Final Report Summary - FUTURAGE (FUTURAGE: A Roadmap for Ageing Research)

Executive Summary:
FUTURAGE was a two-year project to create the definitive road map for ageing research in Europe. The Road Map for European Ageing Research was launched on 18 November 2011 at a large (300 person) conference at the European Parliament. It is the product of the most extensive consultation ever undertaken in this field, involving all of the major stakeholder groups and end users of ageing research, and spanning a 2 year period.

The Road Map creation process began from the perspective that health and well-being in later life will be best understood and, therefore, extended (via policy, practice and product development) if research is carried out in four interconnected fields: biogerontology; social and economic resources; environments of ageing, and; healthy ageing and well being. A fifth theme of end-user involvement was also embedded in the Road Map process.

A unique set of partnerships were formed to support the research priority consultation process and to shape the final Road Map. All the major Coordination Actions in ageing over the last 15 years were represented through a Council of Scientists which provided high-level scientific oversight over the process and the Road Map itself. The membership of the FUTURAGE consortium includes: 11 members of the European Research Area on Ageing (ERA-AGE 2); the Coordinator of the WhyWeAge Road Map for Biogerontology at the University of Namur; the Universities of Lund, Heidelberg, Leicester, Newcastle, Sheffield, Tampere; Age UK (formerly Help The Aged); Age Platform Europe, and; the Italian National Institute on Aging. Additional partners work to support the dissemination of FUTURAGE activities across Europe and in their own countries.

A specially designed iterative process ensured that the specific research priorities were not identified by scientists alone and were subjected to a high degree of reflection and cross-examination from a wide range of stakeholder perspectives, including policy makers, practitioners, business people, older people and their NGOs as well as scientists. This process led to an extraordinary broad and deep consensus on the major future priorities. A total of nine distinct stages of consultation were undertaken which involved the participation of 1000 people and organisations, the latter representing thousands of people.

The final Road Map contains the research agenda that will enable Europe to respond successfully to the unprecedented demographic challenges it faces. Its twin starting points are the high priority allocated to population ageing, by Member States and the European Union as a whole, and the fundamental importance of scientific research as the driver of innovations in public policy, in a wide range of clinical and other professional practices, and in the development of products and services. In addition it advances the case for a new comprehensive approach to active ageing which includes all activities, physical or mental, and all age groups. The seven major priority research themes of the Road Map are linked to the active ageing core theme on the assumption that this should be a central aim of ageing research. These major priority themes are: Healthy Ageing for More Life in Years; Maintaining and Regaining Mental Capacity; Inclusion and Participation in the Community and in the Labour Market; Guaranteeing the Quality and Sustainability of Social Protection Systems; Ageing Well at Home and in Community Environments; Unequal Ageing and Age-Related Inequalities; Biogerontology: from Mechanisms to Interventions. The Road map also identified 8 basic assumptions that should figure significantly in all priority topics and 4 critical
Thus FUTURAGE project has created a Road Map that sets out the major research priorities for European ageing research over the next 10 or so years. It also calls for new approaches to ageing research which are more multi-disciplinary, life course focussed, user engaged and have a big emphasis on knowledge exchange. Furthermore it calls for a new vision of ageing which promotes its positive possibilities rather than deficits, inclusion and full citizenship rather than exclusion. Therefore the Road Map challenges all stakeholders in ageing research policy makers and research funders; NGOs, practitioners, business people; scientists; and older people to work in unison to ensure that research maximises its impact on the well-being of all Europeans as they age.

Project Context and Objectives:
The FUTURAGE project focused on the necessity for a new vision of ageing and innovative ways to develop the science of ageing. A new vision of ageing is required because the present dominant paradigm is now a relic of a previous socio-demographic era in which retirement took place for a majority at state pension ages and post-retirement years were relatively short. Changes in the labour market and social behaviour coupled with a remarkable extension in longevity, associated in some countries with a pushing further up the age range (or compression) of morbidity, have transformed the experience of later life. Commercially too, the new old are no longer ignored, as in the previous era, but routinely regarded as targets for a diverse range of products from cosmetics to package holidays. The boundaries of frailty are being pushed back and, for a growing number of older Europeans, 70 is the new 50. Unfortunately however there continues to be a structural lag between this socio-demographic leap and societal institutions and attitudes, for example in the labour market and media. Hence the need for a new vision. This has to be a positive vision in which all older people, regardless of competence and capability, are included as full citizens, expected to contribute and participate, and in which they feel empowered. The reality of the plasticity and diversity of old age must replace the outdated model of inevitable decline and disability. Later life is but one part of a life course which is characterised by lifelong development.

Demographic context
The upward trajectory of European ageing has been linear for more than 150 years. The increase in life expectancy currently averages 12 months every 5 years and shows no sign of abating. The number of Europeans aged 65 and over is expected to increase by 45% between 2008 and 2030, and will be over 30% of the population by 2060. The total population of Europe is increasing, even though some Member States are experiencing population decline. Using data from the EUROPOP2010 survey the convergence scenario for the EU27 population is projected to increase from 501 million on 1 January 2010 to 525 million in 2035, to peak at 526 million around 2040, and thereafter gradually decline to 517 million in 2060. Accompanying this trend the share of the population aged 65 years and over rises from 17% in 2010 to 30% in 2060, with those aged 80 and over being the fastest growing age group, increasing from 5% to 12% over the same period.

These demographic changes are not distributed uniformly across EU Member States and regions. Most people over 65 live in the Western parts of the EU, although it should be noted that data are not available for some areas of Eastern Europe. Looking to the future, not only will the average (median) European age increase but the process of population ageing will shift eastward. For example, it is estimated that by 2040 countries such as Latvia and Romania will have the highest median ages in Europe, while Sweden and most of the Nordic and Western European countries will share the youngest age profiles. Those countries in Southern and Central Europe, such as Hungary and Slovakia, are likely to have above average age profiles. These differences between Member States and regions demonstrate that a one size fits all approach is not appropriate and therefore the future research and policy agendas have to become more nuanced. It also challenges the European scientific research community to ensure close collaboration and knowledge exchange between Member States, something that the European Research Area in Ageing (ERA-AGE) has pioneered.

