

## Research

The University has a longstanding interest in ageing that began when Peter Medawar was the Mason Professor of Zoology in the late 1940s. Medawar is probably best known for his work on immune tolerance, for which he received a Nobel prize, but he also developed one of the key theories relating to the evolution of ageing – the Mutation Accumulation Theory of Ageing.

In the last decade ageing has become a growing research interest at the University. To reflect the importance of ageing research at Birmingham, the University has set up the Centre for Healthy Ageing Research and is making significant new appointments in 2011 at senior level in Stem Cells and Ageing research to support the work of the centre.

Centre Director is Professor Janet Lord, whose main research focus is ageing of the immune system (Immunosenescence). Professor Lord's research was featured as a scientific highlight in the [BBSRC Strategic Plan 2009-2013 document \(http://www.bbsrc.ac.uk/strategy/\)](http://www.bbsrc.ac.uk/strategy/)

### Research Themes:

#### Ageing and the Cardiovascular System...

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Cardiovascular disorders are predominantly diseases of old age and together they account for over one in three deaths in the western world. Moreover as cardiovascular mortality rates have begun to decline in many high-income countries, they have increased at an astonishing rate in low- and middle-income countries such that premature deaths from cardiovascular disease range from 4% in high-income countries and up to 42% in low-income countries.

The range of cardiovascular disorders associated with the ageing process includes thrombosis, bleeding, heart failure and hypertension. Myocardial infarction and stroke are the two major causes of morbidity and death in this group. Stroke, and especially severe, disabling stroke, is often caused by atrial fibrillation. The interplay of "normal" ageing, environmental stressors, and subtle genetic predispositions to these diseases may offer clues to improve their prevention and management.

Birmingham has research groups investigating various aspects of cardiovascular system and how this changes with age:

- Cerebral autoregulation decreases with ageing such that the blood brain barrier is more easily broken: our studies in older adults are designed to test whether medication or lifestyle changes may be protective or exacerbate conditions.  
[J Marshall \(/staff/profiles/cem/CVRS/marshall-janice.aspx\)](#)
- We are investigating the epidemiology of cardiovascular disease and stroke, with a broad span from clinical cardiology to primary care. Our research into atrial fibrillation has defined the epidemiology of this common arrhythmia and the value of screening for the condition in primary care. The Birmingham Atrial Fibrillation Treatment of the Aged (BAFTA) trial has established the value of oral anticoagulation for stroke prevention in the elderly (age >75).  
[GYH Lip \(/staff/profiles/cem/CVRS/Lip-Gregory.aspx\)](#), [DA Fitzmaurice \(/staff/profiles/haps/PrimaryCareClinicalSciences/fitzmaurice-david.aspx\)](#), [PS Gill \(/staff/profiles/haps/PrimaryCareClinicalSciences/gill-paramjit.aspx\)](#)
- The impact of risk factors for stroke and bleeding in atrial fibrillation have been developed and validated in the CHA2DS2-VASc and HAS-BLED trials. These scores are now used in international treatment guidelines (Europe, Canada). Birmingham research has had a major impact on atrial fibrillation treatment guidelines issued by NICE, the European Society of Cardiology and the Canadian Cardiovascular Society.  
[GYH Lip \(/staff/profiles/cem/CVRS/Lip-Gregory.aspx\)](#), [DA Lane \(/staff/profiles/cem/CVRS/Lane-Deirdre.aspx\)](#)
- Furthermore, we are beginning to study the age-dependent mechanisms that cause atrial fibrillation in a translational approach. We will develop strategies to prevent the expected AF epidemic in the elderly by optimising timely diagnosis and individualising management. This work has the potential to impact future AF management guidelines in a similar fashion as the CHADSVASc score did in recent years.  
[P Kirchhof \(/staff/profiles/cem/CVRS/Kirchhof-Paulus.aspx\)](#), L Fabritz
- We have a major interest into the psychophysiology and understanding of the disease process in cardiovascular disease (including atrial fibrillation and other conditions whose prevalence increases with age), as well as physician and patient perceptions of antithrombotic management strategies, notably in elderly patients.  
[GYH Lip \(/staff/profiles/cem/CVRS/Lip-Gregory.aspx\)](#), [DA Lane \(/staff/profiles/cem/CVRS/Lane-Deirdre.aspx\)](#)
- We are investigating the molecular and genetic basis of the increase in prevalence of bleeding in the elderly in the GAPP study. Patients are recruited from over the UK to investigate disorders in platelet function in this group.  
[SP Watson \(/staff/profiles/cem/CVRS/Watson-Steve.aspx\)](#)
- We are exploring the age related links between inflammation and metabolic disease which increase the risk of heart attack and stroke. In particular, how acquisition of fatty liver disease, which is very common in obese westernised societies, promotes dyslipidaemia in the circulation. We are also interested in the role of the anti-inflammatory omega-3 polyunsaturated fatty acids in promoting healthy cardiovascular ageing.  
[DE Rainger \(/staff/profiles/cem/CVRS/Rainger-Ed.aspx\)](#)

