EVALUATION OF THE FELLOWSHIP SCHEME 2007-2012

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CONTENTS

EXECUTIVE SUMMARY

ACT supports Cambridge University Hospitals (CUH) through a Fellowship Scheme which began in 2007. The objectives of this evaluation were to assess the impact of the scheme, its positioning in the context of the UK's capacity for clinical academic research, to inform future strategy and fulfil reporting obligations to donors.

It is widely recognised that research and innovation needs to address the changing needs of patients and key to delivering the research agenda is the development and maintenance of a clinical academic workforce i.e. those with active clinical practices *and* active in basic and/or clinical research. A number of influential reviews have prompted organisations such as the National Institute of Health Research (NIHR, the research arm of the NHS), the Medical Research Council (MRC) and the Wellcome Trust to develop strategic schemes to train a new generation of clinical academic researchers and expand the capability of translational research in the UK.

The ACT Fellowship scheme sits at the earliest stage in the pipeline of nurturing the next generation of clinical academics by providing short term support (1 year or less) and access to experienced mentorship and supervision. ACT fellowships are awarded annually, with the CUH Research Advisory Committee providing expert peer review of the fellowship applications. In practice candidates have existing CUH connections.

Between 2007 and 2012 18 fellowships were awarded (with a total value of £822,586), 10 in cancer research, 5 in other areas of medicine (cardiovascular, hepatology, immunology, transplantation, underpinning biology) and 3 'Maxwell Charnley' fellowships in dermatology.

The outcomes from the fellowships suggest the scheme is effective and strategically important to CUH:

- The research has made contributions to:
  - better understanding disease mechanisms;
  - developing and refining model systems to study the disease in the laboratory such as animal and cell culture models;
  - generating data to inform the design of clinical trials;
  - developing new methodologies and analytical techniques to diagnosis cancers, assess responsiveness to treatment and predict prognosis;
  - tailor existing therapies to optimise therapeutic benefit over side effects;
- 6 fellows published research papers acknowledging ACT in peer reviewed journals;
- Many of the fellows participating in the evaluation reported that they had presented their research finding at key scientific conferences and several received awards, prizes and accolades for research excellence;
- On immediate completion of the 15 'past' fellowships (i.e. 2007-2011), 10 fellows were retained in Cambridge, 2 fellows moved into other positions already in place and 2 fellows went onto clinical training. The immediate destination of one fellow is unknown.
- 14 fellows participated in the evaluation of the fellowship scheme with 11 of these fellows have completed their fellowship. Of these 11 past fellows, 10 secured external fellowships leading to a PhD qualification, including 6 prestigious MRC and Wellcome Trust

fellowships. These are highly competitive national schemes and the Wellcome Trust regard their '*Research Training Fellowship scheme as an important scheme for the Wellcome Trust and for the UK more broadly in building clinical research capacity and knowledge sharing'*.

Conclusions: The ACT fellowship scheme, through the guidance of the RAC and its Chair Dr John Bradley, has at the earliest stage identified and supported highly motivated and capable young clinical academics. The scheme is effective in fuelling the training pipeline with high calibre individuals and feeding into schemes of national importance to the UK.

The awards, prizes and success of the ACT fellows in securing follow on funding serves testament to the high calibre of the fellows, to their dedication to embarking on a clinical academic career and to the quality of the research and mentorship.

The bedrock of the scheme is the CUH environment which meets the institutional requirements highlighted by the Academy of Medical Sciences review (2009) for the training of clinical academics.

A number of recommendations have emerged from this evaluation:

- continue to assess outcomes and impact and respond effectively to the future challenges and opportunities for the CUH clinical academic workforce;
- add value and expand the scheme and promote connections and more visible collaborations with other organisations and funders and donors;

EVALUATION OF THE ADDENBROOKE'S CHARITABLE TRUST FELLOWSHIP SCHEME 2007-2012

Addenbrooke's Charitable Trust (ACT) is an independent registered charity for Cambridge University Hospitals NHS Foundation Trust and is dedicated to making a difference to improve the experience of patients, their families and the staff who care for them including supporting medical research. One of the ways that ACT supports Cambridge University Hospitals (CUH) is through a Fellowship Scheme which began in 2007.

The objectives of this evaluation were to:

- evaluate the impact and positioning of the scheme in the wider context of strengthening the UK's capacity for clinical academic research;
- gather evidence to inform future strategy;
- fulfil requirements for reporting back to donors.

CONTEXT

It is widely recognised that the needs of patients are changing and the NHS must evolve to meet these changing needs. Diseases are becoming more complex and with an ageing population there is increasing prevalence of cancer and degenerative diseases requiring specialist skills in diagnosis and treatment. Research and innovation need to address these requirements (Cooksey, 2006; Academy of Medical Sciences, 2009; 2013; Association of Medical Research Charities, 2013; Greenway, 2013).

The promotion of research across the health service is now a statutory requirement (Health and Social Care Act 2012). Medical research is expected to deliver healthcare benefits such that basic research into understanding disease mechanisms is expected to lead to new or changed treatment approaches and that translational and clinical research will enhance the effectiveness or efficiency of current available interventions and practices.

A key element to delivering the translational research[1] agenda is the development and maintenance of a clinical academic workforce[2] i.e. those with active clinical practices *and* active in basic and/or clinical research. Clinical academics with their clinical training, contact with patients and experience of healthcare delivery have a true understanding of the nature of the medical problem and, coupled with the acquisition of research skills and knowledge, are best positioned to transform research into tangible healthcare benefits for patients ('bench to bedside'). Importantly clinical academics are also positioned to ensure that clinical observations inform fundamental science ('bedside to bench').

[1] Translational research is defined as 'the process of translating discoveries in the laboratory into clinical interventions for the diagnosis, treatment, prognosis or prevention of disease with direct benefit to human health' (Minna & Gazdar 1996).

[2] Sometimes referred to and used interchangeably as clinician-scientists or physician-researchers.

The gulf between 'bench' and 'bedside' and missed opportunities where research discoveries fail to evolve and mature into benefits for patients ('valley of death') is a major problem prompting a number of independent influential reviews and publications which have identified factors that need to be addressed including:

- Lack of effective communication between basic scientists and clinicians or clinical academic researchers resulting, in part, from differences in culture, education and training backgrounds;
- Lack of resources including poor capacity, training, experienced mentorship and career opportunities for clinical academics.

[See Academy of Medical Sciences 2009, 2013; Butler 2008; Homer-Vanniasinkam & Tsui 2012; Roberts et al 2012).

