Keble Research

Report 2019-20

August 2021

Introduction

This report summarises the research activities supported by Keble College's Research Committee in academic year 2019-20. Its publication has been delayed by a year as a result of the challenges and distractions of the Covid-19 pandemic. One of the consequences of the pandemic was that may activities had to be cancelled or postponed, and a number of our research visitors were unable to come to Oxford.

The College has dedicated funding of up to £100,000 a year to support the research activities of its Fellows and, in particular, to encourage innovative and inter-disciplinary exchanges. Oxford colleges are the ideal environments in which to cultivate the flow of ideas across often long-established academic boundaries.

We support research through three main schemes or programmes:

- Senior Research Visitors (and Collaborating Research Scholars), who are academics of high standing, generally from outside the UK. They may visit for periods of up to six weeks (occasionally longer), receiving free accommodation and dining rights as members of the Senior Common Room. There was only one visitor in 2019-20.
- Research Associates, who are generally post-doctoral researchers at the University who would not otherwise have a college association. Associates may be nominated as members of the Senior Common room for up to three years. In 2019-20 there were 14 associates, including researchers in Theology, Geography, Mathematics, and Engineering.
- Small Research Grants, sums of around £2000 (sometimes more) to support Fellows in their research activities, for example organising conferences and symposia or helping complete a book project with editorial assistance. In 2019-20 grants of just under £9,000 were made.

There is also the option of bundling together nominations for Research Visitors, Research Associates and applications for research grants into coherent Projects which may develop a theme or collaboration over periods longer than just a single year.

The allocation of research support is agreed by Governing Body on the recommendations of its Research Committee, chaired by the Sub-Warden, Professor Stephen Payne.

In 2018-19 the new H B Allen Centre came into operation. Under the coordination of the Centre's Academic Director, Dr Ian Archer, the College is keen to create closer links between the graduate community (now enlarged to almost 400) and the research activities it supports. This is made more possible by the provision of dedicated accommodation in the Centre for research visitors and the creation of a 'research hotel' for shorter stays by visiting academics.

Dr A P Rogers, Senior Tutor

Small Research Grant Reports

Research on Edward Lear
Professor Matthew Bevis

The trip to the US to visit the Lear archives at Yale and Harvard was a great success. I viewed around 2,000 Lear sketches and paintings, and forged key connections with archivists at both institutions. As a result of this trip, the exhibition on Lear is now going ahead next Autumn. *Edward Lear, Moment to Moment* will be the first exhibition solely devoted to Lear's sketches and landscape drawings from across the whole span of his career. It will take place at the internationally-acclaimed IKON Gallery in Birmingham (https://www.ikon-gallery.org), an educational charity that works to encourage public engagement with art. I will curate the show. Along with a substantial exhibition catalogue, the initiative will also feature educational and public events (symposia, interviews, school visits, talks and lectures, collaborations with other artists) along with a website and blog. IKON receives around 120,000 visitors each year; it is estimated that this show will attract around 30,000 visitors in the first instance, and there are also plans to tour it in America. I will also be putting in a bid for £100,000 to the AHRC follow-on grant scheme to support this work.

The Poet's Essay
Professor Matt Bevis

The Poet's Essay series with Adam Phillips has continued to be very successful this year. The summer term's event obviously had to be cancelled due to coronavirus, but the events in Michaelmas and Hilary went very well indeed. The series is free and open to all who wish to attend from inside and outside the university (it is widely advertised on Twitter, Facebook, as well as through University and NHS mailing lists). One of the especially pleasing things about the series, from my perspective, is that it continues to generate enthusiasm from a variety of different audiences. The interdisciplinary nature of the seminars means that discussion often reaches across traditional boundaries (literature, history, psychology, and philosophy) as well as building on recent developments in the medical humanities. Seminars are attended not only by university staff and students from different Faculties, but also by health professionals working in the NHS and private practice.