#### Ageing and Dental Infection ...

Periodontitis (deep seated gum disease) is the most prevalent chronic inflammatory disease to affect humans. As a major cause of tooth loss, severe periodontitis afflicts 8% of UK adults with over 50% having the disease to some extent. However, disease prevalence increases with age, and 85% of the UK population exhibit some periodontal destruction by 65-years-of-age. The cost to the UK economy is substantial and in 2008 was estimated to be £2.78 billion. Moreover, human costs are also high, with tooth loss creating serious issues for speech, diet/nutrition, appearance, and a substantial negative impact on oral health and quality of life. There is also mounting evidence that periodontitis has systemic consequences due to a "spill over" effect of the gum inflammation into the circulation. The impact of such low grade peripheral inflammation appears to be significant, with "all cause" mortality rates over a 25-year period being 85% higher in males with periodontal bone loss. Periodontitis is also recognised as an independent risk factor for cardiovascular disease and stroke. It also has an impact on diabetes control and is independently associated with rheumatoid arthritis.

Why periodontitis prevalence increases with age is uncertain, and research into this important issue is desperately needed, given our ageing population and the chronic disease burden on the individual patient as well as the economy. There are several areas in which the periodontal research group at Birmingham University are exploring why periodontitis becomes more prevalent as we get older and what mechanisms may be involved. Understanding such mechanisms provides opportunities for prevention and novel therapeutic approaches.

These studies include:

- Analysing the way in which the skin cells of the gums (epithelium) react to oral bacteria.
- Studying the behaviour of white blood cells (neutrophils) which can be very destructive to periodontal tissues.
- Determining what can be learned from comprehensively mapping the composition of saliva, as a diagnostic fluid.

#### Analysing the oral epithelium

Epithelium was traditionally perceived as a simple inert physical barrier, whose role was to prevent microbial entry into the connective tissues, thereby protecting the host's vital systems from the external environment. However, contemporary research has revealed that epithelial cells play an active role in the host response to bacterial infections. Gingival (gum) epithelium is intimately related to the bacterial plaque biofilm and research at the Birmingham Dental School has demonstrated that gingival epithelial stimulation by key periodontal pathogens results in activation of cellular transcription factors, which regulate production of pro-inflammatory cytokines. This finding suggests a key role for epithelium in the initiation and propagation of periodontal inflammation. However to date, research investigating how the responses and behaviour of oral epithelial cells change as we age, and thus impacts on these important mechanisms is almost completely lacking, and may help explain the increasing prevalence of periodontitis in older patients.

