Institution: University of Warwick

Unit of Assessment: B10 Mathematical Sciences

a. Overview

This submission covers the research work of the Mathematics and Statistics departments at Warwick. Administratively, the two departments are separate units within the Faculty of Science, but they share a single building and cooperate extensively in both research and teaching. A total of 104.1 FTE Category A staff are included in this submission, of whom 72.2 FTE are formally attached to Mathematics and 31.9 FTE are formally attached to Statistics. A further 6 staff formally attached to the two departments are being submitted to other UoAs.

Research takes place across a broad range of areas in pure and applied mathematics, probability, and theoretical and applied statistics. In particular, we are strong in algebra, algebraic geometry, number theory, discrete mathematics, analysis (including applied, numerical and stochastic analysis), partial differential equations, dynamical systems, geometry and topology, computational mathematics, mathematical and systems biology, mathematical physics and statistical mechanics, probability, mathematical finance, applied statistics, statistical methodology, Bayesian statistics, risk and decision analysis, and computational statistics. Neither department is divided into research groups or administrative sub-units; this encourages interaction between specialities, and much of our best research is produced in the intersection between two or more of these areas; we have not therefore assigned staff to research groups in RA1.

The two departments jointly or separately host or are strongly affiliated with several interdisciplinary research centres which serve to facilitate interaction with staff from other departments. These are: the Centre for Discrete Mathematics and its Applications (DIMAP), run jointly with Computer Science and the Warwick Business School (WBS), which includes one joint appointment with Computer Science; the Warwick Systems Biology Centre (WSB) which is effectively a separate department but which includes seconded and other mathematical science staff, some of whom are submitted here; the Warwick Infectious Disease Epidemiology Research (WIDER) Centre, including two joint appointments with the School of Life Sciences; the Complexity Science Centre which involves Physics and several other departments; the Warwick Centre for Analytical Science (W-CAS), involving staff from several science departments; and the Centre for Scientific Computing (CSC) which is managed jointly by seven science faculty departments. In addition we have joint appointments with Engineering and with WMG (Warwick Manufacturing Group). There are additional formal links at the PhD training level through the various Warwick CDTs (see section (c) below).

Research in OR (Operations Research) is mainly based in the ORMS group in the Warwick Business School (WBS). We have strong connections with this group through the DIMAP centre, as well as many teaching connections, but ORMS staff have been submitted to a different UoA.

The Centre for Research in Statistical Methodology (CRiSM), based within Statistics, and the Mathematics Research Centre (MRC), based within Mathematics, both contribute strongly to the departments' research activity and international reputations. RISCU, the Risk Initiative and Statistical Consultancy Unit, is based within Statistics.

[Convention employed in this submission: Staff names are in *italics* if they are not included in the B10 UoA for REF2014 – in almost all cases these staff are either submitted to some other UoA or left Warwick before the October 2013 census date.]

b. Research strategy

The Mathematical Sciences at Warwick aims to be internationally leading across the full spectrum of our research activity. The departments both have a long and very strong record of attracting excellent academic staff, postdoctoral researchers, graduate students, research visitors and research funding; the period since 2008 is no exception.

There has been significant growth in Mathematical Sciences at Warwick since RAE2008. Total FTE has risen by 22% from the 85.25 FTE submitted to RAE2008 (the total from the 2008 Pure, Applied and Statistics UoAs) to 104.1 FTE submitted now. The number of postdoctoral research assistants has also increased – from 34.5 in RAE2008 to 54 in Oct 2013. Further details of this growth, including PhD numbers, are included in section (c) below. Statistics has grown across the board, with appointments in Statistical Methodology, Probability, Applied Statistics and Stochastic Finance. Mathematics has grown, in particular, in Number Theory, Ergodic Theory, Discrete Mathematics, and Applied and Computational Analysis. Appointments have been made to bring new blood into areas of existing strength and to expand into new areas in a carefully managed way. An important criterion for appointments of both kinds was (and remains) that new staff would, whilst bringing their own independent ideas, have a good interaction with existing staff and not be scientifically isolated; where appropriate they were appointed partly to bridge existing areas of expertise.

Both departments are determined to continue to build on their areas of mathematical and statistical strength, and to continue to hire internationally leading researchers in these areas at all levels. In Mathematics there will be continued emphasis on enhancing expertise in applied/numerical analysis, in particular through hiring staff with experience of interaction with industry and other research users. We will also hire across and between other areas of existing strength in both pure and applied mathematics. In Statistics, the next few years will see expansion especially in areas that interface with computer science, machine learning, and the analysis of large datasets and data streams. Both departments will be eager to continue to expand and strengthen the existing interdisciplinary research in Epidemiology (through links with WIDER and its other partners) and Systems Biology (through links with WSB).

Our recent successes in winning four EPSRC Programme Grants led from Warwick and a Leverhulme Research Leadership award give us an excellent start for the next assessment period and will contribute strongly to our strategy in a number of areas.

- Roberts and Firth: *Intractable Likelihood: New Challenges from Modern Applications* (£2.4m with Bristol, Lancaster and Oxford, 2013-2017).
- Topping: *Singularities of Geometric PDEs* (£1.6m with Imperial and Cambridge, 2013-2018).
- Cremona and Siksek: *L-functions and Modular Forms* (£2.2m with Bristol and international partners, 2013-2019).
- Stuart and Roberts: EQUIP - *Enabling Quantification of Uncertainty for Large-Scale Inverse Problems* (£2.0m, with Heriot-Watt and UCL, 2013-2018).
- Hairer, *Singular Stochastic Partial Differential Equations* (LRLA, £0.9m, 2013-2018).

These grants are all in key strategic research areas and have just begun – they will bring considerable income and a total of more than 60 postdoc years between us and our partners over the next 5 or 6 years. It is also important for our future plans, that:

- CRiSM was reviewed by EPSRC in 2011, regarded as highly successful, and secured new funding (£600K) in 2012 for a further 5 years of activity.

In addition, we will wish to make appropriate appointments to support research and activity in the areas covered by our two recently announced EPSRC CDTs that will recruit for 2014 onwards: MathSys (*Mathematics for Real-World Systems)* and OxWaSP (*Next Generation Statistical Science,* joint with Oxford). Our links and affiliations with two other new Warwick CDTs, CUSP (*Centre for Urban Science and Progress*) and MASC (*Molecular Analytical Science*), will provide additional focus for new interdisciplinary research and PhD training.

Our strategy for research in the new period will therefore combine a continuing commitment to research quality and intellectual advance across mathematics and statistics, energetic engagement with our interdisciplinary partners, and an increased focus on research that connects with research users and other beneficiaries.