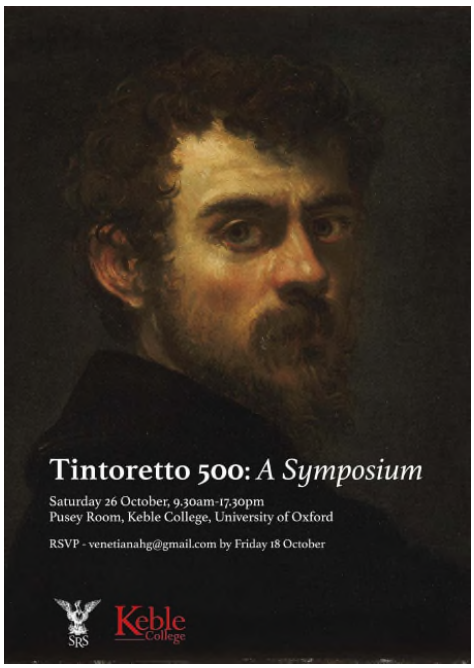
I'd like to take this opportunity to thank the college for supporting these initiatives. As well as helping to build links and communities, the projects have helped to further and develop my own research in vital ways.

Prandtl-Meyer Reflection Configurations, Transonic Shocks, and Free Boundary Problems

Professor Chen

As proposed, the grant has been used to pay the copyediting work that was carried out by Dr. Kurt Ballstadt on my Research Monograph entitled "Prandtl-Meyer Reflection Configurations, Transonic Shocks, and Free Boundary Problems" (joint with Myoungjean Bae and Mikhail Feldman). As a result, the monograph has been accepted and will be published by the American Mathematical Society in the series of "Memoirs of American Mathematical Society" either late this year or next year. The total page number in the form of submission is 224 pages, which could be longer, or so, in its final publication form.

Tintoretto 500: A Symposium
Marie-Louise Lillywhite



Our one-day History of Art symposium took place at Keble on 26/10/2019 and it was organised for two reasons: to mark the 500th anniversary of the birth of the painter Jacopo Tintoretto (1518/9-94), and to inaugurate a new UK-based Venetian Art History Group. Tintoretto was one of the greatest artists of the Italian Renaissance and his anniversary has been recognised internationally with the organization of major loan exhibitions of his paintings in Venice and the USA (New York and Washington DC). Rather than an exhibition, this event offered a sustained academic consideration of Tintoretto's work in its historical context, making an important academic contribution to the current wave of international response. It was the sole event of its kind to mark his quincentenary in the United Kingdom and was well attended my History of Art students (from Oxford and beyond) and academics of various career stages in the field of Renaissance Art History. One of the outcomes of this event is a co-edited volume by Giorgio Tagliaferro (Assistant Professor, University of Warwick), Tom Nichols (Reader, University of Glasgow) and I that will be published by Viella Press in 2021. A second is the successful launching of our Venetian Art History Group which has had a very encouraging response from Art Historians in the UK, USA and Europe.

The symposium featured papers by a carefully selected team of established and emerging Tintoretto scholars. They were asked to address a range of key topics in Tintoretto studies today, addressing questions around Tintoretto's artistic identity; working practice; use of drawing; work for the Venetian state; sacred painting; rivalry with other painters; and the transfer of his business to his talented painter-son, Domenico. The main aim of the symposium was to give an overview of the current state of play in Tintoretto studies in 2019. Papers spoke to a preselected and professionally engaged audience of art historians, museum curators and research students, many of whom already had a special interest in Venetian art history but might not necessarily have been abreast of the most recent developments in the scholarship. At the end of the day we had a roundtable event where we shared ideas for our group and how it might function in the future.

We were very grateful to be funded by Keble and for the help of the catering staff and the porters in ensuring that everything went smoothly. Alongside the Keble funds, we also received a grant from the Society for Renaissance Studies, and we have recently been awarded a publication subvention for our co-edited volume from the Gladys Krieble Delmas Foundation (they fund scholars working on anything Venetian). One of our aims in founding a Venetian Art History Group was to give a platform to doctoral students who often don't have the funds to attend some of the more expensive Art History conferences. The subject tends to be expensive one to study since it necessitates travel and also image rights in the event of publication (which can vary greatly in cost). In common with the humanities more generally, it isn't always particularly well-funded, and departments tend to be small, so we hope that providing a free research day will be useful for our younger colleagues as well as those on fixed term or precarious contracts. It also provides a wonderful opportunity for us to get together in person (in the future) to discuss the latest developments in the field, providing a complement to the Venetian History Group which usually takes place in Cambridge.