The Periodontal Research Group (PRG) at Birmingham proposes studies to explore age-related changes in oral epithelium in terms of:

- Changes in efficiency of bacterial recognition (via pattern recognition receptors).
- Activation of redox sensitive transcription factors (NF- $\kappa$ B, Nrf-2, & AP-1).
- Gene transcription profiles.
- Levels of cytokine production.
- Levels of certain antioxidant micronutrients.
- Changes in epithelial permeability and barrier function and how these may be manipulated using novel micronutrient approaches.

### Studying neutrophil behaviour

Evidence suggests that periodontitis occurs in individuals who have an abnormal neutrophil response to subgingival plaque bacteria and that neutrophil-mediated oxidant injury is an important feature of the disease. Peripheral blood neutrophils from periodontitis patients are hyper-reactive, after Fc $\gamma$ R and toll-like receptor (TLR) stimulation, as well as being hyperactive in respect of unstimulated, extracellular release of reactive oxygen species (ROS). Although Fc $\gamma$ R hyper-reactivity is reduced by therapy, baseline, unstimulated-ROS release is not, suggesting that reactive and constitutive mechanisms underlie the "hyper-inflammatory" phenotype. Priming with GM-CSF or the periodontal pathogens *Porphyromonas gingivalis* and *Fusobacterium nucleatum* (1 bacterial cell per neutrophil) reduces the Fc $\gamma$ R-mediated hyper-reactivity but not hyperactive, baseline unstimulated ROS release.

Hyper-reactive neutrophils differentially express 25, type I interferon-stimulated genes and IFN $\gamma$ , which can enhance Fc $\gamma$ R-mediated ROS generation in vitro, and is increased in plasma from periodontitis patients. Recent studies from this group have demonstrated that the ability of periodontitis plasma to prime for f-MLP-mediated ROS generation is, in part, due to the presence of GM-CSF, IL-8 and IFN $\gamma$ , supporting the idea that peripheral neutrophils in periodontitis patients are in a cytokine-primed state. Interestingly, transcripts for GM-CSF and IL-8 are up-regulated in gingival epithelial cells after stimulation with *P. gingivalis* and *F. nucleatum*, (see above), perhaps indicating that local tissue responses to plaque bacteria may contribute to peripheral neutrophil hyper-reactivity. There is currently, no data on the behaviour of PMNLs from older patients with respect to ROS release in response to different priming agents or to periodontal bacteria, and such studies are planned in order to shed light on this potentially important cause of periodontal tissue damage in older patients.

Recent reports of neutrophil hyper-reactivity in terms of ROS release and the involvement of IFN $\gamma$  in disease pathogenesis, have also, for the first time, raised the spectre of an autoimmune component to the pathogenesis of periodontitis. Moreover, type-1 interferon's and ROS are associated with neutrophil extracellular trap (NET) formation. Whilst normally neutrophils combat periodontal pathogens by intracellular (phagocytosis) and extracellular (degranulation) mechanisms, NET killing has recently been described as an important new paradigm in neutrophil biology. NETs consist of a web of extracellular fibres of DNA plus histones (chromatin) and granular proteins, which bind to Gram-positive and Gram-negative bacteria. These chromatin structures immobilise high concentrations of extracellular antimicrobial peptides, including cathepsins and myeloperoxidase along with histones, leading to physical entrapment and killing of pathogenic bacteria. Lack of NET production (e.g. in Chronic Granulomatous Disease) or presence of bacteria that express DNases which breakdown NETs, results in increased pathogenic activity and potentially catastrophic infections in certain patient subsets. The DNA-histone backbone of NETs acts as a target for endogenous or bacterial peptidylarginine deiminases (PADs), which citrullinate histones as well as other proteins, by deimidating arginine residues, potentially rendering them auto-immunogenic. Further studies are currently ongoing in this area to determine whether this mechanism of generating auto-antigens links periodontitis to other age-related systemic diseases, such as rheumatoid arthritis, and whether decreased efficiency in NET production associates with immune-senescence.