Our strategic aims described in our submission to RAE2008 contained both general and particular statements. We first examine the more particular strategic aims mentioned in 2008, and describe

how we have progressed with these.

RAE2008, Pure Maths: (1) *"The recently awarded large grants – Geometric Flows, the CODY RTN, Discrete Mathematics – will generate new momentum and opportunities to strengthen our research profile."* EVIDENCE – the appointment of Malchiodi, and Topping's new Programme Grant are supporting our work in Geometric Flows; the appointments of Melbourne and Sharp strengthen our position in Dynamical Systems and Ergodic Theory (the subject area of the CODY RTN grant); the appointments of *Kral* (joint with Computer Science), Georgakopoulos, and Pikhurko, and the consolidation of DIMAP as an internationally leading centre in Discrete Mathematics have established our position in this area. (2) "*We will consolidate and build on recent senior appointments in Analysis, Geometry, Number Theory and Probability, and continue to develop in those areas where we are already well established, including those at the frontiers between pure mathematics, applied mathematics, and statistics."* EVIDENCE – the appointments of Andersson, Ball, Vogtmann, Smillie; Dokchitser, Loeffler, Testa, Bartel, Bruin and Weber have built our strength in the four named areas. The new Programme grant in Number Theory (and the large number of appointments in this area) is evidence of the strong growth of this relatively new area (for Warwick) of activity. Additional appointments in Algebra (Schlichting), Algebraic Topology (Farber), Topology (Zhang) and Combinatorics (Mathe) have strengthened our research in other areas of pure mathematics. (3) *"We will make strategic appointments at a more senior level where needed to provide research leadership or to maintain balance."* EVIDENCE – Eight of the appointments named so far in this paragraph were made at the professorial level. (4) *"Future topics under consideration* (for Warwick EPSRC symposia) *are Diophantine problems (Siksek, Cremona); Stochastic Analysis (Hairer, Warren); and Conformal Structures and Dynamics (van Strien). The MRC will continue to expand the range and volume of its activities within Mathematics."* EVIDENCE – the three provisional symposia were funded and ran (with slightly revised titles) in 2012/13, 2011/12 and 2010/11 respectively.

RAE2008 Applied Mathematics: (5) *"We will want to consolidate and build on recent senior appointments (Elliott, Jones) to strengthen core applied mathematical activity."* EVIDENCE – the appointments of Dedner, Stinner, Ortner, Rindler, and Sullivan have contributed to this aim, and the MASDOC CDT has provided a PhD training focus in this area (and its links with statistics). (6) *"Plans are already advanced for an MRC symposium, 2008-09, in Challenges in Scientific Computation (funding applied for), and in preparation for one in 2009-10 on Complexity Science and Systems Biology.* EVIDENCE – these two symposia were funded and ran in the advertised years. (7) *"Recent large grants awarded with a 5+ year time horizon have generated new momentum and opportunities to strengthen our research profile. They will require us to concentrate on developing these new activities – Complexity Science, Systems Biology, Discrete Mathematics. They will also give us the opportunity to move towards greater connection with industry, commerce and public policy. And we will wish to strengthen our growing interdisciplinary links with Statistics, Chemistry, Physics, and Biology."* EVIDENCE – The Centre for Complexity Science and WSB (Warwick Systems Biology) are both now established as leading centres. Appointments affiliated with these Centres, or with WIDER (the new epidemiology group) include del Genio, House, *Hollingsworth*, *Danon* and *Tildesley*. CCS, WSB and WIDER have come together to win the recently announced MathSys CDT. The EQUIP Programme Grant (mentioned above) is further evidence of growing and productive collaboration between applied mathematics and statistics over the period.

RAE2008 Statistics: (8) "*Over the next five years we aim to develop the ways in which the Department works as a research community across the range of methodological statistics and probability, and delivers original research at international levels of excellence.*" EVIDENCE – Among the 15 current academic staff appointed to the Department of Statistics since 2008, 9 work in Statistical Methodology and Applied Statistics (Fiecas, *French*, Johansen, Lee, Leng, *Nichols*, Robert, Rossell, Spencer) , 3 in Probability and Stochastic Finance (Dey, *Henderson*, Zygouras), and a further 3 publish in both of these two broad areas (Jenkins, Łatuszyński, Spanò). Recruitment has been international (10 of the 15 came directly from overseas) and highly competitive. The Department has deliberately nurtured a healthy balance across research areas, and across career stages (the latter especially through the introduction in 2010 of a rolling

programme of appointments to new three-year Harrison Early Career Assistant Professorships). (9) *"Interdisciplinary research will remain prominent; from 2008 it will include substantial involvement in the new BBSRC-EPSRC Systems Approaches to Biological Research initiative (three major grants with Finkenstädt as co-applicant) and a new multidisciplinary (chemistry, physics, statistics) Centre for Analytical Science funded by EPSRC as a further Science and Innovation initiative at Warwick."* EVIDENCE – Statistics' involvement in WSB and W-CAS has grown through further substantial research grants to WSB with Finkenstädt as CI, as well as through the appointments of Rossell and Spencer (the latter formally associated with W-CAS). Research links with other disciplines have led to 3 Statistics Department staff being submitted to other REF2014 UoAs (*Henderson* to UoA 19, *Hutton* to UoA 2, *Nichols* to UoA 15); and our UoA-10 REF2 outputs labelled as "Interdisciplinary" involve collaborators in linguistics, in genetics or genomics, and in epidemiology.

As to the more general strategic aims stated in RAE2008, we believe that the overall effect of staff changes in the two departments at the 2013 census date is an improved age profile, enhanced research leadership, and greater strength across the range of research activity. The strength of our research during the period is evident from the submitted outputs.

We also believe we have succeeded in maintaining and enhancing the exceptionally vibrant research culture in the departments which provides an ideal environment for staff, visitors and PhD students. Most notably:

(i) The MRC has continued to run the annual EPSRC Warwick Mathematics Symposium. In the period 2008-2013 the MRC hosted 6 symposia, organised 118 workshops and scheduled over 4500 individual talks and seminars. It hosted more than 2400 international visits from over 65 countries. An additional 1700 visits were hosted from non-Warwick UK institutions/organisations. Frequent short courses and vacation schools are targeted at PhD students and other ECRs (from Warwick, the UK and overseas).

(ii) CRiSM, funded through the EPSRC's Science and Innovation Awards scheme, has been very successful in encouraging innovative research in the methodology of statistics. It has organised 22 workshops within the period, and hosted over 1000 visitors since 2008.

