)
- Altered lipid composition during growth of yeast under extremely low dissolved O₂ concentrations (co-author)
- Science & Technology Day, 18 May, Göteborg, **Sweden**
- Poster presentation**
- Organosolv biomass pretreatment for fuel production
- **Delivered** a talk to high school students in Trollhättan, **Sweden** focusing on my research career
- SINAFERM, 3 – 6 Sep, Aracaju, **Brazil**
- Poster presentation**
- The impact of oxygen availability on yeast physiology and lipid cellular composition (co-author)
- How anaerobic really are our anaerobic cultivations (co-author)
- 2016 - Physiology of yeasts and filamentous fungi, 11-14 July, Lisbon, **Portugal**
- Poster presentations**
- Anaerobiosis revisited: Is the use of norprene tubing, butyl rubber stoppers and flushing with N₂ sufficient to ensure anaerobic conditions? (main author)
- The impact of oxygen availability on yeast physiology and nutritional requirements (co-author)
- XXIV Congress of undergraduate students, 19 – 21 Oct, Campinas, **Brazil**
- Poster presentation**
- Validation of a small scale and a low-cost anaerobic system for microbial applications (co-author)
- 2015 - FAPESP Week: UC Davis in Brazil workshop, May 12 – 13, São Paulo, **Brazil**
- Production of advanced biofuels from sugarcane-derived biomass organised by the University of Bath and University of Campinas, Mar 31 – 1 Apr, Campinas, **Brazil**
- 2013 - When is Teaching? Getting in or out of the way at the right time Aug 16 – 18, Brockwood Park School, Bramdean, U.K.
- 2012 - Educating the educator. 15 – 30 Aug, Brockwood Park School, Bramdean, **U.K.**
- 2004 -Mini-symposium on Biofilms, 17 Dec, DTU, Lyngby, Denmark
- Yeast Genetics and Molecular Biology meeting, 27 July – 1 Aug, Seattle, **U.S.A.**
- Poster Presentation**
- Physiological studies of *Saccharomyces cerevisiae* strains deficient in glucose sensing and mitochondrial respiration
- Physiology of Yeasts and Filamentous Fungi, Mar 24 – 28, Anglet, **France**
- 2003 - Collaboration, Learning and Project Management (CLP) workshop, 29 Oct, Aalborg, Denmark

- Workshop on curriculum development, Oct 9 – 10, DTU, Lyngby, **Denmark**
- 2002 - The NORFA Network Meeting, Oct 24 – 26, Sigtuna, Sweden
 - Poster Presentation**
 - Use of labelling experiments in the phenotypic characterisation of glucose de-repressed mutants of *Saccharomyces cerevisiae*
 - Functional Genomics Conference, May 23 – 24, Vejle, **Denmark**
 - Biofilm Workshop, Centre for Microbiology, Biocentrum-DTU, Apr 2 – 6, Lyngby, Denmark
- 2001 - Physiology of Yeasts and Filamentous Fungi, Middelfart, **Denmark**
- 2000 - 41st Association of Microbiologists of India meeting, 24 – 27 Nov, Jaipur, India
 - Poster presentation**
 - Optimisation of gellan (an exopolysaccharide) production in *Sphingomonas paucimobilis*
- 1998 Biotechcellence, Feb xx, Chennai, **India**
 - Oral presentation**
 - Bioplastics: Polyhydroxyalkanoates from inexpensive substrates

Professional Membership

- 2019 Fellow of Higher Education Academy (FHEA), U.K.

Additional Skills/responsibilities held

- Excellent organisational skills, including secondary school administration and public events coordination; - Part of the postdoctoral researchers committee at The University of Sheffield, U.K. where I organise seminars for postdoctoral fellows
- Maintain a blog (www.vijayraghavendran.wordpress.com) and a YouTube channel (www.youtube.com/user/vijayraghavendran) which include scientific articles and videos on chemistry, mathematics, Microsoft Excel, and Google spreadsheets
- Part of the organising committee of: 41st Association of Microbiologists of India (~ 1000 attendees); Brockwood Park Reunion (2009, 2014; ~ 400 attendees)
- Screencasting and editing of videos with Microsoft OneNote and Camtasia Studio