### Characterising the saliva proteome

As we age our bodies change and leave behind markers of these changes. Powerful profiling techniques such as "proteomics" can determine these changes. Recent studies have already identified changes between young and older women by analysing their saliva. This fluid contains many proteins that are involved in immunological protection as well as serum derived proteins. The group is currently employing highly accurate and sensitive mass spectrometry techniques such as FT-ICR MS/MS to profile changes in the saliva proteome in healthy, diseased (gingivitis and periodontitis) and edentulous patients. As the oral microflora changes with age, as well as with disease, using sensitive meta-proteomic techniques will help us to unravel biomarkers for healthy ageing and non-invasive techniques for disease diagnosis. Higher levels of biomarkers for dental caries (decay) associated proteins (Cystatin S) have already been found to be elevated in elderly patients with caries and many more discoveries are being made.

<http://www.dentistry.bham.ac.uk/research/tir.asp>

(<http://www.dentistry.bham.ac.uk/research/tir.asp>)

## Ageing and the Immune system ...

Infections represent a major cause of death in older adults and immune system related diseases, such as Rheumatoid Arthritis, represent a significant cause of ill-health in old age. It is now well established that the immune systems' ability to fight infections declines as we age (Immunosenescence) and that our ability to respond to vaccinations is also reduced, limiting options for the prevention of infections in older adults. Understanding the causes of immunosenescence will allow researchers and clinicians to develop interventions to improve immunity in old age and reduce the numbers of deaths from infections such as pneumonia. In 2009 the decision was taken to expand the activity of the MRC Centre for Immune Regulation to include Immunosenescence as a new research theme that would consolidate and develop existing research interests. The new theme will also broaden training opportunities for students within the MRC Centre and raise awareness of a topic that will remain an important health issue in the future. The Immunosenescence theme will be led by Professor Janet Lord, who has been working in this area for almost 10 years.

### Immunosenescence Research

The immune system declines with age, evidenced at the functional level by increased susceptibility to infection and poor vaccination responses. Atrophy of the thymus, the source of new T cells, with age and concomitant expansion of the memory T cell population are key factors in the reduction seen in adaptive immunity and vaccination responses. There are also dramatic changes to the innate immune system with age, including reduced neutrophil bactericidal function and an increase in the constitutive circulating level of pro-inflammatory cytokines such as TNF $\alpha$ , IL6 and IL-1 $\alpha$  (inflamm-aging). The latter contributes to the development of several diseases including cardiovascular disease. Individual researchers at the University of Birmingham have already repositioned their research to include ageing of the immune system and the new Immunosenescence theme has also introduced new groups to the Centre.

The following research topics are included in this theme:

- Effects of age upon neutrophil function and resolution of inflammation – **Prof Janet M Lord** (<http://medweb4.bham.ac.uk/staffprofiles/Printable.aspx?id=258>), **Dr Elizabeth Sapey** (<http://medweb4.bham.ac.uk/staffprofiles/Printable.aspx?id=3683>), Prof Iain Chapple, Dr Mike Milward, Dr Paul Cooper, Dr Anna C Phillips.
- Sleep disruption and immunosenescence – **Dr Shahrad Taheri** (<http://medweb4.bham.ac.uk/staffprofiles/Printable.aspx?id=3229>) and **Prof Janet M Lord** (<http://medweb4.bham.ac.uk/staffprofiles/Printable.aspx?id=258>).
- Thymic atrophy – **Prof Graham Anderson** (<http://medweb4.bham.ac.uk/staffprofiles/Printable.aspx?id=368>) and **Prof Eric J Jenkinson** (<http://medweb4.bham.ac.uk/staffprofiles/Printable.aspx?id=254>).