(iii) Mathematics and Statistics at Warwick have broadened their multi-disciplinary research over the period, in part through the Mathematical Interdisciplinary Research at Warwick (MIR@W) programme which brings together the two departments with 10 others; over the years it has played a significant role in stimulating the creation of several of the interdisciplinary centres currently flourishing at Warwick. MIR@W organises a series of interdisciplinary one-day meetings at Warwick (61 during the period) and acts as a vehicle for interdisciplinary research and PhD training. During the period it led to involvement in an EPSRC project on Energy Storage; it was involved in coordinating the departments' response to the 2012 EPSRC funding call 'Future Manufacturing with Mathematical Sciences'; and it has been involved in formulation of collaborative agreements with National Grid and with Jaguar Land Rover.

(iv) The Centre for Discrete Mathematics and its Applications (DIMAP), based in Mathematics, Computer Science and ORMS, also funded through the EPSRC Science and Innovation Awards scheme, has embedded itself firmly within the departments and has earned a strong international reputation in Discrete Mathematics (including Graph Theory). A new Warwick/QMUL partnership is providing additional opportunities in this area with, for example, three postdoctoral fellows appointed between DIMAP and QMUL during the period.

Further details of our interdisciplinary research activity over the period can be found in section (e) of this statement.

c. People, including:

i. Staffing strategy and staff development

Since 2008, the departments have made 38 appointments of new permanent staff (including 3 joint appointments with Computer Science, Life Sciences and WMG). Most of these are named in

section (b) above. Of the 38, 5 have left and 4 (including the 3 joint appointments) are being submitted to other UoAs. The remaining 29 are included in this submission. Nine of these relatively recent appointments have already won and currently hold 5-year research fellowships. The 38 appointments include 10 appointed as Professors and 4 appointed as Readers.

In the same period there have been 7 retirements, 12 permanent staff have moved to other universities and 1 has gone to industry. Of the 12 departures to other universities, 9 have moved overseas (3 to the USA, 3 to Germany, and 1 each to the Netherlands, Spain and Sweden, usually to return from whence they came) and 3 have moved to other universities within the UK (1 to Oxford and 2 to Imperial).

Since 2008 we have also appointed 19 three-year fixed-term academic staff (research and teaching contracts) of whom 4 have since won permanent positions at Warwick, 3 have left (all to academic jobs elsewhere in the UK) and 12 are still fixed-term and are included in this submission. In the same period we have appointed 25 independent RFs, 4 of whom have since won permanent or fixed-term positions at Warwick, and 10 of whom are submitted here as independent RFs. The 15 RFs who have left Warwick since 2008 (including some who were already in post at the start of the period) all went to academic positions (10 to universities in the UK and 5 overseas).

A total of 29 ECRs are included in this submission. The age-profile of the staff in the two departments is very healthy. The throughput of junior staff is considered very positively; they bring great energy and ideas, and those who do not remain at Warwick get good positions elsewhere and strengthen our future research links with other universities.

The departments make strategic use of promotion and of research leave to encourage individual staff development. All staff undergo annual review and this provides an opportunity to discuss research strategy and progress with a senior departmental colleague. Professorial staff are also asked to report on their research progress on an annual basis as part of the University's senior salary review process.

Sabbatical (paid) leave may be (and in practice generally is) granted for 1 term in 7; staff are encouraged to take this leave systematically in order to consolidate and refresh their research. Staff are also actively encouraged both to take occasional periods of unpaid leave to take up visiting research positions elsewhere, and to apply for individual research fellowships. In the six academic years 2007-2013 staff took a total of 129 terms of sabbatical leave, and 28 terms of unpaid leave.

Promotion policy is an important ingredient for incentivising staff. The departments, supported by the University, have a pro-active attitude towards promotion. Of the 87 permanent staff submitted in category A, 45 are full Professors, 15 are Readers and 18 are Associate Professors (Senior Lecturers), with 9 Assistant Professors (Lecturers still on probation). There have been 8 internal promotions to Professor during the period: Aston, Gelfreich, Hairer, Hobson, Kolokoltsov, Pikhurko, Robinson, and Siksek. In addition, 11 staff were promoted to Reader. No staff have failed to complete probation successfully during the assessment period, reflecting the high quality of our junior appointments and of the training and support provided during probation.

The departments adopt a flexible attitude to teaching allocation and seek only to balance teaching load over the long term. Non-standard allocations can be made where this allows a staff member to engage in a specific research activity that occurs during term-time, or where they wish to organise their time in such a way as to allow a particular period for concentrated research work.

All staff have access to departmental travel funds to attend research workshops, conferences, etc. They also apply for and win funds from the University's International Partnership Funds (for research collaboration and visits in either direction with China, Brazil, North America, Australia, and other countries and institutions) and from the Warwick Institute for Advanced Study (IAS) (for inviting visitors, and running workshops and summer schools). The University's Research Development Fund and Impact Fund (both £500k per annum) support pilot activities that may lead to more substantial grant applications or significant research impact in due course.

The departments fund a Research Support officer, Dr Christopher Veal, and have a close and

successful relationship with him. He provides comprehensive information, advice and support to staff on all aspects of funding for research and research-related activities, including specific expertise in such areas as FEC, EU funding and RCUK policies, and he liaises with the University's Research Support Services (RSS). The departments' administration and finance offices deal efficiently with all non-scientific aspects of holding a grant.

The investment by Mathematics in the MRC and by Statistics in CRiSM benefits all staff in the development of their research. Practical arrangements for visitors, meetings and conferences are handled by the dedicated support staff, and it is easy to plan events and small workshops at short notice. This both encourages a high level of activity, and frees organisers to concentrate on scientific interaction. Individual staff benefit both from the activity they coordinate themselves, and that organised by others; events are arranged so that all staff can participate both academically and socially. Weekly department colloquia/seminars (with refreshments) encourage breadth and a collegiate atmosphere.

Early Career Researchers (ECRs) and other junior staff have a period of probation (5 years or less) during which they have reduced teaching and administrative duties. This allows them time to establish and develop their research activity and contacts. Probationary staff (whether permanent or on a fixed-term contract) are assigned a department mentor, who will give advice on all aspects of their career. They each have an annual review with their Head of Department covering their research progress, teaching, and other contributions, which results in a report (joint from the Head of Department and the probationer) submitted for consideration by the University Academic Staff Committee. Staff from Mathematical Sciences have been successful, during the REF period, in completing probation early when their progress and/or prior experience has justified this.

ECRs on research-and-teaching contracts who do not already have extensive teaching experience are required to earn an accredited teaching certificate (PCAPP) before they complete probation (and those on research-only contracts have the option to do PCAPP though it is not required). The departments organise several activities for ECRs and others specifically focused on aspects of Mathematical Science teaching and learning, augmenting more generic material offered by the University. We also support their attendance at the two-day HEA Induction course for new MSOR lecturers (which counts towards their PCAPP).