The availability of research training fellowships are regarded as fundamental in training, supporting and nurturing a new generation of clinical academic researchers and in expanding the capability of translational research. Major public and private research funding organisations such as the National Institutes of Health in the US, and the National Institute of Health Research (NIHR, the research arm of the NHS), the Medical Research Council (MRC) and the Wellcome Trust in the UK have developed strategic schemes to address these and other issues.

ABOUT THE ACT FELLOWSHIP SCHEME

The ACT Fellowship scheme attracts and nurtures young clinicians and provides an entry point into clinical academic research. The key features are to provide fellows with short term support (1 year or less) and access to experienced mentorship and supervision. Its niche sits at the earliest stage in the pipeline of developing and training of the next generation of clinical academics.

An ACT Fellowship allows the fellow to generate research data, acquire research skills and experience and effectively compete for research training fellowships from the major funders. Importantly, as a short duration entry level scheme, it also provides an early exit and return to clinical duties should the fellow decide not to pursue a clinical academic career (with early exit being a recommendation of the Academy of Medical Sciences review 2009).

THE ACT FELLOWSHIP AWARD CYCLE

ACT awards a number of fellowships on an annual basis in the areas of cancer ('cancer fellowship'), dermatology ('Maxwell Charnley' fellowship) and general medical research. The scheme has evolved so that currently applications are invited from candidate fellows through advertisements on the ACT and CUH websites and in the medical press. It is an 'open' scheme although in practice the applicants are restricted to those in Cambridge or with existing connections to CUH. Often the candidates have identified a prospective mentor and

research project. The selection of the fellows takes place via a two stage application process where preliminary applications are scrutinised and peer reviewed by CUH Research Advisory Committee (RAC, chaired by Dr John Bradley). Short listed candidates are invited to submit a full proposal and then invited to interview and given opportunity to present their proposal and clarify any points. The review criteria are based on the calibre of the candidate and their ability to demonstrate dedication towards an academic career, scientific merit of the research proposal and high calibre supervision and mentorship. The RAC provide constructive feedback to the candidate around the qualities of the application and areas (including the proposed research and budget) that could be strengthened by modification.

PROCESS FOR THE EVALUATION OF THE ACT FELLOWSHIP SCHEME

The first stage was to bring together general information relating to the scheme (such as amount of the award, supervisor, areas and type of research supported etc) and to develop a 'Fellowship Review Form' (see Appendix 1) to capture information such as:

- the training experience, motivations and career intentions of the fellows (including next destination and future career plans);
- research outputs including dissemination of the research findings;
- recognition, accolades and prizes for academic and research excellence awarded by other bodies;
- leveraged funding;
- relevance to patients.

The measures used in the Fellowship Review Form were based on published measures and tailored to reflect the format of the ACT fellowship (i.e. short duration, early career funding). The following sources were used:

- Researchfish - a web-based research outcomes system designed for researchers and funding organisations (replaced the MRC's e-Val) see www.researchfish.com;
- 'Reviewing the returns of research: capturing payback from funding by the Arthritis Research Campaign' published by RAND Europe, 2006;
- 'The 'Payback Framework' explained' by Donovan & Hanney, 2011.

A second stage of field research took place between June 2013 and August 2013 and used the review form to gather information from the fellows either during face-to-face interview or via email.

Finally, the information and evidence gathered by field research was collated and forms the basis of this report.

GENERAL METRICS

Between 2007 and 2012, ACT awarded 18[3] research fellowships with a total value of £822,586. As a rule of thumb the cost of a fellowship was £50,000 to cover the one year salary and employment costs plus a £10,000 contribution towards the host laboratory's research costs. For some fellowships the contribution to the host laboratory was split 50/50 between ACT and NIHR Cambridge Biomedical Research Centre under the training theme[4]. Details are provided in Appendix 1.

The majority of fellowships were of one year duration but there were some of 6 months or less duration reflecting early success in securing follow-on funding from external sources.

The quality of mentorship and academic supervision was high – for example 11 fellows had supervisors who themselves are Fellows of the Academy Medical Sciences. [Note election to an AMS Fellow is prestigious and a peer review process based on exceptional contributions to the medical sciences (for further detail see http://www.acmedsci.ac.uk/p60.html)].

Of the 18 fellowships there were:

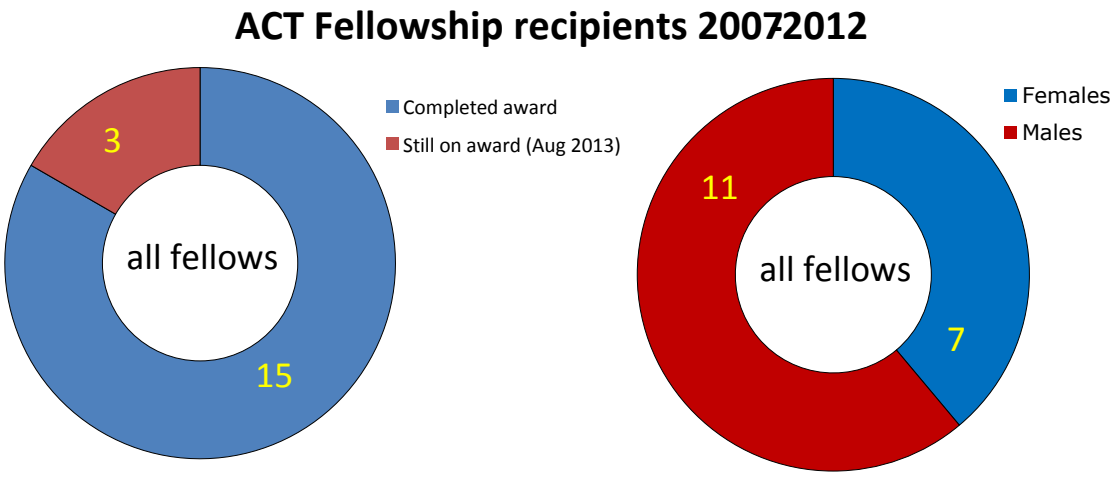
- *5* fellowships in *general medical research* including cardiovascular disease, fundamental biology, hepatology, immunology and transplantation;
- *10* fellowships relating to *cancer* research including blood, bowel, brain, breast, ovarian, paediatric, renal and thyroid cancers;
- *3* 'Maxwell Charnley' fellowships in *dermatology*.

Of the 18 fellowship recipients:

- there were 11 males and 7 females (i.e. approximate ratio of 1.5 to 1);
- 14 fellows took part in this evaluation (i.e. 78% participation rate) with one fellow being on maternity leave until 2014 and 3 fellows with whom contact had been lost.
- 10 fellows participated in the evaluation by completing the Fellowship Review Form via face-to-face interview and 4 fellows completed the form via email.