- Ageing and predisposition to Rheumatoid Arthritis – **Dr Karim Raza** (<http://medweb4.bham.ac.uk/staffprofiles/Printable.aspx?id=129>), **Dr Dagmar Scheel-Toellner** (<http://medweb4.bham.ac.uk/staffprofiles/Printable.aspx?id=156>), **Prof Chris D Buckley** (<http://medweb4.bham.ac.uk/staffprofiles/Printable.aspx?id=619>)
- CMV and Immunesenescence – **Prof Paul Moss** (<http://medweb4.bham.ac.uk/staffprofiles/Printable.aspx?id=211>), Dr Jos Bosch
- Studying immunesenescence and stress responses in *C. elegans* – **Dr Robin May** ([www.biosciences.bham.ac.uk/labs/may/](http://www.biosciences.bham.ac.uk/labs/may/))
- Improving Vaccination responses in old age – **Dr Kai Toellner** (<http://medweb4.bham.ac.uk/staffprofiles/Printable.aspx?id=244>), Dr Anna C Phillips, Prof Doug Carroll.

## Ageing in Nematodes ...

There is now a huge body of evidence suggesting that ageing, immunity and stress resistance are closely linked. However, the molecular basis of this linkage is unknown. In the School of Biosciences Dr Robin May and his team use the nematode worm, *Caenorhabditis elegans*, to investigate how these different aspects of biology are coupled at the cellular level.

Firstly, by comparing closely related nematode species that exhibit widely differing lifespans, they have begun to dissect the changes that occur in pathways regulating ageing, immunity and stress resistance over the course of evolution. This work has revealed a critical role for the forkhead transcription factor DAF-16 (homologous to the FOXO proteins in humans) in mediating changes in ageing and immunity during speciation. Secondly, Dr May's research takes advantage of the powerful genetic tools available in *C. elegans* in order to examine immunological and longevity 'trade-offs' at the single gene level. By doing so, they hope to be able to extrapolate these findings to humans and other mammals and therefore understand more about the biological basis of healthy ageing.

## Ensuring good health in old age ...

Ageing research is a strategic priority across the whole university and draws on existing research excellence across many schools with a fundamental collaborative, multidisciplinary ethos reflecting the complex nature of ageing. The aim of such research is improved understanding of the age-related processes that contribute to increased frailty and pathology in older adults, with the ultimate aim of developing and validating interventions to delay the ageing process and improve health and quality of life in old age. Put succinctly the mission of the Centre is to carry out research to ensure that old age is enjoyed rather than endured.

## 'Understanding Human Ageing' film



(<http://www.adobe.com/go/getflashplayer>)

Major current research projects and initiatives within ageing research at the University include a portfolio of Immunesenescence funding valued at around £5m, with Immune Ageing included as a new theme within the MRC Centre for Immune Regulation. Other areas of major research activity include Endocrine Changes with Age (Arit, Cooper), Brain Ageing (Toescu, Kourtzi), Musculoskeletal Ageing (Stewart, Wagenmakers), Exercise and Motivation to Exercise in older adults (Duda).

Although ageing is studied in a range of model systems, including mice and nematodes, the majority of research is based upon human ageing. This is facilitated by a large cohort of healthy older adults, the Birmingham 1000 Elders, who volunteer to help with research into ageing at the University. Human studies are carried out within two Wellcome Trust Clinical Research facilities, one located adjacent to the College of Medical and Dental Sciences, medical school building and the second is located in the College of Life and Environmental Sciences' School of Sport and Exercise Sciences. The latter is fully equipped for studies involving exercise interventions. In 2010, these facilities will be extended to include a mobile research

unit (the Health Research Bus) that will allow researchers to carry out research in the community, giving access to populations often difficult to recruit to biomedical research.

## Health Services for Older adults ...

The Health Services Management Centre (HSMC) at the University of Birmingham, led by **Jon Glasby, Director and Professor Health and Social Care** ([/staff/profiles/social-policy/glasby-jon.aspx](http://staffprofiles/social-policy/glasby-jon.aspx)), is the leading UK centre providing a combination of research, teaching, professional development and consultancy to health and social care agencies ([www.hsmc.bham.ac.uk](http://www.hsmc.bham.ac.uk) (<http://www.hsmc.bham.ac.uk>)).