ECRs are encouraged to apply for any appropriate early career or starter research funding. For example, since 2008, 10 staff have won EPSRC First Grants. They, like other new staff, have access to department start-up funds to support research activity in their first two years. They are encouraged to become involved in organising seminars and meetings in the departments at an early stage, and are integrated early into departmental consultative processes around appointments and other strategic decisions.

The departments and the University actively support postdoctoral researchers (see below). Since January 2008 ninety-nine PDRAs employed by the two departments have left Warwick; 42% moved to a permanent academic position, 46% to another postdoctoral position, 6% to industry, 3% to teaching, and 2% to finance (after excluding 6% unknown).

The departments regard the success of Warwick fixed-term lecturers (see start of this section) and postdoctoral researchers in obtaining permanent positions elsewhere as a sign of vibrancy and health; it is both evidence of the quality of our appointments, and testimony to the support offered to these staff while they are here.

The open research culture of the departments provides an ideal environment for all new staff, emeritus staff, visitors and others. New staff typically have a reduced teaching load and negligible administrative load in their first year; this allows time to settle in and establish a strong network of contacts within the departments (and within the UK if they have come from overseas). The opportunity to give high-level research-related courses, often at fourth year undergraduate and graduate level, or to attend courses given by others, generates contacts with PhD students and research interactions at all levels.

The University of Warwick implemented the *Concordat to Support the Career Development of Researchers* from 2009 and was awarded an HR Excellence in Research Award for its work in this

area in January 2013. A monthly newsletter draws attention to possible funding sources and directs researchers to support and advice activities. PDRAs in the departments had considerable success in applying for Roberts funding in the period when this was available.

Staff in the two departments currently hold 15 externally-funded 5-year research fellowships: 6 from the EPSRC, 6 from the ERC, 2 from the Royal Society and 1 from the Wellcome Foundation. Current holders are:

- 1 EPSRC Fellowship (Aston),
- 3 EPSRC Leadership Fellowships (Gelfreich, Robinson, and Siksek),
- 2 EPSRC CAFs (Dembele and House),
- 3 ERC "advanced" grants (Melbourne, Preiss, Stuart),
- 3 ERC "starter" grants (Kral, Ortner, Pikhurko),
- 2 Royal Society URFs (Dokchitser and Loeffler); and
- 1 Wellcome Senior Research Fellowship (*Nichols*).

In addition, 5 staff currently hold Early Career Fellowships of 2 or 3 years duration: 1 Leverhulme ECF (Mathe), 2 Marie Curie Fellowships (Sengun and Sijsling), 1 EPSRC PDRF (Hladky), and a Royal Commission for the Exhibition of 1851 Research Fellowship (Bartel).

A number of fellowships held earlier in the period have now finished. These include an EPSRC CAF (Hart, 2008-13); 2 Leverhulme ECFs (*Danon* and *Cheraghi*), 3 Marie-Curie fellowships (*Elkin, Lamy,* Sorrentino), 2 EPSRC PDRFs (*Fletcher* 2009-12, Mathe 2009-12); an ERC Starter Grant (*Coja-Oghlan*); and 3 Leverhulme Senior Research Fellowships (Pollicott 2007-08, *van Strien* 2007-08 and Barkley 2009-10).

The University of Warwick, through its Institute for Advanced Studies (IAS), ran an open competition (in all subjects) for ten 3-5 year Global Research Fellowships in 2011 and 2012; the departments were pleased to win 3 of these (Chleboun, *Gadre*, Sprittles).

The departments have a very international staff. Of the 38 permanent appointments since 2008, 16 first came to Warwick from outside the UK: 7 from the USA, 7 from continental Europe, and 2 from Asia. The 22 appointed from the UK include 10 who received their mathematical education outside the UK. Of the 19 fixed-term appointments, only 4 were from the UK. Destination information for outgoing staff is near the start of this section. During the period, the departments hosted 12 year-long international visiting scholars, 12 hosted for between 6 months and a year, and 22 hosted for between 3 and 6 months. Many more visited for shorter periods (see section (d)).

The University has a comprehensive policy and commitment to equality and diversity to which both departments subscribe enthusiastically. Both departments have been awarded Athena SWAN Bronze status this year (2013), while the University has just won Silver status. Both departments are supporters of the LMS Good Practice Scheme and have Athena SWAN action plans which are now being implemented. Caroline Series is Chair of the EMS Women in Mathematics Committee. The Departments are also fully committed to the non-gender aspects of equality and diversity.

ii. Research students

The number of PhDs awarded has more than doubled over the REF assessment period, from 16 in 2008-09 to 39.44 in 2012-13. The total over 5 years is 136.2 (average 27.2 per year), up from a total of 97 (in the 3 relevant RAE2008 UoAs) over the 7 years 2001-2007 (average 13.85 per year). In the two departments, the total PhD FTE population has increased from 82 at the end of the RAE period (2007) to 149 now (excluding CDT MSc students) – an 82% increase. Our increasing recruitment of PhDs fits with the University strategy which is to double the PhD numbers in the period 2008-2015.

The most significant source of funding for our PhD programme is EPSRC. In the most recent EPSRC allocation of Doctoral Training Grants (covering the 2013 and 2014 intakes), the departments were awarded 10.3% of the total UK funding allocation. The departments jointly run a CDT in the Mathematical Sciences (MASDOC), which is funded by a £4.2m grant from the EPSRC and which has just admitted its fourth cohort of ten students; the first MASDOC PhDs will graduate next year. Both departments are significantly involved (together with Physics, Computer Science

and other departments) in running the CDT in Complexity Science (which has admitted 31 students in 4 intakes, 2007-2010, and after a review and renewal another 30 in 3 intakes 2011-2013); this CDT currently has 35 PhD students and 22 MSc students (including 11 on the one-year MSc who are expected to continue to a PhD, and 11 on the 2-year Erasmus Mundus funded Masters Course in Complex Systems Science).

For entry in 2014 onwards, the departments have been awarded (as mentioned in section (b) above) funding for 2 new CDTs: MathSys and OxWaSP. In addition the departments will continue to recruit for and run the MASDOC CDT, and will build further upon innovative and successful features of the MASDOC training (such as the research study groups).