[3] During this period the Evelyn Trust also made 5 fellowships awards administered by ACT, which are not included in this evaluation.

[4] In 2013, 4 cancer related fellowships have been awarded funded across the ACT general medical and cancer funds and NIHR Cambridge BRC funds.



PEER REVIEWED RESEARCH PUBLICATIONS

The ACT fellowships have generally supported young fellows entering research training with the majority of fellows having no or limited research experience above that received as part of clinical training (although some fellows had undertaken voluntary work experience or received a small bursary towards short duration work experience in a research laboratory). Thus the ACT fellowships cover a period of acquisition of background knowledge and training in research skills and methodologies. Such early stage, coupled with the short duration of the fellowship, would suggest little opportunity for the fellows to contribute to full research publications in peer review journals. Nevertheless, six fellows as part of collaborations with other researchers, have publications (acknowledging ACT) in high quality peer reviewed journals (see Table 1 for details)[5]. Dr Lukas Niederreiter achieved two lead author papers relating to the biology of intestinal inflammation and tumour formation and Dr Hamid Raza Ali achieved two lead author and a third paper relating to the development of new histopathological methods for diagnosing breast cancer and predicting response to therapy.

[5] Publications were reported by the fellows or by a literature search (July 2013) using PubMed, PubMed Central, Google Scholar and Scopus

TABLE 1: Full research papers published in peer reviewed medical and scientific journals

Year of fellowship	Year of publication	Citation
2011	2013	Niederreiter L et al. ER stress transcription factor Xbp1 suppresses intestinal tumorigenesis and directs intestinal stem cells. *J Expt Med* 2013; 210; 2041-56. Adolph TE, Tomczak MF, Niederreiter L* et al. Paneth cells as a site of origin for intestinal inflammation. *Nature* 2013; 503: 272-276. *joint lead author
2010	2011	Gounaris I, Charnock-Jones DS, Brenton JD. Ovarian clear cell carcinoma -- bad endometriosis or bad endometrium? *J Pathol* 2011; 225: 157-160.
2009	2013	Benham H et al Th17 and Th22 cells in psoriasis and psoriatic arthritis. *Arthritis Res & Therapy* 2013 15; R136.
2009	2011 2012 2012	Raza Ali H, Dawson S-J, Blows FM, Provenzano E, Pharoah PD, Caldas C. Cancer stem cell markers in breast cancer: pathological, clinical and prognostic significance. *Breast Cancer Res* 2011; 13(6): R118. Ali HR, Dawson SJ, Blows FM, Provenzano E, Pharaoh PD, Caldas C. Aurora kinase A outperforms Ki67 as a prognostic marker in ER-positive breast cancer. *Br J Cancer* 2012 106**:** 1798-806. Yuan Y, Failmezger H, Rueda OM, Ali HR, Graf S, Chin SF, Schwarz RF, Curtis C, Dunning MJ, Bardwell H, Johnson N, Doyle S, Turashvili G, Provenzano E, Aparicio S, Caldas C, Markowetz F. Quantitative image analysis of cellular heterogeneity in breast tumors complements genomic profiling. *Science Translational Medicine* 2012; 4: 157ra143
2008	2010	Sarwar N, Aspelund T, Eiriksdottir G, Gobin R, Seshasai SRK, Forouhi NG, Sigurdsson G, Danesh J, Gudnason V. Markers of dysglycaemia and risk of coronary heart disease in people without diabetes: Reykjavik prospective study and systematic review. *PLoS Med* 2010; 7: e1000278.
2007	2010	Malzer E, Daly M-L, Moloney A, Sendall TJ, Thomas SE, Ryder E, Don Ryoo H, Crowther DC, Lomas DA, Marciniak SJ. Impaired tissue growth is mediated by checkpoint kinase 1 (CHK1) in the integrated stress response. *J Cell Sci* 2010; 123: 2892–2900.

RESEARCH ABSTRACTS, PRESENTATIONS AND PRIZES

10 of the 14 fellows participating in the evaluation reported having published scientific abstracts and making presentations at key meetings in the field of research and also at major internal meetings such as University of Cambridge Graduate Research Symposium and the Cancer Research Institute retreat. Several of the fellows received travel bursaries and awards for their presentations at scientific conferences (see Appendix 3 for details).

Some fellows delivered training to colleagues both at local and national levels.

DESTINATIONS / RETENTION IN CAMBRIDGE

The evaluation collected information on 'next destination' of the fellow on immediate completion of the ACT fellowship and, as far as possible given the limited size of the cohort, longer term destinations or intentions. Not all past fellows participated in the evaluation; however, information regarding immediate destination could be gleaned from the internet and publication records. Of the 15 fellowships awarded between 2007-2011 (with three 2012 fellowships still in progress in Cambridge determined Aug 2013), 10 past fellows were immediately retained in Cambridge, 2 fellows returned or took up positions that had been in place or arranged prior to commencing the ACT fellowship i.e. Dr Helen Benham returned to Australia and Dr Tom Booth moved to the National Hospital for Neurology and Neurosurgery in London (Drs Benham and Booth retain academic links with CUH), 2 fellows took up clinical training posts (i.e. Dr Nicholas Rabey training post in plastic surgery in Oxford/Portsmouth and Dr Elizabeth Wallin continued clinical training in Addenbrooke's and Ipswich). The immediate destination of the remaining fellow (SYT) is unknown.

For some fellows research data generated during an ACT fellowship was published and for other fellows research data may have been immature and not ready for 'prime time' publication. Nevertheless the generation of research data, together with experience gained, has been of clear value in supporting applications to major external funders. 10 of the 11 past fellows who participated in the evaluation securing external funding to either start or continue a programme of research leading to a PhD qualification (see Table 2 for details). Information gathered from internet sources suggests that 2 of the fellows who did not participate in the evaluation went on to undertake PhDs or other research in Cambridge.

External funding came from:

- Other grant giving medical research charities with an interest in the field of research - Cancer Research UK, Crohn's in Childhood Research Associationand the Kay Kendall Leukaemia Fund;
- Clinical Research Training Fellowships schemes from the Wellcome Trust, the Medical Research Council (MRC) and the Royal College of Radiologists;
- Institutional funding to support 'own' (Princess Alexandra Research Fellowship & University of Queensland Research Scholarship, CUH NIHR Cambridge Biomedical Research Centre).