For nearly forty years, it has established a unique reputation as a 'critical friend' of the healthcare community. In particular, it is committed to 'rigour and relevance' in health and social care – using research to inform teaching and consultancy, but also using teaching and consultancy to make our research more relevant to real-life problems in the health and social care system.

This research includes a major element considering health services in relation to older adults, who are currently major users of such services and will continue to be so if current demographic trends persist. Key areas of work include:

- Public and patient engagement
- Clinical and strategic commissioning
- Leadership and organisational development
- Quality and innovation in service provision

Specific work on ageing includes:

- **Research for Downing Street on the future reform and cost of adult social care** (<http://www.birmingham.ac.uk/schools/social-policy/departments/health-services-management-centre/news/2010/02/social-care-reform.aspx>)
- **Research with older co-researchers into older people's experiences of moving across service boundaries** (<http://www.birmingham.ac.uk/research/activity/social-policy/patient-experience/research/transitions-older-people.aspx>)
- **EU research into long-term care in 13 European countries** (<http://www.birmingham.ac.uk/research/activity/social-policy/partnerships-collaboration/research/interlinks.aspx>)

## Physical Activity in Older Adults ...

Humans are almost unique in reducing their level of physical activity with age - for most societies old age is seen as a time to slow down, take it easy and conserve energy. However, there is now mounting evidence that reduced physical activity has detrimental effects on health at all ages. It is only relatively recently that the biomedical community has concluded that ageing is a lifelong process and that the robustness of the individual in the latter phase is influenced by environmental factors such as diet, exercise and stress experienced throughout the life course. Preventing ill health in old age can thus be achieved by appropriate interventions at any stage in life and the pressing need now is to develop and validate such interventions.

In the School of Sport and Exercise Sciences (SSES) researchers have identified exercise as a major health intervention paradigm, as the evidence base for the beneficial effects of exercise on cardiovascular function, maintenance of the musculoskeletal system, immunity, well-being and cognition is now well developed. The question is thus not whether exercise can prevent frailty in old age, but how little is required, what kind of exercise is most effective and acceptable for older adults and how far do the beneficial effects of exercise extend with respect to health? These questions drive a major portion of Centre research.

### **Mechanisms of sarcopaenia and osteoporosis:**

Research led by Professor Anton Wagenmakers in SSES and Professor Paul Stewart and Dr Mark Cooper in the medical school investigates cellular mechanisms involved in age-related muscle loss (sarcopaenia) and osteoporosis. Their work is addressing current gaps in our understanding of these processes, namely the way in which diet, exercise, inflammatory cytokines and endocrine hormones interact to control gene expression and protein turnover in bone and muscle. At the same time it is recognised that the most important outcome for older adults is an improvement in musculoskeletal function. Therefore studies of cellular mechanisms are undertaken in conjunction with colleagues concerned with the structure and function of skeletal muscle and bone and the changes in motor control that occur with ageing.

The key contributing groups in this area investigate tissue specific and generic mechanisms influencing the development of sarcopaenia and osteoporosis in ageing and the interaction with exercise. Wiebke Arlt, Mark Cooper and Paul Stewart examine the endocrine regulation of muscle turnover, focussing on the role of muscle and bone 11 $\beta$ -HSD1 and on the impact of inflammatory cytokines on this axis. George Balanos, Chris Shaw, Kevin Tipton and Anton Wagenmakers interact to study exercise physiology, muscle function, muscle protein turnover and adaptation in older adults.