The University allows the two departments to contribute additional studentships from their own budgets. An average equivalent of 6.7 UK stipends/fees (for 3.5 years) have been funded by the departments every year during the REF period (average funding £410K p.a. considering the 6 intakes 2008-2013) with a higher average over the last three years of 9.6 UK stipend/fee equivalents (average funding over £590K p.a.). A large part of this additional support is directed at international students, who contribute significantly to the vibrant research environment and to the truly excellent international and multicultural interactions within the University and the departments.

In addition, averages per annum of 3.5 UK stipends/fees have been funded through the University peer-reviewed scholarship schemes (now called Chancellor's Scholarships), 1.9 by non-EPSRC grants (for example ERC fellowship grants), 4.1 on EPSRC research project grants (before this funding source was removed) and 5.5 by overseas government or self-funded schemes.

We aim to recruit PhD students with a strong mathematical sciences background to all our programmes (including the CDTs). The Mathematical Sciences DTG is used to fund highly qualified students for PhDs in Mathematics, Interdisciplinary Mathematics, or Statistics. The DTG is allocated strategically, to fund both students working in core research areas and, where appropriate, to fund studentships for candidates who will be jointly supervised by staff from Maths/Stats and from other departments (examples include Physics, Computer Science, Systems Biology, WMG, and WBS).

In both Mathematics and Statistics, the normal policy has been to award 3.5 year studentships to DTG-supported students (and recently the University has increased the duration of its Chancellor's Scholarships from 3 to 3.5 years). In both departments, policies are kept under review and funding for 1+3 year studentships is considered in appropriate cases. The CDTs' recruitment of students is always onto to their structured 1+3 degree programmes.

The proportion of UK PhD students recruited with a first class undergraduate degree is 92%. When we take a student without a first class undergraduate degree, this is on the basis of excellent subsequent performance e.g. at Masters level or as demonstrated by published or publishable high quality research articles. The proportion of those with a Masters level qualification is 74% (non-UK 84%, UK 64%); the lower UK proportion of MSc students is largely due to the recruitment of excellent UK students from universities with very strong integrated Master of Mathematics degrees, such as our own.

PhD students make a crucial contribution to the research activity and environment in the University, and University policy is to ensure that all students receive appropriate training. Both departments have worked to ensure that all PhD students, regardless of their source of funding, receive the mathematical and transferable skills training expected by the EPSRC. The aim is to prepare them for careers either in academic research, or in business or industry, or in other high-level roles where the ability to conduct independent work and to communicate ideas and results is valued.

A variety of training mechanisms are in place in Mathematics, in Statistics, and in the Complexity and MASDOC CDTs, and the current arrangements are rapidly developing as good practice in one area is transferred to others.

All PhD students are required to take at least 100 hours of assessed broadening training as required for EPSRC-funded students. The national EPSRC-funded Statistics Taught Course

Centre APTS is run from Warwick Statistics and plays a central role in providing broad training for Statistics PhDs at Warwick and more widely in the UK. Of the 4 residential weeks organised each year, one is usually located here at Warwick. Statistics PhDs normally take their 100 hours training through APTS. Warwick Mathematics benefits from its participation in the 5-partner EPSRC-funded Taught Course Centre managed from Oxford with Warwick, Imperial, Bath and Bristol; this TCC delivers 20 PhD-level modules each year by video-conferencing. New broad masters-level modules are being introduced in Mathematics primarily for PhD students. Probability and Mathematics students take 100 hours training agreed with the supervisor and Director of Postgraduate Studies selected from these courses, MSc modules from the CDTs and elsewhere, and from the broader and more advanced modules from the final year of our integrated masters degrees.

Statistics students receive training in Statistical Consultancy from the Royal Statistical Society, and are encouraged to develop their consulting skills by giving support to students from other departments through RISCU. Mathematics has introduced compulsory cohort-based first year PhD modules on Expert Speaking and on Advanced Mathematical Writing. The University runs the PG Certificate in Transferable Skills organised by the Faculty of Science, and generic skills training is available from the Warwick Research Students Skills Programme; the Postgraduate Researcher Enterprise Programme provides PhD students with the knowledge and skills to create an impact. Students can also access the Wolfson Research Exchange and the PG Hub. Encouragement to take up the training opportunities offered by the University (and elsewhere) is conveyed to students through induction, the supervisory process and targeted emails. PhD students in the CDTs engage in an increasing number of international exchanges (which enhance both their research and their training).

The University strongly supports the departments in their contributions to PhD training within the UK, both through support for the Taught Course Centres (in Mathematics, Statistics, and in ORMS) and through funding (via the Warwick IAS) for Early Career Vacation and Summer Schools.

Assessed results of specific training courses or events are fed into the progress monitoring procedures. In Mathematics, progress is monitored through twice yearly Progress Board meetings, on the basis of an annual report/assessment from students, supervisors and mentors. Starting in 2012, PhD students are initially registered for an MPhil, and the process by which they are upgraded to a PhD is providing additional focus on training outcomes. In Statistics, progress towards a PhD is considered at 9, 15, 24 and 36 months, with additional light-touch monitoring at 30 and 42 months (if needed) and makes use of two-person panels (not including the supervisor). The CDTs each have their own monitoring processes approved and reviewed by EPSRC. Overall monitoring processes have become significantly more sophisticated over the review period, and the good effects of this are evident in the progress of our students and the quality (and timeliness) of their theses.

We have several measures of the quality of our PhDs. In a recent survey we found that those who continue in academia publish around 5 quality research papers on average in the 3-4 years following submission of their PhD thesis. For PhD students who have submitted since January 2008 approximately 75% continue in academia, 10% go into finance, 10% into industry and 5% teach in HEIs or FE/Schools [after excluding 11% unknowns]. Informal feedback from employers on the quality of our graduates is consistently positive.

d. Income, infrastructure and facilities

The two departments occupy the Zeeman building on the central campus site; the first and major phase (approximately £15m) opened in December 2003. The building was designed to encourage research interaction, and has proved highly successful. It includes a library, and comfortable common rooms which are very effective in promoting interaction between staff, students and visitors. It was designed with generous space to accommodate visitors, and includes lecture and seminar rooms which are ideal for the many workshops and meetings organised at Warwick. The Zeeman building was extended in 2008 (£3.6m) to provide more offices, dedicated space for CRiSM and for the Centre for Complexity Science and its associated CDT, more PG space and an

extra seminar room. At the same time, the Zeeman and Computer Science buildings were linked by a bridge to facilitate the growth of DIMAP and interaction with Computer Science. In 2012 a new and larger Taught Course Centre (videoconferencing) lecture room was equipped. The departments have wifi everywhere in the Zeeman building, and excellent access (including electronic access) to all the facilities of the University library.