Healthy Life Expectancy
It is inevitable that, as the impact of infectious diseases recedes, the emphasis of both science and policy shifts from reduced mortality to longevity, and then to healthy life expectancy (or disability free life expectancy). This welcome policy focus has been given high visibility at the European level by the European Innovation Partnership on Active and Healthy Ageing (EIPAHA) which has set the highly ambitious target of raising healthy life expectancy across the EU by an average of 2 years by 2020.

The extent of the challenge presented by this target can be seen from Figures 3 and 4 which show the variation in healthy life years for men and women aged 65. The current average healthy life years at 65 in the EU is 8 years for both men and women, but this varies among Member States from 3 years in Estonia to 13 years for women and 14 years for men in Denmark. Healthy life years at birth average 61 for women and 60 for men across the EU, but range from 52 in Latvia to 70 in Malta for women and 49 in Estonia to 68 in Denmark for men. In fact the healthy life years gap between European countries exceeds the gap in life expectancy and both of these gaps are driven mainly by the low levels of life expectancy and healthy life expectancy in Central and Eastern European countries. Analysis of data from the EU15 prior to enlargement, by Carol Jagger and her colleagues, revealed a complex picture in which healthy life years were expanding (men in Austria, Belgium, Finland and Germany; women in Belgium, Italy and Sweden) and contracting (men in Denmark, the Netherlands, Sweden and the UK, women in Germany, Greece, Ireland, the Netherlands and Portugal).

This is the demographic context in which the Road Map was prepared and to which it is principally addressed. It is aimed at assisting Europe to respond to the demographic challenges and, in particular, at understanding and promoting active ageing and the growth of healthy life expectancy.

European Policy Priorities

The Road Map was not designed purely by scientists nor is it aimed at the scientific community alone. Indeed it seeks to integrate a wide range of stakeholder interests in the ageing research and general ageing fields. It was prepared with major EU policy priorities in mind. Thus the Road Map aims to contribute to the Europe 2020 strategy objective to develop a competitive and resource-efficient economy based on knowledge and innovation. The FUTURAGE partners identified research priorities that could contribute to the European smart and inclusive growth objective by investigating ways of helping people to participate longer in society and adapting good quality responsive services for people as they age. The agreed priorities could also support European sustainable growth by exploring approaches to improving older peoples health and participation, thus reducing social protection costs as well as enhancing quality of life.

The priorities identified by the Road Map are also completely in line with the goals of the pilot EIPAHA recently launched by the European Commission. Extending healthy life years in Europe had already emerged as a hot topic from the FUTURAGE consultation process before this announcement was made. Moreover we hope the Road Map will contribute to the 2012 European Year for Active Ageing and Solidarity Between Generations. As we emphasise below active ageing is the centrepiece of the Road Map. In order to increase older peoples participation in society, including the labour market, as well as to promote healthy ageing, further research is needed in the priority fields highlighted in the Road Map. Also, being aware of the discussion on the European Institute of Innovation and Technology (EIT) FUTURAGE recommends the inclusion of ageing in the Strategic Innovation agenda of the EIT. This will help to ensure that the results of the research on ageing are better translated into effective actions.

Objectives

Although there has been significant investment in European ageing research it does not match the scale of the investment that has taken place in the United States and equally importantly it lacks the coordinated approach that has United States has followed for more than 30 years.

The FUTURAGE project began with a commitment to address five objectives targeted at overcoming this gap:
1. To promote state-of-the-art assessments of research priorities, newly emerging fields and methods including user involvement for the next 10-15 years. These will form the basis for the road map document.

2. To engage Europe's leading scientists, from the main disciplinary groups relevant to healthy ageing, well-being and quality of life, in a collective endeavour to prioritise ageing research.

3. To also engage the key stakeholders in ageing research - funders, policy makers, practitioners, product producers (especially SMEs) and older people in this process so that the final road map commands widespread support and is of lasting relevance.

4. To help to close the gap between science and society by informing the public about ageing research and its importance. This communication will be done chiefly via the project website and newsletter.

5. To successfully launch the definitive road map in a high profile European event.

This demonstrates the power of FUTURAGE to harness and build on existing initiatives to avoid duplication and maximise the use of resources. Thus the key principles governing FUTURAGE are scientific quality, inclusiveness (in terms of scientific disciplines and stakeholders) the maximisation of European added value and open communication.

Project Results:
The large scale collective effort that has gone in to the FUTURAGE project to generate the Road Map for European Ageing Research has been distilled into seven major priority research themes, framed around the paradigm of active ageing.

THE PRIORITY OF ACTIVE AGEING
During the Road Map development process active ageing quickly emerged as a major multi-disciplinary theme. Rather than being one among several priority themes, moreover, it is the red thread that links all of them. In scientific terms active ageing is used as a helpful umbrella term to encompass various combinations of quality of life essentials such as continuous labour market participation, active contribution to domestic labour (caring, housework), active participation in community life and active leisure. It is valuable too in being able to synthesise strands of research on ageing and developmental science which traditionally have not had much in common. For example the need to combine research able to drive social policy or cultural investments with that concerning the individual level of ageing, such as in regard to health, cognitive functioning and motivation. The concept of active ageing is also valuable in social gerontology in linking the macro, meso and micro perspectives of ageing research.