TABLE 2: Past ACT fellows (who participated in the evaluation) in receipt of follow-on funding towards a PhD qualification

Fellow	**Funder**
Ines Harper 2008	Wellcome Trust Clinical Research Training Fellowship PhD continuation
Helen Benham 2009	Princess Alexandra Research Fellowship & University of Queensland Research Scholarship PhD continuation
Nicholas Matheson 2009	Wellcome Trust Clinical Research Training Fellowship PhD
Hamid Raza Ali 2009	CUH NIHR Cambridge Biomedical Research Centre PhD continuation
Thomas Booth 2010	MRC/Royal College of Radiologists Clinical Research Training Fellowship British Association of Cancer Research Student Award EG Fearnsides Scholarship Award, School of Clinical Medicine, University of Cambridge Cancer Research UK Clinical Research Training Fellowship CCACE MRC Centenary Early Career Researcher Awards PhD
Shaun Flint 2010	Wellcome Trust Fellowship - Translational Medicine and Therapeutics scheme (part funded by GSK) PhD
Ioannis Gounaris 2010	MRC Clinical Research Training Fellowship PhD
Lukas Niederreiter 2011	Crohn's in Childhood Research Association PhD continuation
Nicholas Grigoropoulos 2011	Kay Kendall Leukaemia Fund PhD
Elizabeth Wallin 2011	MRC Clinical Research Training Fellowship PhD (University of Oxford, start Dec 2013)

'Dream run' was how one fellow described securing an ACT fellowship which served as a good grounding and allowed a successful single external fellowship application

'…fantastic opportunity to get started in research and provided me with preliminary data to support my formal PhD funding application....'

'… the ACT 'process' and fellowship was useful in building confidence and training. At interview [for an external follow-on fellowship] being in receipt of funding was viewed positively..'

'…ACTfellowship kicked in at the right time'…

CAREER INTENTIONS

The scheme began in 2007 and many of the fellows went on to complete a PhD (i.e. at minimum an additional two years of research) and then complete clinical training. Given the small size of the cohort there is very limited data on 'actual' career path. Nevertheless the fellows who participated in the evaluation, who were either mid or had just completed a PhD or when onto further clinical training, expressed the intention to continue on the clinical academic track.

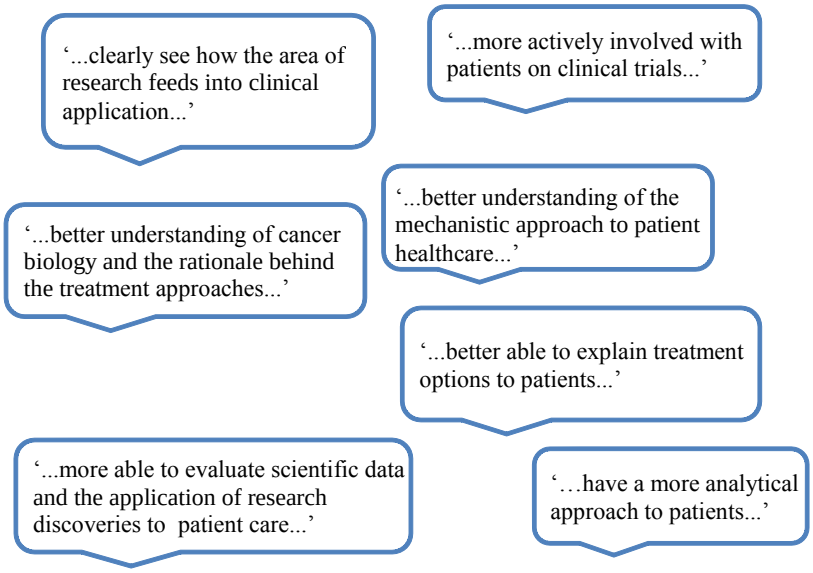
BENEFITS TO PATIENTS

The scheme has funded the earliest stage of training of clinical academics providing short term support (between 6 months and one year). The research undertaken has potential to inform future research that may ultimately deliver benefits for patients or more effective and efficient health service delivery. The research covered by the fellowships ranged from basic research through to translational and clinical research making contributions to:

- better understanding of disease mechanisms;
- developing and refining laboratory systems to study the disease such as animal and cell culture models;
- generating data to inform the design of clinical trials in patients;
- developing new methodologies and analytical techniques to diagnosis cancers, assess responsiveness to treatment and predict prognosis;
- tailor existing therapies for individual patients to optimise the balance between the desirable therapeutic effect and unwanted side effects.

Whilst the realisation of tangible benefits to patients does lie in the future, the research training has delivered less tangible yet important immediate patients benefits exemplified by comments from the fellows.

INTANGIBLE YET IMMEDIATE PATIENT BENEFITS EXEMPLIFIED BY COMMENTS FROM THE FELLOWS



STRATEGIC VALUE OF THE ACT FELLOWSHIP SCHEME

The impact and importance of the ACT fellowship is anticipated to grow in line with reforms within the NHS and statutory obligations to integrate research into the delivery of healthcare. In addition there are demands for protected research time and increasing flexibility to be built into the clinical training programme to allow the development of the new generation of clinical academics.

The bedrock of the ACT fellowship scheme is the CUH environment and the calibre of opportunities this provides for clinical academic training. The Academy of Medical Sciences review (2009) identified a number of key institutional factors stating that research training for clinical academics 'should take place in the very best and stimulating research environments which may involve training in a basic scientific environment pertinent to their clinical academic interest' and there should be 'cross fertilisation with …. basic and clinical research areas including access to technology and engineering platforms'.

The Academy of Medical Sciences review (2009) highlighted specific institutional requirements:

- 'thriving research environment'
- 'sound academic record'
- 'opportunities for inter-disciplinary working'
- 'technological breath and access to underpinning technology platforms'
- 'visible academic leadership'
- 'robust partnerships with the NHS'

The environment of CUH NHS Trust excels in meeting these requirements as a fertile ground for training clinical academics. CUH serves a critical role in translating research discoveries in healthcare benefits, being recognised both nationally and internationally as a centre of excellence where ideas created in the laboratory are translated into benefits for patients. This is exemplified in *Clinical Research Network Portfolio Activity League Table* published by the NIHR, where CUH is positioned 5th (out of 311) with regard to the number of clinical studies performed and the number of patients volunteering to take part in clinical research between 2012 and 2013. During this year CUH recruited 11,760 patients into 328 clinical studies (see **http://www.crncc.nihr.ac.uk/health%20professionals/research_performance/index).**

The opening of the Cancer Research UK Cambridge Institute in 2007 consolidates CUH's position as a centre of excellence for cancer research. This major investment has the potential, through a better fundamental understanding of cancer biology, to improve methods for screening and diagnosing cancer and to develop more effective and life saving treatments. ACT has supported cancer research with 10 out of the 18 fellowships being cancer related and some of them in the Cambridge Cancer Research Institute.