Keble Complexity Cluster Workshop Michaelmas 2019
Professors Helen Byrne, Gui-Qiang Chen, and Andras Juhasz

Continuing what constitutes by now a long-standing tradition in Keble's academic activities, December the 3rd saw the Michaelmas term 2019 Keble Complexity Cluster Workshop take place. Organised by Professors Helen Byrne, Gui-Qiang Chen, and Andras Juhasz, this rendition of the workshop included talks from Oxford graduate students as well as well-established mathematical scientists, both based at Oxford and visiting.

Professor Heather Harrington was the first speaker of the event, giving an introduction to algebraic systems biology. Signaling pathways describe molecular interactions which can be described as enzyme kinetics and may be assumed to follow mass-action kinetics. Such a mathematical model constitutes a polynomial dynamical system. First, a presentation was given on how to analyse these models with steady-state data using computational algebraic geometry and statistics. Then a presentation on the analysis of time-course data followed using differential algebra and geometry for model identifiability. Finally, there were remarks on how the parameter space of the model given the available data could be analysed using topological data analysis. This was joint work with L. Marsh, E. Dufresne, H. Byrne, and S. Shvartsman.

A related presentation, albeit of a more topological flavour, followed from doctoral student Agnese Barbensi. The topic was double branched covers of knotoids and entanglement in proteins. Knotoids are a generalisation of knots that deals with open curves. In the past few years, they have been extensively used to classify entanglement in proteins. Through a double branched cover

construction, a bijective correspondence was presented between knotoids and strongly invertible knots. The talk characterised forbidden moves between knotoids in terms of equivariant band attachments between strongly invertible knots and in terms of crossing changes between θ-curves. Finally, some applications to the study of proteins were presented. This was based on joint works with D. Buck, H.A. Harrington, M. Lackenby and D. Goundaroulis.

Shortly afterwards, Panayiotis Kevrekidis, a visiting professor from the University of Massachusetts, gave a talk on a topic that explored the dynamics of systems that exhibit self-similarity. The main perspective has been that of seeking to consider self-similarity as a bifurcation problem, whereby a frame exists (co-exploding with the solution), where the solution appears to be steady. Then, one can perform stability analysis and comprehend the dynamical features of the solution. This stability analysis also has some interesting implications, including the potential shift of eigenvalues that relate to symmetries. However, blow-up is also an interesting dynamical problem. One can envision case examples where the solution goes through infinity and emerges on the other side. The talk included a few select such examples to illustrate how to potentially compute with such equations both at the ODE level and at the PDE level. A number of open problem along these lines was highlighted both at the bifurcation level as well as the dynamical evolution level.

The fourth talk was given by William Hart, a graduate student. The title of the talk was "Mathematical modelling of infectious disease epidemics: from patient-level to population scale models". Mathematical models are increasingly used to predict the dynamics of infectious disease epidemics, both within each patient and at the population scale. When population scale models are used for epidemic forecasting, an unrealistic assumption is usually made that the infectious ness of each patient remains constant throughout the infectious period. A modelling framework was presented that has the potential to improve forecasts, by enabling patient-level dynamics to be nested within population-scale models. Applying the methods developed to transition from patient-level influenza A dynamics to population-scale predictions, the predictability of outbreaks in the context of limited and/or inaccurate patient-level data was explored.

For the grand finale, Professor David Gabai, visiting from Princeton University, gave a talk, explaining his early result on the existence of taut foliations on knot complements.

Events like the complexity cluster workshop enable the development of interdisciplinary ideas on a tangible and practical level, rather than merely a theoretical one. The interaction of people from various areas of the mathematical (and not only) sciences ultimately amounts to a broadening of everyone's scientific point of view. As a final remark, the Complexity Cluster Workshop event did not disappoint anyone that attended and its continued excellence as an event means that it has a promising future.

Keble College Research Committee Project Report (KSRG087)

Oxford Air Quality Meeting

Thanks to Research Committee's support, I held the first Oxford Air Quality Meeting on 10 January 2020 in the O'Reilly Theatre. The event's aim was to host a day-long meeting bringing together the experts in air quality measurement, Emissions formation, health impacts of air pollution, and air quality policy and to encourage them to interact and network. The event was free of cost to participants. Further details are given in the sub-sections below, but suffice it to say that the event:

- "sold-out",
- had 18 high-quality and high-profile speakers,
- attracted substantial external sponsorship,
- received overwhelmingly positive feedback,
- was attended by members of every part of the Keble community
- was a great success!