The University has approved £15m in its capital plan from 2016/17 for a new Mathematical Sciences building adjacent to and integrated with both the Zeeman building and the current Department of Computer Science building, to provide approximately 40% future expansion space for Mathematics, Statistics and Computer Science. The University's willingness to support Mathematics and Statistics through a new building is indicative of its determination to support and continue to expand Mathematical Sciences at Warwick.

The departments took a leading role in the establishment of the Centre for Scientific Computing (CSC) at Warwick. This high performance computing capability includes hardware that is upgraded every 3 years; a 6000 core machine was installed in 2011. The facility was enlarged through the £3.5m EPSRC e-Science grant MidPlus to become a regional Centre of Excellence for massively parallel jobs, and complements the fast throughput machine at QMUL (Queen Mary University of London) and 1PB data storage at the University of Birmingham. All staff have access, if required, to the CSC's high-performance computing resources, including training, support and access to a workstation cluster set-up to facilitate programme development in an environment which is compatible with the HPC provision.

The Department of Statistics runs an additional scientific computing cluster (BUSTER), dedicated to meeting the needs of most department members and PhD students for running computationally intensive code. Mathematics supports a smaller cluster of high-end workstations used by the Number Theory group.

Research income in the two departments (REF4b) has increased steadily over the assessment period, rising from £3.1m in 2008-09 to £5.4m in 2012-13. Recent awards guarantee that this increase will continue; indicative internal Warwick totals for recent new awards held by the two departments (which includes some funds, for example from the new Programme Grants, that will be sub-contracted to other institutions) are £8.3m (in 2011-12), and £16.3m (in 2012-13).

The main change in the profile of research funding over the period is a welcome increase in the proportion coming from the EU (from 5% in 2008-09 to 16% in 2012-13), largely resulting from an increase in the number of ERC fellowships won. The proportion of our income coming from RCUK and the Royal Society remains large (71% in 2012-13), the major part of which comes from EPSRC. We have also had some income in the period from other research councils (BBSRC, ESRC) and other sources (NIH, ONR). The total value of our EPSRC current grants is £33.7M (from the EPSRC website on 1st October 2013).

Over the coming years, we will continue to seek funding to support our core research activity across mathematics and statistics. We will aim to continue with our recent success in winning responsive mode and first grants from EPSRC. We will also continue to encourage staff to apply for personal fellowships (from all sources, including EPSRC, Royal Society, and ERC); two more staff (Hairer and Rodrigo) have recently learnt that they have won 5-year ERC "consolidator" grants that will start in 2014. We plan to continue applying for support for the programme of year-long Warwick MRC Symposia. Overall, we will aim for further diversification in our funding sources (and so to reduce the risk of over-reliance on EPSRC).

We will be seeking additional funding to support our plans in Data Science, and via WIDER and WSB for our growing activity in Epidemiology and Mathematical Biology. With the DIMAP Science and Innovation award coming to an end, we will be seeking additional funding (through grants and fellowships) to sustain this activity. Our REF3a submission includes more details of our plans for impact-related research and funding.

With regard to consultancy and professional services, RISCU is the consultancy unit within the Department of Statistics (more information about this can be found in REF3a). It focuses on solving interesting problems with research challenge, and generates an increasing number of useful

connections, both within the University and externally. At present RISCU does not contribute significantly to income, its aim being to provide a route for first application of our research and for high-level knowledge transfer.

e. Collaboration or contribution to the discipline or research base

There are a huge number of individual research collaborations as evidenced by the large number of submitted outputs with co-authors based elsewhere in the UK and internationally. To some extent this is natural given the international nature of the academic staff and their pre-Warwick links, but many other collaborations are built as new opportunities for scientific exchange arise.

Virtually all of our staff travel extensively, to meetings or for research visits, and our very active workshop and visitor programmes bring many potential collaborators to Warwick. Travel funds are available to all staff in both departments to pay for visits that are not covered by existing grants. The University provides additional support (both outgoing and incoming) through its various international partnership funds and through the Warwick IAS. Generous arrangements for sabbatical and unpaid leave allow staff to make longer visits where appropriate. A particular example of notable international links is Reid's links with Korea, Japan, China, and Russia; originating from his collaborations and contacts in Algebraic Geometry. The departments are leveraging his links to build connections in other subject areas. There are multiple strong individual links particularly with the US and North America and with many European countries.

At a less individual level, an EU grant BREUDS supports visits in both directions with Brazil for researchers in Dynamical Systems. Our four Programme Grants (see section (b)), joint with other UK Institutions, are evidence of strong coordinated links across the UK in some of our strongest areas of research. Staff lead or participate in numerous LMS subject or regional networks/grants.

At the level of PhD training, the Academy for PhD Training in Statistics (APTS) is led from Warwick and runs four residential weeks of training each year for PhD students in Statistics from across the UK. The MRC and CRiSM run graduate schools and vacation schools, and staff from the two departments also frequently lecture in such schools organised elsewhere (both in the UK and overseas). Warwick hosted the Young Researchers in Mathematics (YRM) Conference in 2011, and will do so again in 2014.

Our mathematical and statistical collaborations with non-academic research users including industry, government and policy makers are highlighted in our REF3a Impact Template.

Support for and examples of interdisciplinary research within and beyond Warwick include the affiliation of our staff (and joint appointments where appropriate) with various Warwick interdisciplinary centres and their internal and external research collaborations and activities.

At a University level, Warwick has organised elements of its collective research activities through a series of Global Research Priorities (GRPs) that promote interdisciplinarity, encourage critical mass, and focus on major research challenges. The departments have particular involvement in the GRPs in Food Security (Smith is one of the leaders), Innovative Manufacturing (Connaughton, Kendall, Theil), Science and Technology for Health (Keeling, House), Energy (*French,* MacKay) and Behavioural Science (MacKay).

Two staff from Mathematics (*Rand*, Burroughs) are seconded to Warwick Systems Biology (WSB) and another (van den Berg) has his office in WSB. Additional staff from both departments are affiliated to WSB. The close association of WSB with the Mathematics and Statistics departments is a distinguishing feature of WSB amongst UK Systems Biology centres; a key to its success is the strength and breadth of the mathematical, statistical and bioinformatics skills that it brings to bear on its biological projects.

The Mathematical Epidemiology group at Warwick is led by Keeling who holds a joint appointment between Mathematics and the School of Life Sciences. A second joint appointment (*Hollingsworth*) has been made recently as part of a new strategic collaboration between Warwick (Mathematics and Life Sciences in this case) and the Liverpool School of Tropical Medicine. Appointments during the period (House, *Tildesley*, *Danon*) strengthened the link with the departments and in particular

with the Centre for Complexity Science. In 2012 the Epidemiology group, with the support of the departments and the University, formalised its existence as the WIDER (Warwick Infectious Disease Epidemiology Research) centre, involving staff from several Warwick departments (including WMS, the Warwick Medical School), and is expanding its range of interdisciplinary activity to engage with and bring novel modelling and statistical inference techniques to a broader set of public health problems.