THE STRATEGIC VALUE OF THE ACT FELLOWSHIP SCHEME EXEMPLIFIED BY COMMENTS FROM THE FELLOWS

The awards, prizes and success of the ACT fellows in securing follow on funding serves testament to the high calibre of the fellows, to their dedication to embarking on a clinical academic career and to the quality of the research and mentorship. ACT fellows compete effectively in highly competitive national schemes. The success rate for applicants to the MRC scheme is approximately 22% (see Table 3) and for the Wellcome Trust is around 18% with an annual average of 18 fellowships being awarded from 216 applications (Annie

Sanderson, Data Analyst, Wellcome Trust 2013). The Wellcome Trust regard their '*Research Training Fellowship scheme as an important scheme for the Wellcome Trust and for the UK more broadly in building clinical research capacity and knowledge sharing'* (Wellcome Trust Career Tracking Report: Wave 1). Dr Tom Booth was the recipient of a joint MRC/Royal College of Radiologists Clinical Research Training Fellowship, the only such award since 2009.

The Wellcome Trust have tracked the career of their past Fellows and reported that early research experience better prepares. The ACT scheme operates at the earliest point of the pipeline.

TABLE 3: Applicant success rates for the MRC clinical research training fellowships http://www.mrc.ac.uk/Fundingopportunities/Applicanthandbook/Successrates/Applicationsuccessrates/index.htm#P78_1107).

	MRC Clinical Research Training Fellowship Scheme		
Year	No. of applications	No. of awards	Success rate
2011/12	196	44	22%
2010/11	198	48	24%

With the guidance of the RAC and its Chair Dr John Bradley, ACT at the earliest stage identified and supported highly motivated and capable young clinical academics and fuelled the training pipeline with high calibre individuals. 6 out of 10 past fellows who went onto to start or continue a PhD, did so by securing funding from the MRC or Wellcome Trust research fellowship schemes, showing the ACT fellowship scheme is of clear value in feeding into prestigious schemes of national importance to the UK.

The comparatively small number of females in clinical academia is of great concern to the Academy of Medical Sciences (2009). The Wellcome Trust Clinical Career Tracker reported 11 female and 31 male recipients of Research Training Fellowships (2006-2010). The ACT scheme with a gender ratio of 1 female : 1.5 males compares favourably.

STRATEGIC RECOMENDATIONS

The Evaluation of past ACT fellowships had shown the scheme to be successful and high impact. Recommendations are made around adding value to the existing fellowship scheme and creating opportunities to expand the scheme and address gaps in research training pathways.

These recommendations take into account ACT's charitable objectives in supporting CUH NHS Trust, the feasibility of implementation and, on a practical level, other available resources and collaborative opportunities.

RECOMMENDATIONS

1. Continue to assess the impact of the scheme and regularly gather outcomes and information to better understand and respond effectively to the challenges and opportunities for the CUH clinical academic workforce.

2. Establish a past fellows networking event and other networking opportunities of practical benefit to fellows and prospective candidates.
3. Ensure the Fellowship scheme continues to attract talented young people and provides early entry around clinical academic research.

4. Expand the scheme to strengthen other transition points in the clinical academic training pathway e.g. intermediate fellowships.

5. Consider expanding the scheme to include healthcare professions such as nurses, healthcare scientists and other healthcare professionals.

6. In the longer term, explore the value, desire, opportunities and practicalities for formalising the international context of ACT fellowships and in fostering connections and collaborations with the pharmaceutical / biotechnology industry.

CONCLUSIONS

The role of ACT is to support and promote CUH in its aim to be one of the best academic healthcare organisations in the world for the benefit of patients. Clinical academics, healthcare scientists and allied healthcare professionals play a significant role in delivering this aim, yet entry and progress in these training and career pathways can be difficult. National schemes are in place to address these issues, but competition for such external resources is high and gaps remain. It is appropriate for an NHS Charity to support clinical academic training and bridge these gaps as part of the interplay between research and patient benefit.

ACKNOWLEDGEMENTS

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APPENDIX 1: FELLOWSHIP REVIEW FORM

REVIEW OF ADDENBROOKE'S CHARITABLE FELLOWSHIP SCHEME 2007-2012
(DATE OF REVIEW)

NAME OF FELLOW	
YEAR OF FELLOWSHIP	
TITLE (£)	
AREA OF RESEARCH COVERED IN FELLOWSHIP Include short description or key words	
CURRENT POSITION	
DESTINATION / CAREER DEVELOPMENT e.g. • Post taken up on completion of fellowship • Career development: other new posts, promotions, appointments, positions of responsibility • Retention in field covered by fellowship • Retention in Cambridge	
DISSEMINATION / KNOWLEDGE SHARING OF FELLOWSHIP RESEARCH E.g. (please list) • Publications • Presentations (oral, poster) – give name of meeting • Participation in workshops, seminars etc • Media briefings	
AWARDS AND RECOGNITION (resulting from work undertaken during fellowship)	
LEVERAGED FUNDING e.g. • Strengthening grant / fellowships applications to external organisations • New collaborations	
TRAINING AND DEVELOPMENT OF RESEARCH OR TECHNOLOGICAL SKILLS • Acquired during fellowship • New qualifications acquired after fellowship	
PATIENT OR HEALTHCARE BENEFITS e.g. • has the research changed patient management • informed or influenced policy or clinical guidelines	
IP / RESEARCH TOOLS / SPIN OUTS	
OTHER RELEVANT INFO	