Active ageing requires a social-ecological view of ageing. Different levels such as evidence-based policy action (macro), community and neighbourhood arrangements (meso) and individual intervention (micro) must go hand in hand in order to effectively promote active ageing. In addition, the social-ecology perspective implies a contextual view to be imposed on active ageing, because active ageing outcomes are significantly driven by the interplay between persons and environmental resources and constraints. A social-ecology view also comes with a purposefully wide understanding of environmental levels including the physical, spatial, social, economic, cultural legal and value context and the chronosystem, that is, the flow of individual and historical time as a context of active ageing. This also means that the concept of active ageing must be multi-disciplinary including, for example, sociology and social policy research, psychology, biogerontology and economics in order to acknowledge its holistic nature. Because of its integrative potential, the construct of active ageing aims to nurture the bridge-building between the different thematic areas of the Road Map, for example between health, social participation and the role of place and context. While there are compelling scientific reasons to employ the concept of active ageing as a central theme the political ones are no less so. In brief the concept already has a major European and global profile. The European Year of Older People in 1993 represented the first proclamation by Europe of a new active and participative discourse in ageing. This was expanded into an outline of a European approach to active ageing during 1999, the United Nations (UN) Year of Older People. The ECs policy document and the special conference it staged on the topic of active ageing set a radical vision of this concept and how it would be implemented across a broad field of national and European responsibilities. On the global front the World Health Organisation (WHO) has also advanced a multi-dimensional concept of active ageing: The process of optimising opportunities for health, participation and security in order to enhance quality of life as people age. Active ageing
applies to both individuals and groups. It allows people to realise their potential for physical, social and mental well-being throughout their lives and to participate in society according to their needs, desires and capacities, while providing them with adequate protection, security and care when they require assistance.

This conceptualisation has made two important contributions to European (and global) discourses on active ageing. It added further weight to the case for a re-focusing of active ageing away from a narrow focus on employment and towards a consideration of all of the different factors that contribute to well-being. Specifically it argues for the linkage, in policy terms, between employment, health and participation. Along similar lines it emphasised the critical importance of a life course perspective. In other words, to prevent some of the negative consequences associated with later life it is essential to influence individual behaviour and its policy context at earlier stages of the life course. The WHO’s approach to active ageing also contributes to the growth of the discourse on older people as active participants in society that had been signalled so strongly at European level in 1993, was reiterated in the European response to the UN Year of Older People in 1999 and will be centre-stage in 2012. The priority of active ageing was adopted by the UN’s Madrid International Action Plan on Ageing (MIAPA) in 2002, along with the principle of older peoples right to participate.

The Need for a Comprehensive Vision of Active Ageing

We are convinced of the need for a new comprehensive paradigm of active ageing, one which brings together its gerontological heritage, stretching back to the 1960s successful ageing concept, and the current pressing policy imperatives. This new paradigm would also reflect the need for a life course approach to ageing (in science, policy and practice) which transcends the traditional age segregation into three life stages: education, work and retirement and adopts an age-integrated approach in which all three concurrently span much of the life course. The foundations for a comprehensive approach to active ageing exist already in European and WHO documents. Their emphasis on well-being and participation is highly important as is the life course focus. Also, crucially, activity must consist of all meaningful pursuits (mental and physical) that contribute to the well-being of the individual concerned. Because of the dangers of exclusion active ageing should not be focussed only on the young-old. For all age groups, it should be participative and empowering and, in public health terms, preventative. To these essentials must be added a division of labour and responsibility to underline the fact that active ageing depends on a wide range of different actors and cannot simply be a top-down imposition by policy makers. For example age management in enterprises to improve opportunities for older workers, must be largely a matter for organisations themselves. Furthermore, we should not assume that active ageing exists as a fully developed entity but, rather, it should be seen as an aspiration. Thus it might be defined as: A comprehensive strategy to maximise participation and well-being as people age. It should operate simultaneously at the individual (lifestyle), organisational (management) and societal (policy) levels and at all stage of the life course.

An effective strategy for active ageing would be based on a partnership between the citizen and society. As far as society is concerned the policy challenge is to recognise the thread that links together all of the relevant policy areas: not only employment, but also health, social protection, social inclusion, transport, education and so on. A comprehensive active ageing strategy demands that all of them are joined up and become mutually supportive: creating a true Society for all Ages as expressed by the UN. The parallel role of the citizen is to act with responsibility to take advantage of opportunities, for example in education and training, and to participate where appropriate. It is this comprehensive vision of active ageing that is at the heart of the Road Map, including its life course emphasis and the priority accorded to reducing unhealthy life years. There is close affinity too between the Road Map and the WHO’s strategy for realising active ageing. According to the WHO there are eight main determinants of active ageing: culture and gender (both of which are cross-cutting), health and social services, behavioural, the physical environment, the social environment, economic determinants and those related to the person concerned (such as biology, genetics and psychology). The research themes of the Road Map, although arrived at via an independent and wide ranging consultation, are very similar to these determinants of active ageing. The seven research themes identified in the Road Map are: Healthy Ageing for More Life in Years; Maintaining and Regaining Mental Capacity; Inclusion and Participation in the Community and in the Labour Market; Guaranteeing the Quality and Sustainability of Social
HEALTHY AGEING FOR MORE LIFE IN YEARS

Importance of Theme

The focus on extending life expectancy and reducing mortality was relevant whilst deaths from infectious diseases and maternal mortality were high. Most European countries have now substantially reduced premature mortality and mortality rates even in late old age are falling. Emphasis has therefore moved to ensuring the quality of life at older ages and many political agendas now stress the need for healthy ageing in terms of increasing healthy years of life. Nevertheless the gain in healthy years must outpace the increases in life expectancy to ensure a decrease in unhealthy years. Since health is multi-dimensional it is difficult to define but healthy ageing should encompass good physical, mental and psychological health. The benefits of this to society are immense. In early old age good health has economic benefits, improving productivity by allowing individuals to stay in the labour market or to provide informal care to grandchildren or indeed parents. Late old age is more characterised by high levels of multiple chronic diseases but maintaining good functioning and well-being in the very old could reduce pressure on health and care services. Knowledge of what older individuals have to do to add more years to their life and what they might expect as they age, empowers them to make informed decisions about retirement, housing, family and leisure. In this section we use a broad definition of health, including physical, mental and psychological aspects and stress the gains that a wider European platform has to deepening our knowledge. Understanding the biology of the ageing process and what constitutes healthy ageing, identifying risk factors for unhealthy ageing and developing appropriate and timely interventions at a societal and individual level to reduce unhealthy life years is crucial to maximise the health of our older populations.