Attendees

The O'Reilly theatre "sold-out" for the event – with around 160 attendees. These were roughly equally spread between the four communities targeted: air quality measurement, combustion & emissions, health, and public policy. In addition a few interested members of the general public, and the Keble community attended.

Keble

Keble was an excellent venue to host the event. Given the diverse nature of the attendees having the "neutral territory" of a college, rather than a department, was extremely important. As a result a lot of interaction between otherwise siloed communities took place. As noted above, it was particularly pleasing to see members of the JCR, MCR, SCR, and college staff all attend the meeting. I am particularly grateful to Dr Archer for publicising the event to the MCR.

Agenda

The final agenda is attached to the end of this report. As you will see the event attracted 18 high-profile speakers, including from Public Health England, and DEFRA. In addition the UK Clean Air Champion gave the opening keynote. Transport for London gave one of their first public statements of the results of the London Ultra Low Emission Zone, implemented in April 2019, at the conference.

All of the presentations have been archived on a dedicated website (https://www.oaqm.org/2020-conference) to enable those not attending the meeting to see what was said, those presentations to be referenced, and to encourage delegates to look back at the meeting. It also provides a resource worldwide for those interested in Air Quality.

Feedback

A number of pieces of feedback have been received, both solicited and unsolicited. A "surveymonkey" survey was sent to all attendees, and 44 responses received. Overall no respondent rated the event less than good, and 90% very good or excellent. A number of practical pieces of feedback about the number of presentations and networking opportunities were also received. All respondents said that they hoped the event would be held next year. Outside of that, a number of people have said how good and necessary they thought the meeting was, in particular the UK Clean Air Champion, who was extremely positive, and I think the event helped put Oxford on the map in the Air Quality world, certainly in his eyes.

Outcomes

I said in my original application: "*A key measure of success would be if there were sufficient demand and interest to host the meeting again in 2021. Another, more importantly, would be if any tangible policy outcomes were achieved as a result of the interactions at the meeting.*"

Clearly the first of these has been achieved (see the feedback section above) with all respondents to the survey indicating that they would like the meeting hosted in 2021.

Knowing all of the outcomes from such a meeting is impossible, but I am aware of a number:

- Invitation for a speaker to report to the Public Health England Scientific Committee for the AQ Evidence Review
- Linked Global Action Plan with Oxfordshire County Council for forthcoming schools framework
- Linked Emissions Analytics with both Oxford City Council and Transport for London for new ways of enforcing Low Emissions Zones
- Four new partners for a NERC funding proposal (now submitted)

Costs

The event accounts are shown below. I was fortunate to be able to secure a substantial amount of sponsorship – enough to defray a substantial portion of the cost of the event. Research Committee's essential underwriting of the event – up to £4,135 – enabled me to have the confidence that the event would definitely happen, when soliciting speakers and sponsors, and I am delighted that the support from others, meant that Research Committee's eventual contribution was less than a quarter of that requested.

Expenditure	£
O'Reilly theatre and lunch (@£50pp for first 80 + £25pp thereafter)	5,750.00
Publicity	90.18
Banners	110.00
Website	108.00
	6,058.18
Income	
Cambustion sponsorship	500.00
Campbell Associates sponsorship	500.00
Emissions Analytics sponsorship	500.00
TSI sponsorship	750.00
Research England Strategic Priorities Fund (SPF) QR allocation funding	3,135.00
	5,385.00
Research Committee balance	336.59
Conference Office balance	336.59

Thanks

I am incredibly grateful to a number of people without whom the Oxford Air Quality Meeting could not have happened:

- Senan, Nick and all of the conference team and catering staff
- The Porters for assisting and directing guests
- The organising committee
- Research Committee, for its support from the outset

Future

It is my intention to host the event again!