Statistics has a recently established group working on neuro-imaging and related digital healthcare technologies (led by *Nichols*, a joint appointment with the Warwick Manufacturing Group). Several Statistics staff also have involvement in the Centre for Analytical Science (W-CAS). Spencer, from Statistics, has formal W-CAS affiliation, and other staff have been involved in the organisation of successful W-CAS interdisciplinary workshops on statistical problems in analytical science.

Although formally separate, the physical co-location of the two departments encourages intradisciplinary, cross-departmental research at the interfaces between pure and applied mathematics and statistics. Three of the most prominent examples of research links across the departments are the MASDOC CDT, P@W (Probability at Warwick) which provides a unifying umbrella for the organisation of research activities in stochastics, including reading groups, seminars, workshops and the 2011/12 EPSRC Warwick colloquium, and work straddling computational statistics and partial differential equations on MCMC algorithms and inverse problems for infinite dimensional problems, henceforth supported by the EQUIP programme grant.

The Complexity Science Centre is deeply embedded in (and shares the Zeeman building with) the two departments. Staff from the two departments (Connaughton, del Genio, Graham, Grosskinsky, House) and from Physics and Computer Science, have their offices within the Centre, and are engaged in interdisciplinary research, in particular through the supervision of PhD students in the Complexity Science CDT.

Taking the Complexity Science CDT together with other PhD-level interdisciplinary activities, including the MASDOC CDT, the MOAC (Molecular Organisation and Assembly of Cells) and Systems Biology CDTs, and PhD students based in the Centre for Scientific Computing and in DIMAP, there is an increasing number of PhD students who are co-supervised between the two departments within the Mathematical Sciences, or with staff from other Warwick departments. We consider this to be an increasingly important contribution to the strength of our research environment and PhD provision.

Additional support from the departments for interdisciplinary research comes through the organisation of the many interdisciplinary meetings and workshops organised by or through MIR@W, CRiSM, and the MRC and which reach local, national and international audiences.

Additional opportunities for interdisciplinary research are arising through institutional links. For example, the new Warwick/Monash Alliance has led to a fruitful research collaboration between Smith and an IT colleague at Monash in the development of decision support systems for food security, a project now supported by EPSRC.

Information about how our interaction with research users has informed research activity and strategy (including PhD training) is contained in our REF3a Impact Template.

Leadership in the Academic Community

The Department of Mathematics was delighted to have been awarded a **Regius Professorship** in the Queen's Diamond Jubilee list in early 2013 (one of only 12 in all subjects, and the only one in Mathematical Sciences in the UK).

Ball and **Roberts** have both been elected Fellows of the Royal Society (FRS, 2013) and **Ball** was, in addition, elected to as a Fellow of the Royal Society of Edinburgh (FRSE, 2013). **Firth** has been elected to the British Academy (FBA, 2008). **Kendall** was President-Elect and is now the President of the Bernoulli Society (2013-) and **MacKay** is President of the IMA (Jan 2012-Dec 2014). ***Nichols*** was elected Fellow of the American Statistical Association, 2012. **Stuart** was elected an inaugural SIAM fellow (2009) and **Ball**, **Series**, **Smillie**, **Vogtmann** and *David* ***Epstein*** were elected inaugural Fellows of the AMS (2013). **Barkley** (2008) and ***Kerr*** (2009) were elected

Fellows of the American Physical Society. ***French*** was elected an Honorary Fellow of the International Institute of Risk and Safety Management (2011).

Since RAE2008, a number of new prizes and honours have been awarded including the Ostrowski Prize (**Preiss**, 2012), two Royal Statistical Society Guy Silver Medals (**Roberts** 2008, **Firth** 2012), four Wolfson Research Merit Awards (**Hairer**, ***Hutton***, **MacKay** and **Stuart**), a Humboldt Research Award (**Elliott**, 2010), and a Philip Leverhulme Prize (**Ortner**, 2012). **Roberts** also won an Institute of Mathematical Statistics Medallion in 2009. **Stewart** won the first Zeeman Medal (2008) from LMS and IMA. **Ball** held a Clay Senior Scholarship (2011/12). **Reid** was Distinguished Professor at Sogang University in Seoul (2009-2012) under a Korean World Class University project, and is now (since May 2013) Scholar at the Korea Institute for Advanced Study. ***Kral*** won the European prize for Combinatorics (2011). **Mathe** won the Banakh prize (2012). **Graham** was placed first for online character recognition in the worldwide ICDAR Chinese Handwriting Competition (2013). **Kolokoltsov** won the St Petersburg University prize for the best research and teaching output in 2011, for the book *Understanding Game Theory*, World Scientific 2011. ***Nichols*** won the Wiley Young Investigator Award, Organisation for Human Brain Mapping, 2009. **Rossell** had a paper in the *Cancer Cell* 10 Best Articles list (2012). Staff who are holding or who have held personal research fellowships are listed in section (c) above.

Series and **Stuart** are serving on the REF2014 panel B10 Mathematical Sciences (and **Firth**, **MacKay**, **Preiss**, **Roberts**, and **Series** served on the RAE2008 panels). **Firth** represented Statistics and OR on the HEFCE REF Expert Advisory Group (2009).