Fundamental Insights Crucial for Future Research

Healthy ageing is a well-used term that is understood on a general level to encapsulate the ability to be socially engaged, productive and to function independently both at a physical and cognitive level. Models of successful ageing, a similar and overlapping construct to healthy ageing, have been developed. As for successful ageing, there is little or no consensus on the definition of healthy ageing, despite its widespread use both in research and the wider social and political arenas. This is a major issue to be resolved if we are to appropriately and comparably monitor healthy ageing across Europe. Indeed, since environmental factors play a large role, biological age, ascertained through biomarkers of ageing, may differ from chronological age and may predict the future onset of age-related disease and/or residual life expectancy more accurately than chronological age. If healthy ageing embraces social engagement then basic cognitive-linguistic and emotional processes contribute and must be maintained. Moreover, we have little understanding of what healthy ageing means in late old age and what are the preferences of older people themselves. Does it mean ageing without chronic diseases, or without disability, or with the ability to fall ill and recover, or with a good quality of life? Similar definitional problems exist with frailty which has been used to denote an older person who is vulnerable and at risk of poor outcomes, although international agreement has been reached that frailty might be considered a pre-disability state. Problems with definition and lack of comparability across European countries also extend to other measures that underpin ageing, for example socio-economic status, disability, functioning, multi-morbidity, social engagement.

It has been increasingly recognised that the ageing process is shaped throughout the entire life course, not only in old age, and that events in childhood, youth and early adulthood increase the risk of early occurrence of chronic disease, which in turn increases the risk of premature disability. A life course approach to healthy/unhealthy ageing is therefore essential but
research should also be cognisant that newer cohorts may behave differently. Prospectively a life course view requires a long-term commitment and vision but seeds must be sown soon if we are to fully understand the influence of early and midlife physical and mental health, attitudes and lifestyle. Future studies also need a more comprehensive and holistic approach to delineating the biological, social, psychological, clinical, behavioural, economic, cultural and technological factors that drive healthy/unhealthy ageing at the individual level as well as the wider societal, public health, health and social care delivery and environmental reforms which may also impact positively on reducing unhealthy life years. Europe provides a ready platform for evaluating macro level influences.

Key Topics for Future European Ageing Research

Seven challenges and the main research questions relating to future European ageing research in the area of healthy ageing for more life in years are listed below:

Healthy ageing and frailty understanding the process and defining the concepts
What do older people understand by healthy ageing and does this vary between the young and old-old, between men and women and between different European cultures?
Can we agree a definition of healthy ageing and its relevant dimensions that cross cultures and societies?
What is frailty? How does it progress and can we identify biomarkers of frailty to intervene earlier?
See also: Unequal Ageing and Age-Related Inequalities, and; Biogerontology: from Mechanisms to Interventions

Organising and delivering interventions for health promotion
Is the timing of physical activity/exercise over the life course important for healthy ageing?
Are there gender differences in the way physical activity influences healthy ageing?
What are the relative merits of different forms of physical activity (habitual exercise, sustained aerobic exercise, strength and balance training) on specific domains of healthy ageing such as cognitive functioning?
Can we use the immune risk profile (IRP) to personalise nutritional interventions?
How do lifestyle, behavioural and pharmacological interventions interact to increase healthy ageing?
How do socio-economic factors inhibit healthy lifestyles and can this knowledge be harnessed to improve interventions?
See also: Ageing Well at Home and in Community Environments.

The ageing process and early markers of ill health
What do the molecular, biochemical, morphological and functional aspects of vascular ageing interact and how does this play out in different subclinical and clinical events?
Are markers of ageing in midlife different from those which become apparent in late life?
Are different markers of ageing interrelated or do they progress in parallel to each other?
Are markers of ageing the same in men and women and do they have the same consequences?
See also: Biogerontology: from Mechanisms to Interventions.

Modelling links between disease and functioning over the life course
What drives increasing disability?
Can we identify different population subgroups whose progress through disease to mental and physical functioning and through to participation in society, is slower than others?
What role does the environment play in delaying progress through the disablement process?
See also: Ageing Well at Home and in Community Environments and Maintaining and Regaining Mental Capacity across the Life Course.

Effectiveness and efficiency of clinical care and social care
What are the barriers to implementing the best models of inter-disciplinary care that are effective in many European countries in all the European countries?

How should clinical trial design be best adapted to include all patients who may receive the therapeutic intervention?

See also: Ageing Well at Home and in Community Environments (end-of-life and places of dying); Guaranteeing the Quality and Sustainability of Social Protection Systems (sustainability of informal support networks and long-term care needs of people with multiple chronic conditions), and; Ageing Well at Home and in Community Environments (use of technology).

Education and lifelong learning

How are older measures of education and more recent and wider measures of lifelong learning interrelated with other socio-economic measures (occupation, income and material circumstances) and do they have an additive or multiplicative effect on healthy ageing?

To what extent can education and lifelong learning mitigate the impact of key life events?

See also: Inclusion and Participation in the Community and in the Labour Market.

Environmental conditions for ageing well

How does the interrelation between the person and their environment affect mental, physical and psychological health and their trajectories with ageing?

To what extent do these relationships differ by generation, culture, society or political context?

See also: Ageing Well at Home and in Community Environments.