Felix Leach – 17th January 2020

Oxford Air Quality Meeting Programme

Friday 10 January 2020, 9am – 5pm

09:00 – Welcome: Cllr Tom Hayes (Cabinet Member for Zero Carbon Oxford, Oxford City Council)

09:10 - **Opening Keynote**: Prof. Martin Williams (King's College London) - **UK Clean Air Champion**

Session 1 – Air Quality and Measurement

09:40 - Roy Harrison (University of Birmingham): 'Non-exhaust emissions from road traffic'

10:00 - Brian Stacey (Ricardo Energy & Environment): 'Ultrafine Particle measurements – comparison of road traffic and airport environments'

10:20 - David Carslaw (University of York): 'The European NO_2 problem - insights from vehicle emission remote sensing'

10:40 - Eloise Marais (University of Leicester): 'Monitoring the efficacy of emission mitigation strategies in cities using instruments in space'

--11:00-11:30 Break--

Session 2 – Emissions

11:30 - Nick Molden (AIR Alliance): 'Solving poor air quality quickly and fairly: how the consequences of Dieselgate have been misunderstood'

11:50 - Sam Akehurst (University of Bath): 'What will you be driving in 2040?'

12:10 - Mark Peckham (Cambustion): 'NO_x pollution "hot spots" measured on-board a variety of passenger vehicles'

12:30 - Chris Morgan (Johnson Matthey): 'Catalyst technologies for current and future vehicle emissions legislation'

--12:50-13:50 Lunch--

Lunch and exhibition is in the Douglas Price Room – above the lecture theatre

Session 3 – Health Effects & Communication

13:50 - Karen Exley (Public Health England): 'Outdoor Air Quality and Health: Evidence to Action'

14:10 - Clare Heaviside (University of Oxford): 'Air pollution and health in the UK, and the impact of policy measures over the last 50 years'

14:30 - Chris Large (Global Action Plan): 'Being the most powerful clean air movement we can be'

14:50 - Corinne Wilkins (DEFRA): 'Overcoming barriers in communicating on air quality'

--15:10-15:40 Break--

Session 4 – Implementation

15:40 - Catherine Westoby (Transport for London): 'Tackling London's air pollution crisis: the introduction of the Ultra Low Emission Zone and other measures'

16:00 - Mai Jarvis (Oxford City Council): 'Going for Zero'

16:20 - Jake Backus (Empathy Sustainability): 'The OxAIR project'

16:40 - Phil James (University of Newcastle): 'From compliance to observation: learning from the Internet of Things in our cities'

Feedback:

Oxford Air Quality Meeting
Posters

1	Investigation of emissions from diesel powered trains and their impacts on air quality	Hu Li	University of Leeds
2	*Title tbc*	Hongming Xu	University of Birmingham
3	High-speed microscopic visualisations of nozzle bound fuel behaviour on a diesel injector	Alex Gander	University of Brighton
4	Fast Transient Real Driving Emissions (RDE) Measurement for Air Quality	Felix Leach	Keble College, University of Oxford
5	The STFC Air Quality Network	Kevin Smith	STFC, UKRI
6	High Spatial Resolution Roadside NO_2 dispersion	Samuel White	Keble College, University of Oxford
7	Assessing the impact of zero and low emissions control interventions upon air quality in Oxford City (OxAria)	Suzanne Bartington	University of Birmingham
8	ANTICIPATE 'Actively anticipating the unintended consequence of public policy for air quality'	Valentine Seymour	University of Surrey

Thanks to our sponsors:

Research Associates

Research Associates are nominated by Fellows. They are researchers with whom the fellow is working closely in relation to a particular project, or who is otherwise likely to make a significant contribution to the development of College research activities. Research Associates are members of the Senior Common Room and receive meal rights. These are up to three-year fixed-term nonrenewable appointments. Criteria for selection include: the likely contribution of the associate to the development and success of the nominating Fellow's (or their research group's) research; the likely contribution of the associate to research lectures, seminars, or similar activities in College; the research record or potential of the associate; and due regard for the spread of associates across subject areas.

Dr Rob Bellamy	Creativity
Dr Nicola Farrer	Organic Chemistry
Dr Przemysław Gameł	Chemistry
Dr Heather Harrington	Mathematics
Dr Antonis Iliopoulos	Archaeology
Dr Tamas Josza	Biomedical Engineering
Dr Daniel McCowan	Oncology
Dr Reuben Message	Geography
Dr Alexandra Palmer	Geography
Dr Ralph Schroeder	Internet Studies
Dr Daniel Schumann	Theology
Ms Julie Scott-Jackson	Geoarchaeology
Dr Premysław Walega	Computer Science
Dr Shengguo Zhu	Mathematics

The Research Centre for Victorian Political Culture also has three Research Associates:

Professor Kenneth Gray

Dr Philip Salmon

Dr Ralph Walter