There is also a significant research effort looking at the role that obesity plays in ill health in old age. Increased abdominal adiposity with age, leading to insulin resistance and eventually Type 2 diabetes is now well documented. In addition the increased circulating lipids and inflammatory cytokines that occur with obesity also have profound effects on muscle turnover. The Centre for Healthy Ageing Research therefore also has strong links with the [Centre for Obesity Research](http://www.obesity.bham.ac.uk/) (<http://www.obesity.bham.ac.uk/>)

### **Loss of neuromuscular control with ageing and stroke:**

1 in 3 people aged over 65 will fall each year, there are 190,000 osteoporosis associated fractures in the UK per year and 40% of older people admitted to nursing homes have suffered from falls. Many elderly people develop incontinence due to weakness of the muscles and impairments in reflexes involved in control of the bladder. Stroke survivors suffer major loss of motor functions and are in need of rehabilitation. Current understanding of the mechanisms leading to age-related loss of neuromuscular control and how much they contribute to muscle strength and function loss and reduced postural stability is incomplete. In the Centre we are undertaking fundamental studies investigating effects of physical training/skill acquisition on functional activities such as reaching, grasping, standing and walking. The results will be translated into reconditioning programmes for frail older adults and rehabilitation programs focusing on stroke, hip fracture/replacement and incontinence.

To achieve this aim the Centre integrates research in the Sensory Motor Neuroscience lab (Alan Wing), the Visual Cognition lab (Glyn Humphreys), the Cognitive Neuroimaging lab (Zoe Kourtzi) and the Human Movement Research lab of SSES (Mark Hollands) and translates fundamental knowledge into Primary Care via the Physiotherapy Translational Research Group (Cath Sackley).

### **Motivating adults to increase physical activity**

It has been shown that exercise has a broad range of health benefits - reducing age-related loss of muscle, maintaining mobility, strength and independence in older adults. Regular physical activity has also been linked to positive mental health and reduced depressive symptomatology. However it is also well recognised that changing lifestyle behaviours in adults is difficult and basic research is required to understand the motivational paradigms that would be most successful in older adults and the barriers to participation in exercise in older adults. Information on which form of exercise (aerobic, resistance, etc) and which setting (group based vs home based) is most advantageous for older adults is required.

The research activities of Professor Joan Duda and colleagues in SSES are focused upon the social environmental factors (e.g., autonomy and social support provided) and motivational processes (e.g., degree of self determination and self efficacy) underpinning the quantity and quality of exercise engagement. One particular emphasis is on the social cognitive mechanisms by which physical activity can impact the mental health of older individuals. Current projects that involve middle age and older adults are the Step by Step walking intervention to encourage walking as a regular exercise in healthy older adults. There is also a trial intervention to promote autonomous motivation for exercise and physical activity in rheumatoid arthritis patients.

## Social Influences on Ageing ...

Research in the Centre for Healthy Ageing Research is not limited to medical or biological research but aims to cover all aspects of life as an older adult. Three research projects are currently being undertaken in the Business School and within the College of Social Science, several with links to the life sciences.

### **Ageing, employment and wellbeing: the role of participation in physical fitness activities and sport**

This research involves Fiona Carmichael, Jo Duberley, Isabelle Szmigin, Jon Coaffee Symeon Dagkas and Lesley Phillpots. This is an exploratory project which is investigating issues relating to the participation of older people in sports and fitness activities, the factors that enable and constrain such participation and the impact this has on wellbeing and work.

The topic is of growing interest to policy makers because of population ageing. In this context, maintaining the health and wellbeing of older people could be one way of helping to reduce dependency rates and enable older people to actively participate in the community for longer. This is an important consideration since significant age gaps in employment rates exist across all OECD countries where less than 60 percent of those aged 50-64 were employed in 2004 compared to 76 percent of those aged 24-49 (OECD, 2006). A related literature, to which participants of this study have contributed, has investigated the factors that contribute to these lower employment participation rates among older people. A common theme is that higher incidences of ill health among the older population are an important causal factor. A separate and largely unrelated literature provides evidence that lack of participation in sport and physical activity impacts negatively on health by reinforcing the occurrence of obesity and a number of chronic conditions such as cardio-vascular diseases and diabetes. Linked to this evidence, the European Commission claims that the sport movement has a greater influence than any other social movement on participation in health-enhancing physical activity.