**MAINTAINING AND REGAINING MENTAL CAPACITY**

**Importance of Theme**

By the overarching term mental capacity we mean a collection of abilities and behaviours that ageing individuals possess and apply in aligning their lives most closely to their needs. In addition, with the term mental capacity we also refer to the capability of ageing individuals to share their competence, life experiences, and world views with others, particularly the younger generations. As a consequence, mental capacity certainly encompasses the entire spectrum of cognitive functions such as memory processes, speed of information processing, or executive functions as addressed by traditional cognitive ageing research as well as geriatric medicine and gero-psychiatry. However, this topic also addresses more general competencies such as knowledge important to master daily life, skills to maintain and secure ones social integration, coping abilities that enable ageing people to deal with critical transitions and major life experiences, and the regulation of positive and negative emotional functioning and forms of psychological resilience. The latter is highly significant in advanced old age, i.e. in a period of life in which losses accumulate and the end-of-life approaches rapidly. In this wide sense, mental capacity is central to day-to-day health and functioning, independent and rational action, societal participation and personal meaning in the last stages of the human lifespan. The ability to deal with end-of-life issues also significantly depends on the availability of mental capacity. Losing mental capacity in a dramatic way can be seen in the most profound way in dementia-related disorders. Depression including sub-threshold depression and anxiety-related disorders are other major conditions, which undermine mental capacity greatly. However, this priority mostly follows a normal ageing perspective addressing behavioural and social ageing processes of the majority of older adults. This is important to note because robust evidence underscores that coping abilities supporting efficient loss management in old age (e.g. in terms of multi-morbidity and social losses) largely remain intact until very old age. Similarly, effective down-regulation of negative affect and the maintenance of high well-being into very old age (e.g. the so-called well-being paradox of ageing) are resources available to the majority of older adults, even if cognitive functions such as working memory or speed of information processing are on the decline.

Against this background, this section builds on two meta-premises important for the understanding of behavioural and social ageing processes and outcomes. First, we follow a positive psychology perspective translated to the lifespan, in which we assume that the human system is equipped rather well to deal with the challenges of an increasing long life. Second, we
assume at the same time that a long life, particularly the period of advanced old age, brings new developmental risks, which
have to be treated intensively and in detail in future ageing research and practice. For example, recent research based on the
distance-to-death research paradigm (data-analysis are done with death as reference point) shows that dramatic decline in
cognitive functioning, well-being and affect can happen in the time window close to death and may thus challenge meaning-
making processes at the end-of-life. Research on mental capacity can only be successfully conducted by forging linkages
between biogerontology, psychology, the health and exercise sciences, geriatric medicine, public health and the social and
political sciences of ageing. The latter perspectives are crucial in order to translate fundamental insights on the mechanisms
for maintaining and regaining mental capacity to everyday life contexts. In light of such reasoning, it is also becomes evident
that the Mental Capacity aspect of the Road Map must be seen in close conjunction with the section devoted to Healthy
Ageing for More Life in Years, and also with themes such as Inclusion and Participation in the Community and Labour Market
and Ageing Well at Home and in Community Environments. Due to its central role for everyday functioning as well as the
multi-faceted nature of the consequences of losing mental capacity, the issue also comes with huge financial implications
related to long-term care and losing social capacity for our societies at large. A particularly important area for Europe’s future
growth is the ageing workforce, an issue with substantial linkages to the psychology of ageing. For example, because several
cognitive processes already begin to decline rather early in the lifespan (such as speed of information processing and psycho-
sensori-motor and executive control processes), efforts to counteract and counterbalance such trajectories will become a key
intervention issue. Therefore, investing into research able to fully exploit the impact of lifelong prevention and training
towards maintaining and regaining the highest possible mental capacity must become a key European ageing research priority
in the future.

Fundamental Insights Crucial for Future Research

The principles of using a lifespan developmental perspective, treating ageing as a multi-dimensional, multi-directional process
with remaining plasticity are of crucial importance with regard to mental capacity. While cognitive abilities such as information
processing speed, working memory, attentive processes, and episodic memory already show reliable decline beginning already
around the age of 30 years, other abilities related to world knowledge such as verbal skills, the complex integration of life
experiences, and wisdom oriented cognitive performances such as insights into the relativity and uncertainty of human
existence remain rather stable into very old age or may even increase. In addition, older people seem better capable of
dealing with negative emotions (such as feeling sad or angry) and also better equipped to maintain positive emotions (known
in the current research literature as the positivity effect of ageing). Such proof of multi-dimensionality and multi-directionality
of mental capacity must also be seen in the light of the plasticity of mental functioning. For example, cognitively stimulating
and enriching environments contribute much to the exploitation of cognitive reserve capacities along the full ageing process
until very old age, although the impact and sustainability of such engagement effects seem to diminish in very old age.
Similarly, it has been found that some social contexts (e.g. focussed intergenerational interchange and social learning
opportunities at large) are able to elicit personal growth even in very old age, for example in regard to personality traits such
as openness to experience and creativity. It generally seems to be the case that cognitive reserve and compensation
potentials in old and even very old age are significant, but frequently still under-rated in our societies and health-care
systems. This also means that the course and outcome regarding mental capacity can only be understood in a lifespan
developmental perspective. In particular, the role of middle adulthood as the most direct bridge to old and very old age
deserves much more research attention in the European ageing research context.