APPENDIX 2: SUMMARY OF ACT FELLOWSHIPS 2007-2012

Year Award	**Fellow***indicates Fellow of Academy of Medical Sciences	**Participated in evaluation**	**About the research**	**Immediate destination**	**Where now (Feb 2014) / current position**
2007 £45,000	Marie-Louise Daly Mentor: Prof David Lomas*	NO maternity leave until mid 2014	*Molecular pathways in the regulation of PERK and its involvement in ER-stress* FUNDAMENTAL BIOLOGY: genes, drosophila model, preclinical	Retained in Cambridge	CLINICAL FELLOW (Dermatology) Kings College Hospital (2012)
2007 £37,413	Emma Gudgin Mentor: Dr Brian Huntly	NO lost contact	*Transcriptional Control of the CDX-HOX pathway in Acute Myeloid Leukaemia* CANCER: acute myeloid leukaemia (AML) cell lines, patient samples, new treatments; translational / clinical research; haematology / oncology	Retained in Cambridge at Institute of Stem Cell Research	Since 2010 associate faculty member at Cambridge Institute of Stem Cell Research - remains part of Brian Huntly's team
2008 £50,000	Ines Harper Mentor: Dr Gavin Pettigrew	YES	*Humoral autoimmunity and allograft vasculopathy* TRANSPLANTS: mouse model, cell cultures, translational / preclinical	Retained in Cambridge and in field	ACADEMIC CLINICAL FELLOW (Radiology) University of Cambridge
2008 £20,000	Rao Kondapally Seshasai (co-funded with Gates Foundation) Mentor: Prof John Danesh	NO lost contact	*Quantifying the impact of glycaemic control on the risk of coronary heart disease: analysis of case-control data of 5,000 participants from the Pakistan Risk of Myocardial Infarction Study (PROMIS)* CARDIOVASCULAR DISEASE: clinical, epidemiology / public health, coronary heart disease	Retained in Cambridge and in field	Went on to PhD in Dept Public Health and Primary Care, Cardiovascular epidemiology Unit, Cambridge; from 2011 Clinical Lecturer in Cardiology at St George's

Year Award	**Fellow** *indicates Fellow of Academy of Medical Sciences	**Participated in evaluation**	**About the research**	**Immediate destination**	**Where now (Feb 2014) / current position**
2008 £60000	Soo Yeun Teo Mentor: Prof V Peter Collins*	NO lost contact	*Biological and clinical significance of alterations in chromosome 1 in paediatric medulloblastoma* CANCER (PAEDIATRIC): molecular histopathology, human tissue, prognostic indicators, translational	Unknown	Unknown
2009 £60,000	Helen Benham Maxwell Charnley Mentor: Prof Hill Gaston*	YES	*The role of IL-22 producing lymphocytes in the pathogenesis of psoriasis and psoriatic arthritis* DERMATOLOGY/RHEUMATOLOGY: Lab based, disease pathology, new targets	As planned, returned immediately to Australia; retained in field	University of Queensland Diamantina Institute PhD scholarship (completion 2013) Consultant Rheumatologist at Princess Alexandra Hospital Brisbane Continued collaboration with Prof Hill Gaston
2009 £37,077	Nicholas Matheson Mentor: Prof Paul J Lehner*	YES	*Characterisation and functional analysis of the TRC8 tumour suppressor gene, a novel ubiquitin E3 ligase* CANCER (RENAL): lab based, molecular pathophysiology, tumour suppressor genes, immunity, infectious disease	Retained in Cambridge and in field	WELLCOME TRUST RESEARCH TRAINING FELLOWSHIP CUH
2009 £45,000	Hamid Raza Ali Mentor: Prof Carlos Caldas*	YES	*Digital morphometric analysis of cancer stem cells in breast carcinoma* CANCER (BREAST): translational, diagnostic services, histopathology	Retained in Cambridge and in field	CLINICAL LECTURER (Pathology) CUH Recipient of ACT research award

Year Award	**Fellow***indicates Fellow of Academy of Medical Sciences	**Participated in evaluation**	**About the research**	**Immediate destination**	**Where now (Feb 2014) / current position**
2010 £39,725	Ioannis (John) Gounaris Mentor: Dr James Brenton	YES	*Examination of the role of ARID1A in endometrial proliferation, endometriosis and endometriosis-associated ovarian cancer pathogenesis* CANCER: cancer biology, biomarkers, early diagnosis, animal model	Retained in Cambridge and in field	CLINICAL RESEARCH FELLOW PhD student Cancer Research UK Institute Cambridge, CUH
2010 £25,000	Thomas Booth Mentor: Prof Kevin Brindle*	YES	*The development of new imaging methods for detecting brain tumour response to treatment* CANCER (BRAIN): glioblastoma, imaging methodology/ analysis, rat model , biomarkers, measuring early brain tumour response to therapy, translational	Planned posting in London; retains some connections with Cambridge	NEURORADIOLOGY FELLOW National Hospital for Neurology and Neurosurgery, London
2010 £61427 reduced to 6 months	Shaun Flint Mentor: Prof Kenneth Smith*	YES	*Analysis of gene expression in purified leukocyte subsets and correlation with clinical outcomes for patients with active Systemic Lupus Erythematosus (SLE)* IMMUNOLOGY: lab based, translational	Retained in Cambridge and in field;	CLINICAL RESEARCH FELLOW (Medicine) PhD student; CUH.
2011 £53,000	Nicholas Grigoropoulos Mentor: Prof Ming-Qing Du	YES	*The genetic basis of diffuse large B-cell lymphoma refractory to R-CHOP treatment* CANCER (BLOOD): clinical & translational research, 'tumour' bank	Retained in Cambridge and in field	CLINICAL RESEARCH FELLOW PhD student CUH

Year Award	**Fellow***indicates Fellow of Academy of Medical Sciences	**Participated in evaluation**	**About the research**	**Immediate destination**	**Where now (Feb 2014) / current position**
2011 £41,290	Lukas Niederreiter Mentor: Prof Arthur Kaser	YES	*Epithelium intrinsic role of XBP1 in colitis associated with cancer* CANCER: lab based, lab models	Retained in Cambridge and in field	CLINICAL RESEARCH FELLOW PhD student CUH
2011 £45,069 9 months	Nicholas Rabey (Maxwell Charnley) Mentor; Prof Fiona M Watt*	YES	*Fibroblast gene expression in hypertrophic scars and cutaneous squamous cell carcinoma* MAXWELL CHARNLEY: DERMATOLOGY / CANCER (SKIN): lab based, pathogenesis, genomics, immunohistochemistry, human skin biopsies, towards identification of new therapies	Short term training post in plastic surgery	SPECIALIST REGISTRAR Dept Plastic & Reconstructive Surgery, Queen Alexandra Hospital, Cosham, Portsmouth
2011 £44,106	Elizabeth Wallin Mentor: Dr David Jayne*	YES	*Lymphocyte analysis in health and autoimmunity* IMMUNOLOGY: clinical, optimising therapy	Completed clinical training in Ipswich	CLINICAL RESEARCH FELLOW PhD student University of Oxford Collaboration with Cambridge based PhD supervisor
2012 £43,000 Current	Abby MacBeth (Maxwell Charnley) Mentor: Dr David Jayne*	YES	*Understanding lupus: interferon-alpha related pathways in skin & blood' clinical, optimising therapy* DERMATOLOGY : clinical & translational; optimising therapy for patients	n/a	In post as ACT CLINICAL RESEARCH FELLOW (part time) CUH
2012 £57,479 Current	Richard Mair Mentor: Prof Kevin Brindle*	YES	*Stratifying anti-angiogenic response in glioblastoma* CANCER (BRAIN): glioblastoma, lab based models, tumour avatar		CLINICAL RESEARCH FELLOW PhD student Cancer Research UK Cambridge Institute, CUH