This project investigates the role of participation in sports and physical fitness activities in the determination of the health, well being and employment of older people. The factors that enable and constrain the participation of older people in such activities are also being investigated. Attitudes to physical activity can act as an important barrier to participation but much of the qualitative research in this area has focussed on young people. Attitudes to physical activity and the mechanisms of behaviour change among older people thus remain under researched and this study will help to address this imbalance.

### **Women's wellbeing in later life**

This research project involves Dr. Fiona Carmichael, Dr. Joanne Duberley and Professor Isabelle Szmigin. This is a small exploratory project which aims to explore issues impacting on older women who are either close to retirement and are considering leaving the organisational workforce or have recently retired. The research recognises that the financial position of older women who may have had weaker attachment to the labour market is likely to be more vulnerable than that of older men. In particular the research will focus on (i) their financial security, (ii) their wellbeing and (iii) the options and barriers facing them in their retirement choices and what to do next, including

training, voluntary work, setting up their own businesses, or taking on alternative paid work.

The objectives of the research are to:

1. To build on existing understanding of older women's financial capability and suggest ways that government and other organisations can help women in developing their financial capability and confidence at a critical time of their lives.
2. Provide policy makers and support organisations with a better understanding of how older women manage later life choices; what obstacles and opportunities they see to their wellbeing.
3. To provide a report to be presented to organisations working with older people that outlines key issues regarding financial security, capability, work and training opportunities and wellbeing for older women
4. To provide data which should act as a starting point for academics and others thinking about how best to ensure continued participation of older women and their financial security and wellbeing.

### **Ageless Advertising and Society: Research into ageing stereotypes and their societal effects.**

This research project is lead by Professor Isabelle Szmigin. Ten years ago the UN called for 'ageless thinking'. Yet with an ageing world population, business has taken little heed of this call, especially in terms of how older people are represented in society through images of what an older person is. This research investigates how older people are represented in advertising, media and public documents. The aim of the research is to identify the identity positions that society presents of older people and what this may mean for older people's engagement with the commercial world.

### **The Ageing Brain ...**

Despite significant progress in understanding how the human brain ages at the anatomical and cellular levels, much less is known about the relationship between structural and neural changes that underlie the ageing of cognitive abilities and determine an individual's functional, rather than chronological, age. A core challenge in human cognitive ageing is to understand the mechanisms that lead to rapid cognitive decline in some older adults while others maintain high levels of cognitive performance.

A research team led by Professor Zoe Kourtzi is interested in the links between brain structure and function and how these change and adapt with age. They aim to develop new tools for cognitive ageing research by combining methods from mathematics, computer science, psychology, and neuroscience. In particular, they combine advanced mathematical approaches (i.e. machine learning) for the analysis of biological data (behavioural performance, functional brain activations) with multimodal brain imaging techniques (structural MR, functional MRI, EEG) and behavioural methods. This integration of advanced measurement and analysis methods allows them to develop new sensitive tools for studying the variability of cognitive ageing across individuals from rapid decline to sustained high levels of performance. The team's methods and findings provide new insights in understanding life-long learning and cortical plasticity and will be potentially useful for early diagnosis and intervention in normal and pathological ageing.

### **University of Birmingham Cognitive Neuroimaging Lab**

**(<http://cnil.bham.ac.uk/index.html>)**

A second team led by Professor Glyn Humphreys is examining age-related variation in cognition in conjunction with detailed neuro-anatomical studies of structural and functional changes in the brain. Their studies focus on effects of ageing on working memory and attention and they use structural and functional MRI, diffusion tensor imaging and MR spectroscopy to assess changes at the neural level. They are also assessing effects of attentional retraining on the maintenance of cognitive function and have a clinical interest in rehabilitation of cognitive function after stroke.

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