Going further, mental capacity is also closely linked to another core lifespan developmental science principle, i.e. the need to
consider the historical context of development and the role of cohort flow. Major areas of mental capacity such as speed of
information processing or inductive reasoning have been found to be generally on the rise in different ages including old age
(see in particular the findings of the Seattle Longitudinal Study of Cognitive Aging) reflecting the generally observed so-called
Flynn effect, i.e the increase of intelligence (IQ) across the recent decades in the population. This positive cohort effect in
mental capacity seems to go hand in hand with a trend toward better health and functioning in the cohorts of older adults
since the 1960s, although there is evidence that some plateau may have been reached. Indeed, emerging evidence suggests
that these trajectories may not be the same in more recent cohorts due to new health and function risks, which forthcoming cohorts bring to their ageing process. Cohort effects play a major role when it comes to new input into mental capacity such as skills and knowledge needed to deal with ICT. Such technology increasingly emerges for the ageing enduser as a significant tool to support and optimise ageing processes in various constellations, including conditions of multi-morbidity, major care needs, and severe cognitive impairment. Therefore, great and sustainable investment is needed to bring such skills to older people in the most efficient way possible as well as to largely reduce their cohort-related disadvantages to fully use new technology. At the same time, due to the significantly increased life expectancy, there is an increased risk in late and especially very late life for cognitive impairment and the occurrence of dementia-related disorders, although some evidence underscores that prevalence may decrease in the future, for example due to increasingly better educated cohorts. Individual as well as clinical and societal challenges also include the discovery of mild cognitive impairment (MCI; with a high likelihood of converting into dementia in the longer run) as well as sub-threshold and mild depression (with a high likelihood of converting into affective disorder in the longer run and possibly also into cognitive impairment trajectories). This highlights the need to widen the aims to better understand brain ageing from a fundamental biological level to social and psychological aspects. It is important to mention in this context that age changes in brain metabolism are still poorly understood. Factors influencing peripheral metabolism and longevity often have good or bad effects on brain ageing depending of degree and/or context. Different brain areas and cell types need to be studied with regard to brain metabolism and ageing, and their function understood in the context of the whole organism. Interesting topics include whether age-related neuronal and cognitive changes in humans implicate any of the master regulators of metabolism or the neuroendocrine system. Therefore, research at the behavioural and social level must be much better coordinated in the future with biogerontology research, in order to more comprehensively understand the underlying dynamics as well as identify promising intervention areas.

Key Topics for Future European Ageing Research

Eight challenges and the main research questions related to future European ageing research in the area of maintaining and regaining mental capacity across the lifespan are listed below.

Research on the outcome of cognitive training and physical exercise
- How far can training, particularly multi-component training including cognitive and physical exercise components, take the ageing system in different stages of the lifespan (middle adulthood, young-old age, oldest age)?
- What are the most efficient training and psycho-educative approaches and how can they become implemented most successfully in everyday life of older adults?
- How is healthy life expectancy affected by effective training models and how can better sustainability of training net effects be achieved?

Role of context for enhancing cognitive engagement
- How strong is the effect size of social and physical environments as compared to person factors related to mental capacity development?
- Can improvements in the work environment lead to the maintenance or enhancement of mental capacity of ageing employees?
- How are older adults dealing with cognitive decline in everyday life? What are efficient compensatory and optimising strategies and what can we learn from such real world analysis for maintaining mental capacity at large?

Role of the motivational-emotional, personality and self-related system for the development and maintenance of mental capacity
- How far does the positivity effect in terms of cognitive processing lead and what are the potentials and limitations for older people?
- What are the relations between personality and self processes and the course and outcome of mental capacity?
- Can there be new synergies between the declining cognitive apparatus and the relatively stable personality and self system?
Better considerations of life course dynamics of mental capacity
How strong is the effect of life-span precursors on the course and outcome of mental capacity trajectories in later life (in particular: middle adulthood, but also very early periods of life, even those before birth)?
Is there an effect of major person-environment transitions as people age on mental functioning?
How can the lifespan-based potential toward prevention of mental capacity decline be used to the maximum effect possible in order to extend healthy life years?
See also: Ageing Well at Home and in Community Environments.

Better consideration of transitions from normal to pathological processes related to mental capacity
How far can a more fine-tuned differentiation between normal and pathological ageing go?
What are the major markers of transitions from normal to pathological cognitive processes and how similar or dissimilar are these across countries?
Can such new knowledge be efficiently used for prevention purposes and the extension of healthy life expectancy?

Research on how societies are dealing with mental capacity
How strong is the effect of stereotyping and age discrimination on trajectories of mental capacity?
Is there evidence that the reduction of negative stereotyping is serving the maintenance of mental capacity?
How frequently are dementia fears in European societies, what differences may exist between countries and how are such fears affecting ageing people in their everyday lives?

Research on challenges related to mental capacity in advanced old age
How great is the potential to maintain mental capacity to the largest degree possible for very old individuals?
How can very old individuals be psychosocially supported when their meaning-making processes are under threat and when coping with multi-morbidity and the accumulation of loss experiences become a life priority?
How can society and social institutions support the required educational processes (in a wide understanding) that can help cope with the challenges of a very long life?

Better consideration of multi- and inter-disciplinary synergies
What are the most synergy-rich combinations of disciplines in order to better understand the malleability and plasticity of human ageing?
How can core issues of ageing and healthy life expectancy be furthered by focusing innovative health and cognition, physical exercise and biogerontology, or affect / personality and neuroimaging linkages?
How can early-stage researchers be brought together as efficiently as possible to explore and establish such synergies?
See also: Biogerontology: from Mechanisms to Interventions.