Year Award	**Fellow***indicates Fellow of Academy of Medical Sciences	**Participated in evaluation**	**About the research**	**Immediate destination**	**Where now (Feb 2014) / current position**
2012 £58,000 Current	Fotis Sampaziotis Mentor: Dr Ludovic Vallier	YES	*In vitro modelling of cholestasis associated with cystic fibrosis: development of a platform for the generation of cholangiocytes from human induced pluripotent stem cells* HEPATOLOGY: lab based models, iPSCs, cell cultures, regenerative medicine	n/a	

APPENDIX 3: PRESENTATIONS, PRIZES AND ACCOLADES

Ines Harper 2008	British Transplantation Society 2009 (**recipient of the best abstract award**) American Transplant Congress 2009; European Society Organ Transplantation 2009 University of Cambridge Graduates Research Symposium (**recipient of best presentation award**) Dr Harper secured a Wellcome Trust fellowship which extended the ACT funded work and has extensively presented the research findings on the national and international stage e.g. British Transplantation Society 2010/ 2011, The Transplantation Society 2010 (**recipient of Basic Science TTS award**), European Society for Organ Transplantation 2011 (**recipient of Travelling Fellowship**).
Helen Benham 2009	Poster presentation on *Th17 and Th22 cells in psoriasis and psoriatic arthritis* at the British Society for Immunology Conference 2009 Oral Presentation on *Th17 and Th22 cells in psoriasis and psoriatic arthritis* at the Australian Rheumatology Association Annual Scientific Meeting 2010 **(New investigator award finalist)**
Nicholas Matheson 2009	Raymond and Beverly Sackler Studentship 2011-2013 Trinity College Research Scholarship 2011-2013 Keystone Metabolic Control of inflammation and Immunity meeting 2013 **(recipient of British Society for Immunology travel award)** University of Cambridge Department of Medicine Retreat **(recipient of graduate student poster prize)** Cambridge Immunology Forum 2012 **(recipient of graduate student poster prize)** British Society for Immunology Congress 2011 **(shortlisted for 'Bright Sparks in Immunology' prize)**
Tom Booth 2010	Presentation on *Determination of the pKa of a hyperpolarized H13CO3- pH probe* at the International Society for Magnetic Resonance in Medicine (Melbourne Australia 2012) Booth TC et al Proc Intl Soc Mag Reson Med 2012; 20:1671 Presentation on *Minkowski functional image analysis allows pseudoprogression to be differentiated from progression in brain tumours* at the annual meeting for the Society of Neuro-oncology (Washington DC, 2012). Booth TC et al Neuro-oncology 2012; 14 (S3): iii35 British Association of Cancer 2011 Research Student Award
Shaun Flint 2010	Research updates to colleagues to facilitate recruitment to the Renal Department
Ioannis (John) Gounaris 2010	Cancer Research Institute Retreat: Research update Poster presentations at the European Cancer Congress 2013 (ECCO/ESMO, Netherlands) and the 2013 National Cancer Research Institute meeting

APPENDIX 3: PRESENTATIONS, PRIZES AND ACCOLADES (continued)

Lukas Niederreiter 2011	UEGW (United European Gastroenterology Week) (>14000 attendees) 2012 Amsterdam. Recipient of **'Certificate of Excellence'** in 'Insights into Colorectal Cancer' session [Gut 2012 61: (53): A54]; travel award by UEG. 8th ECCO (European Crohn's and Colitis Organisation) congress (>4500 attendees) - February 2013 Vienna. Plenary session. **Recipient of Top Abstract prize** (Top 5 of >700 abstracts) DDW (Digestive Disease Week) (>15000 Attendees) - May 2013 Orlando. **Distinguished Abstract Plenary**. SymBLS - Graduate student life science conference - September 2012 Cambridge Peterhouse College
Elizabeth Wallin 2011	Poster presentation at ANCA Workshop, Paris 2013
Abby MacBeth 2012	Presentations on 'Out of Programme Research' (e.g. practical aspects on looking for and secure funding) to colleagues i.e. local level and to trainees connected to UK Dermatology Clinical Trials Network i.e. national level
Fotis Sampaziotis 2012	Informal presentations to collaborators

APPENDIX 4: SOME FELLOWSHIP STORIES

Dr Helen Benham (2009): ***The role of IL-22 producing lymphocytes in the pathogenesis of psoriasis and psoriatic arthritis £60,000 Maxwell Charnley Fellowship***

Under the mentorship of Professor Gaston Hill, this project formed Year 1 of Helen's PhD and the research contributed to understanding disease mechanisms in psoriasis and psoriatic arthritis by characterising immune cells in both diseases, which may in the future be targeted for therapy.

On completion of the ACT fellowship, Helen returned to Australia as a Consultant Rheumatologist at the Princess Alexandra Hospital in Brisbane, Australia and secured a scholarship to complete her PhD at The University of Queensland Diamantina Institute. Helen maintains collaborative links with Professor Hill Gaston in Cambridge and in 2013 was a finalist for the 'New Investigator Award' by the Australian Rheumatology Association.

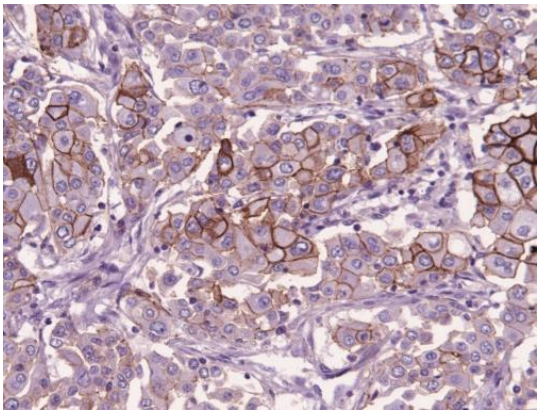
Helen's ambition is to combine clinical, research, and teaching work for the betterment of her patients and all those with who suffer with rheumatological disease.