Aston is now Hon Sec of the RSS Research Section (Jan 2013-) and was an external member for the Government Statistical Service (UK) Task Force on X-13-ARIMA-SEATS and Seasonal Adjustment 2011-12. **Ball** is Scientific Director of ICMS (2010-2014) and chair of ERCOM (the umbrella organisation for European mathematics research centres, since April 2013). **Firth** was Chair of the RSS Research Section (for a second time) in 2009. **Hairer** is a member of the scientific steering committees of the Oberwolfach Institute (2013-present), the Institute Henri Poincaré (2012-present), and of ETHZ-ITS (2013-present). ***Henderson*** is a member of the Meetings and Nominating Committees of the Bachelier Finance Society. **Jacka** chaired an International Review of Mathematics at the University of the West Indies, Mona Campus, 2011. **Keeling** is a member of the Joint Committee for Vaccination and Immunization (a Government advisory board), the Scientific Pandemic Influenza Modelling group (Department of Health), the BBSRC Animal Disease Working Group, and the Wellcome Trust Expert Review Group 5. **Kotecky** serves on the ERC Starting Grants review Panel 2007-12. ***Nichols*** was elected Secretary of the governing body of OHBM 2013-14. **Reid** was an External Review panel member for RIMS, Kyoto University, 2012. **Roberts** was an ISBA Board member 2007-2010. **Series** is Chair of EMS Women in Mathematics Committee, a member of the Norwegian National Promotions Committee (2012-), an Association of Commonwealth Universities Scholarship Commission Adviser (2007-13) and was President of the Maths section of the British Science Association in 2011. ***Sparrow*** was a member of an External Review panel for Monash University Mathematics, 2012. **Steel** was Chair of the Prize Committee of the International Society for Bayesian Analysis, 2012-13 and a panel member for the Research Council of Norway, 2013. **Stuart** was a member of the ICMS Programme Committee 2005-13, the Advisory Board for the Berlin Mathematical School 2009-13, the SIAM Fellows selection committee 2010-12 and the ICIAM/GAMM Collatz Prize Committee (since 2012). **Topping** was review panel member for an International Max Plank Research School (IMPRS), 2008 and a member of the Scientific Committee of the Oxford Centre for Nonlinear PDE 2008-1). **Vogtmann** was/is a member of the Scientific Advisory Committee for MSRI 2006-10, the ArXiv Advisory Board (since 2004) and the Park City Mathematical Institute 2010-.

Service on national mathematical bodies includes:

EPSRC: Roberts was a Member of the Mathematical Science Strategic Advisory Team (SAT) 2010-13. There are 25 submitted staff on the peer review College (and others who have served in the period and departed). Several staff have been involved in EPSRC panels including **Ball** (CDT outline sift panel, 2013) and **MacKay** (panel to review support for IHES 2012).

Newton Institute: Scientific Steering Committee members, **Preiss** (2009-12) and **Kendall** (2011-

14); **Series** was Chair of Correspondents, member of the Management Committee (2009-2012).

LMS: Council (**Kendall**, 2011-12); Nominating Committee, **Series**, Chair, 2010-12, **Ball** 2012-15, and **Stuart** 2011-13; Publications Secretary, ***John Jones***, 2011-12; Education Committee, **Mond**, 2009-13; Prizes Committee, **Ball** 2009, **Topping** 2013.

Royal Society: Sectional Committee 1, **Preiss,** ***David Epstein*** 2010-13; Travel Grants Panel, **Elliott**, **Keeling**, **Loeffler**, **Stuart**; International Joint Projects Panel, **Kendall**, till 2013.

Royal Statistical Society (where not already mentioned)**: Aston,** Research Section committee, 2011- ; **Firth**, Honours Committee, 2012- ; **Lawrance**, Chair, RSS West Midlands Group; **Robert C**, Research Section committee, 2006-09); **Roberts G,** Research Section committee, 2010-13, inaugural member of the Applied Probability Section committee, 2012-13, Honours Committee, 2013-, Publications Committee, 2010-13; **Smith**, RSS Statistics and Law Working group, 2009- ; **Steel**, Research Section committee, 2005-2008.

In recognition of their research within the period, five staff have been invited to lecture at the 2014 **International Congress of Mathematics** (**Hairer**, **Malchiodi**, **Pollicott**, **Stuart** and **Topping**). The numerous plenary and invited lectures delivered during the period include, as a small selection: **Ball**: Seminaire Bourbaki (IHP Paris) January 2012*;* **Elliott**: plenary lectures, MAFELAP 2013, Brunel; Humboldt Prize lecture, Berlin, 2010, GAMM 2010, 2010, Karlsruhe; Free Boundary Problems: Theory and Applications, Chiemsee, June 2012. ENUMATH, Uppsala, 2009; **Firth**: plenaries, 23rd Nordic Conference on Mathematical Statistics, Voss, 2010 and 26th International Workshop on Statistical Modelling, Valencia, 2011; **Hairer**: invited lecturer ECM, Krakow, 2012 and Lipschitz lectures (Bonn, July 2013); **Lozin**: plenaries: GO VIII 2012, LAWCG VI 2014; **Mackay**: plenary, BAMC/BMC Edinburgh, 2010, No Lineal 2012, Zaragoza*;* Melbourne: plenary, SIAM Conference on Applications of Dynamical Systems, 2009; **O'Connell**, Doob Lecture, 36th Conference on Stochastic Processes and their Applications, Boulder, July 2013*;* **Roberts**: Closing lecture: Hierarchical models and MCMC, Crete, 2011 and Opening Lecture, 9th Conference on Bayesian Nonparametrics, Amsterdam, 2013; **Rodrigo**: plenary, Royal Spanish Society Centenary, Young Researchers Conference 2011; **Series**: Larmore Lecture, Queen's University, Belfast, 2011*;* **Smillie**: plenary, 27th Brazilian Colloquium on Mathematics, 2009; **Steel**: CFE keynote speaker, 4th International Conference on Computational and Financial Econometrics, London, 2010; **Stewart**: The Queen's Lecture, Berlin 2008*,* keynote lecture, Festival della Matematica, Rome, 2009 and Royal Society 350th anniversary panel discussion (with Melvyn Bragg, Bill Bryson, Maggie Gee and Richard Holmes) 2010*;* **Stuart**: Invited lecturer, ECM, Krakow, 2012 and plenaries, SciCADE 2013, ENUMATH 2011, DSPDEs 2010 (SIAM); **Vogtmann**: plenary, BMC 2011.

We have not attempted to list the very many instances of conference organisation by staff members during the period, nor their normal editorial board / advisory board duties. **Ball**, **Hairer**, **Tribe** and (John) ***Jones*** were organisers of four or six-month Newton Institute programmes during the period, and ***Henderson*** was an organiser for a 6-month Fields Institute programme on Quantitative Finance. Staff hold or held the following more senior editorial positions: **Ball**: Founding editor-in-chief of Transactions LMS; **Cremona** and **Preiss**: joint editors of LMS Proceedings (2008-12); **Elliott**: Founding Editor (1 of 3), Interfaces and Free Boundaries; **Holt**: Editor-in-Chief, LMS Electronic J of Mathematics and Computation; **Jacka**: Editor-in-Chief, Stochastics; **Malchiodi**: Managing Editor, Calculus of Variations and PDEs; **Pollicott** and **Sharp**: Managing Editors, Ergodic Theory and Dynamical Systems; **Reid**: Editor, CUP LMS lecture notes series; **Robert C**: Editor, J Roy Stat Soc B (2006-09); **Roberts G**: Editor, J Roy Stat Soc B (2010-13); **Robinson**: mathematics consultant for the Oxford English Dictionary; **Steel**: Editor, Bayesian Analysis, 2010-.