INCLUSION AND PARTICIPATION IN THE COMMUNITY AND IN THE LABOUR MARKET

Importance of Theme

Increasing the level of peoples participation in society and ensuring that this contribution can continue along the whole life course represents today a widely shared policy target. The extent to which societies facilitate participation and promote inclusion at all ages is a key component of peoples access to their inalienable rights as citizens, and has implications for society as a whole from an economic and social point of view. At a micro level, participation represents a crucial element for active ageing, since being involved in social and professional activities is positively associated with several indicators of socio-economic status and well-being, including better health as well as mental and physical functioning. At a macro level, the positive impact observed on socio-economic institutions and public resources when participation is facilitated shows that
stronger efforts will be needed in the coming years, in order to implement welfare policies able to reach and maintain both financial sustainability and quality of the social protection system (see also the section on Guaranteeing the Quality and Sustainability of Social Protection Systems). At an intermediate, meso level, the facilitating or inhibiting role played by social institutions such as families, companies or other social networks is also relevant in affecting peoples inclusion and participation along the life course, and will therefore need to be closely monitored by future research efforts. Demographic and socio-economic changes have produced major changes to European societies in recent decades. This calls for a new consideration of participation patterns and possible future scenarios in terms of evolving family and societal structures due to demographic (e.g. low birth rate), normative (e.g. introduction of divorce) as well as economic and cultural changes (e.g. increasing participation of women to the labour force). These are reinforced by recent phenomena such as the global economic crisis and the growing use of ICT. Future ageing research has therefore a number of distinct roles to play in facilitating inclusion and participation over the life course, both as a support to policy makers and practitioners in their efforts and as a major social institution in its own right.

Fundamental Insights Crucial for Future Research

Participation in the community and in the labour market is a broad concept that embraces different dimensions of human life. It can be described as the sharing of individual resources in socially-oriented as well as economic activities, i.e. the complex set of behaviours and relationships that people activate with other individuals, groups or organisations. In this sense, it refers to different social networks in which people are embedded and interact during their life: families and kinship, friendships, peer groups, companies, non-profit organisations, political parties, and so on. Clearly, participation cannot be merely defined by the number of contacts between people and these social networks, but it should necessarily include also the quality and scope of such interactions. Inclusion (and its counterpart exclusion) can be understood as the extent to which existing social, economic, political and cultural norms, institutions and environments facilitate or inhibit participation. Uncovering the mechanisms and processes of inclusion/exclusion in our societies is crucial to better define the prerequisites and enablers for participation, taking into account also the psychological structure of ageing individuals and their behaviours and attitudes toward different forms of social interaction. Research in this area requires therefore not only a multi-disciplinary but also a multi-layered approach, able to capture for instance existing gender and cultural differences, both within countries and across Europe, at a micro, meso, and macro level. Research on participation related to ageing and older people will certainly benefit from a stronger and more systematic life course perspective, since social interactions necessarily modify as individuals age and face changes, such as those related to family structure (e.g. birth of a child, death of a relative), working conditions (e.g. relocation), urban dynamics (e.g. the ethnic composition of neighbourhood) as well as social and cultural transformations (e.g. concerning the path to retirement or the gender division of care tasks).

Key Topics for Future European Ageing Research

The first challenges are over-arching issues for promoting participation and inclusion in its widest sense, cutting across all social relationships and socio-economic activities. A further set of more specific key priorities can furthermore be distinguished between barriers or enablers experienced in the community and those in the labour market. The challenges and main research questions are listed below:

Ageism

What are the attitudes to ageing as a process? How are they formed and evolved? How can they be altered?
What are the gaps between perceptions and realities of older people’s skills, abilities and contributions to society?
How can the current social perceptions of age and ageing be effectively influenced in order to eliminate prejudicial attitudes?
Which role can the media play in this respect?
What interventions at the micro, meso and macro level can be successful in changing perceptions towards older people?
To what extent is discrimination institutionalised through legislation and regulations (e.g. in limiting access to health and social care services) across European countries?
Lifelong Learning
What are the most appropriate non-formal and informal learning forms for older people?
What are the barriers faced by older people in accessing formal training and educational opportunities? How can they be best overcome? And what is the role of educational institutions (e.g. the University sector or technical colleges) in supporting older learners?
What are the specific needs of older women, migrants and disabled older people in this field, as well as of people living in rural or remote areas?
How can knowledge transfer among generations be promoted to ensure the most benefits to all involved parties?

Migration
Which policies and practical strategies can most appropriately tackle the challenges raised by migration for integration and social cohesion?
How migration can contribute to the challenges associated with the ageing of our society?
What role can the ageing process play, on the other hand, for migration-related phenomena?
See also: Guaranteeing the Quality and Sustainability of Social Protection Systems.

Overcoming the digital divide
What role can ICT and virtual networks play in facilitating social inclusion?
What are the effects of ICT-tools in terms of intra- and intergenerational relationships?
Which measures are most effective in reducing or preventing the digital divide in using new technologies? And this especially in fields like long-term care, where they represent a crucial support tool for both formal and informal care providers?
See also: Guaranteeing the Quality and Sustainability of Social Protection Systems.

Mobility and accessibility
How can we achieve an optimal balance between physical mobility and accessible environments to enable maximum participation and inclusion among all age groups?
What are the health and economic outcomes of interventions designed to facilitate accessibility?
What role can assistive technologies play in facilitating accessibility for those with limited physical mobility?
How do mobility limitations impact on social relations in different, very old age groups (e.g. very old couples or singles)? And what kind of differentiated solutions are needed to overcome them?
See also: Healthy Ageing for More Life in Years (on delaying and preventing frailty), and; Ageing Well at Home and in Community Environments (on the role of supportive environments).

Ageing and spirituality
What is the role of spirituality in facilitating social participation at an individual level?
Which role does spirituality play in promoting or hindering social inclusion and an active contribution of ageing individuals in different societal sectors?
How does spirituality affect intergenerational relations?
How can research on spirituality contribute to the ethical debate on conditions of living and dying, also in the light of current and future technological developments?

Volunteering
Which measures and initiatives can improve the match between demand and supply of ageing volunteers, especially in sectors which are traditionally off-limits for them? How can a better image of volunteering in older age be promoted to this purpose?
Under which circumstances can volunteering represent a source of fulfilment and social inclusion for ageing individuals with poor health and socio-economic status?
How are informal caregiving and volunteering reciprocally related? Is there a trade-off between the two activities? How can investments in volunteers' human capital be ensured along the whole life course through appropriate programmes?