Courtesy of The University of Queensland Diamantina Institute

Dr Hamid Raza Ali (2009): ***Digital morphometric analysis of cancer stem cells in breast carcinoma £45,000***

Dr Raza Ali completed the fellowship under the mentorship of Professor Carlos Caldas at the Cancer Research UK Institute and used state of the art computational techniques to develop new methods for use in pathology laboratories to classify breast cancer. The fellowship formed Year 1 of Raza's PhD, with Years 2 and 3 supported by the Cambridge Biomedical Research Centre. In 2012, Raza received further ACT support to strengthen an innovative collaboration with the University of Cambridge's Institute of Astronomy and has since been appointed an academic clinical lecturer at the Department of Pathology funded by the NIHR. The collaboration uses sophisticated image analysis and computational techniques to develop methods of personalised breast cancer therapy by predicting the risk of tumour recurrence and which patients are not likely to benefit from standard treatment. This research has been published in high profile research papers with Raza participating in press and TV interviews.

Feb 2013 Dr Raza Ali said *"We've exploited the natural overlap between the techniques astronomers use to analyse deep sky images from the largest telescopes and the need to pinpoint subtle differences in the staining of tumour samples down the microscope"*[6].



A highly magnified image of breast cancer cells. The brown staining shows some cells which express high levels of a protein called integrin alpha-6 (ITGA6). The combination of elevated levels of IGTA6 and the other proteins may serve as a 'marker' to identify patients at higher risk of the cancer returning.

Dr Ioannis (John) Gounaris (2010): ***Examination of the role of ARID1A in endometrial proliferation, endometriosis and endometriosis-associated ovarian cancer pathogenesis £39,725***

Under the mentorship of Dr James Brenton, John set out on a programme of research to study the fundamental biology of endometrial and ovarian cancer and to develop and refine animal models to study the disease in the laboratory. This research has potential to provide new methods for screening and early diagnosis of ovarian cancer in at risk populations (i.e. women with endometriosis). John used the experience, knowledge and research data generated in the very early stages of this fellowship to secure a prestigious MRC Clinical Research Training Fellowship. Working at the Cambridge Cancer Research Institute he now has established a network of research collaborations in the Cambridge area and internationally.

Dr Lukas Niederreiter (2011): ***Epithelium intrinsic role of XBPI in colitis associated cancer £41,290***

Under the mentorship of Professor Arthur Kaser, Lukas's project investigated the role of the ER stress transcription factor Xbp1 in the formation of tumours in the intestine. This project formed one year of Lukas's PhD, with Years 2 and 3 being funded by Crohn's in Childhood Research Association. Lukas has presented research findings at several conferences and in 2012 received a 'Certificate of Excellence' from the United European Gastroenterology Society.

[6] See more at: http://www.cam.ac.uk/research/news/cancer-researchers-and-astronomers-team-up-to-beat-cancer#sthash.xFe55l9z.dpuf; http://www.dailymail.co.uk/sciencetech/article-2281475/Scientists-borrow-technique-used-astronomers-distant-galaxies-identify-cancerous-tumours.htm

Dr Nicholas Grigoropoulos (2011): ***The genetic basis of diffuse large B-cell lymphoma refractory to R-CHOP treatment £53,000***

This project, under the mentorship of Professor Ming Qing Du, studied the genetic abnormalities of diffuse large B-cell lymphoma - the most common aggressive lymphoma. For Nicholas, this work contributed to Year 1 of his PhD, with the Kay Kendall Leukaemia Fund funding Years 2 and 3. Nicholas has been lead author on a series of educational and influential reviews published in the British Medical Journal on best practice for the diagnosis of leukaemia and care of patients in the community.

Dr Elizabeth Wallin (2011): ***Lymphocyte analysis in health and autoimmunity £44,106***

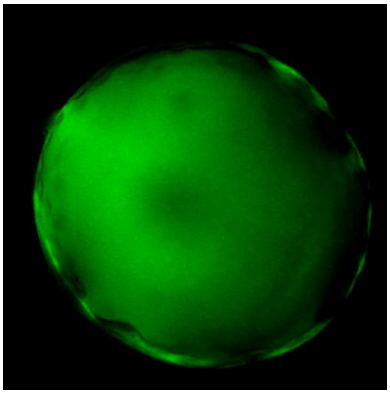
This research, under the mentorship of Dr David Jayne, contributed to a better understanding of fundamental biology and pathophysiology of autoimmune diseases generating new knowledge to predict prognosis and personalise the use of existing immunosuppressive therapies. Following the ACT fellowship Elizabeth returned to clinical duties and secured a MRC Clinical Research Training Fellowship for a PhD in renal immunology (Dec 2013) at the University of Oxford. Elizabeth continues to collaborate with Cambridge researchers, one of whom will co-supervise her PhD.

Abby MacBeth (2012): ***Understanding lupus: Interferon-alpha related pathways in skin & blood' clinical, optimising therapy £43,000 Maxwell Charnley Fellowship***

Abby's project, under the mentorship of Dr David Jayne focuses on the mechanism of action of therapeutically used medicines for the treatment of system lupus erythematous and will examine the pathophysiology of the disease to provide insight into the development of new treatments. Abby has established research collaboration with Kings College London and provided training to colleagues on 'Out of Programme Research'. Abby intends a clinical academic career in dermatology and will use the experience and data generated during the ACT fellowship to support a future application to the MRC for a Clinical Research Training Fellowship.

Fotis Sampaziotis (2012): ***In vitro modelling of cholestasis associated with cystic fibrosis: Development of a platform for the generation of cholangiocytes from human induced pluripotent stem cells £58,000***

Cystic fibrosis (CF) is one of the commonest, potentially lethal, inherited diseases. Some but not all CF patients develop liver damage. The damage starts in Biliary Epithelial Cells (BEC) a type of cell lining the hepatobilary tract i.e. tubes that transfer bile from the liver to the bowel. Under the mentorship of Dr Ludovic Vallier at the Cambridge Stem Cell Institute, Fotis's work is focused on generating BECs from skin samples obtained from CF patients and creating and refining a model system to study CF in the laboratory. This resource will be made available to colleagues and collaborators.



High magnification image of bilary epithelial stem cells (derived from a human skin biopsy) grown in the laboratory for 20 days. It shows the active transfer of a green fluorescent dye (Rhodamine123) in the lumen of a 3D bile duct organoid (composed of many cells), revealing that the generated cells show functionality similar to that of cholangiocytes *in vivo* and that this is a useful model system.

Richard Mair (2012): ***Stratifying anti-angiogenic response in glioblastoma £57,479***
Glioblastoma multiforme (GBM) is the most common brain cancer with an average survival of 14 months. It is a vascular and angiogenic tumour and some improvements in patient survival have been shown using medicines that block tumour blood vessel growth. Under the mentorship of Professor Kevin Brindle at the Cambridge Cancer Research Institute, Richard will determine whether newly developed methods of brain scanning can detect changes in the brain cancer after this type of treatment and, at an early stage, identify which patients responding to treatment and those who are not.