Participation as consumer or user
How can businesses and service providers be effectively incentivised to mainstream the principles of Design for All in the development of products, goods and services?
What role does age-based discrimination play in exclusion of older people from service use and consumer markets?
How do consumption and expenditure patterns vary between age groups and across the life course?
To what extent are variations in consumption and expenditure patterns between age groups a function of demand (different needs and preferences based on age) or supply (markets failing to supply goods and services equally effectively for all age groups)?

Discrimination in the labour market
What are the different types of direct and indirect age discrimination at play in the labour market?
What is the economic and social impact of age discrimination in the labour market?
Which measures are most effective in preventing work-related age discrimination?

Enabling a longer working life
What regulations on pensions and labour laws are most effective in supporting those who wish to work longer?
What incentives for employers are most effective in retaining and hiring older workers?
What is the optimal balance between social protection and labour market policies in the promotion of older worker employment?
How can employers effectively adjust to the ageing workforce?
What is the role of volunteering in helping older workers remain or re-enter in the labour market?
What further healthcare and employment measures should be introduced to better preserve the employability of the workforce?
What lessons can be learnt from the application of the workability approach in various settings?

Reconciliation of paid work and informal care
What are the barriers that informal carers face to remain in employment? What are the specific barriers faced by caregiving women and migrants?
What employment, tax and social protection policies and measures are more effective in ensuring various adequate working arrangements for reconciliation and adequate minimum income for both men and women?
What services are more effective and should be developed to support informal carers? What is the role of the information and communication technologies in this field?
How can we ensure a better sharing of caring and work responsibilities at a micro (individual) and macro (societal) level between women and men?
How can informal carers be empowered in decision-making that affects their lives, in order to ensure their participation?

GUARANTEENING THE QUALITY AND SUSTAINABILITY OF SOCIAL PROTECTION SYSTEMS

Importance of theme
The concept of social protection refers to the set of welfare policies and interventions aimed at preventing and managing social and economic risks (e.g. unemployment, poverty, disability or dependency), in order to ensure an adequate level of well-being to the population. Such interventions consist of providing benefits to potentially vulnerable social groups in terms of both material (e.g. cash transfers and in-kind services) and non-material resources (e.g. training and education). The final goal
of social protection systems is mainly reached by means of both social insurance programmes, i.e. through measures anchored on direct contributory schemes, and social assistance, i.e. support mechanisms that, usually not based on contributions, grant monetary help and/or in-kind services to vulnerable population groups. Within the concept of social protection, the role of both governmental and non-governmental stakeholders has to be considered. This is increasingly important at a time in which public institutions are no longer the only providers of welfare services, due to the presence of multiple social actors such as non-profit organisations and market institutions, as well as stakeholders like communities, families, and other social networks. Social protection systems represent at the same time both a traditional and an innovative research field, since recent demographic, socio-economic and cultural changes have fostered renewed interest in this area. Two major factors have exerted their influence: the in-depth impact of ageing on the demographic composition of European populations (e.g. in terms of balance between the working/non-working population, younger/older cohorts, the two genders and so on), and; the economic downturn affecting Europe and the world since 2007-08. The economic downturn has put new and increasing constraints on public welfare budgets, calling for a possible retrenchment of state interventions and a stronger role for privately funded services. Both trends pose dramatic challenges in terms of sustainability to the current welfare states, and require innovative approaches to identify solutions able to ensure that quality will remain a core feature of social protection systems across Europe in the future. Sustainability of social protection systems is a key challenge for the older but also for the younger generations, who are now experiencing new forms of social risks such as a late and difficult (re-)entry into the labour market and precarious employment. In this respect, and beyond the sustainability issue, strong inequalities can be recognised in European ageing societies between protected groups of population, who in the past could benefit from relatively generous early retirement schemes, and other categories, such as precarious workers and immigrants, who are more often left out of such measures.

Fundamental Insights Crucial for Future Research

Current European welfare systems were mainly built and/or restructured after the Second World War, in times of economic growth, targeting traditional forms of vulnerability such as illness and unemployment. According to this approach, pension schemes were for instance designed according to estimates based on life expectancy projections referring to a situation in which life after retirement was commonly short. Today's scenarios and the impact exerted on them by current population ageing trends therefore require intense scientific and political efforts, in order to update and remodel the role played by different actors and institutions. This is needed also in the light of long-term unemployment in late adulthood, a phenomenon now common in many European countries that is likely to increase the risk of poverty in older age in the future, especially now that the pension retirement age is being increased, thus exposing to unemployment many older workers who earlier benefited from pre-retirement schemes. While it is not yet completely clear how future social protection systems will impact on the above phenomena and, vice versa age-related changes in the prevalence of chronic conditions call for a reshaping of the current patterns of service delivery, still mainly focussed on acute care provision. In this respect, research should pay more attention to understanding how to best meet the long-term care needs of the population using most care resources, i.e. of people suffering from multiple chronic diseases, often implying a combination of both behavioural and physical disability. For instance, the rise in the number of people suffering from Alzheimer's disease and other forms of dementia brings with it the need to develop appropriate and targeted formal services, as informal caregivers of these patients are very likely to suffer from the negative social, economic and health consequences related to a long-term, time-consuming and stressful care experience. Moreover, the increase of cancer-related morbidity and mortality is challenging the capacity of European public welfare systems to provide appropriate palliative and end-of-life care, both in home and institutional settings. The broad issue of quality of care services is furthermore related to another type of social risk, that of elder abuse and neglect, mainly perpetrated by close relatives in domestic settings but often taking place also in institutional and home care settings, when monitoring and control mechanisms are inadequate or only partly implemented. In this respect, it is crucial to investigate more in-depth the cost-saving potential of prevention, in order to more clearly distinguish those cases in which preventing illnesses and abuses can have a saving effect on public health care costs from those which end up increasing the overall health care expenditure (such as for instance the screening costs sustained for detecting diseases with a very low prevalence). Similarly, technological development represents a further challenge for current social protection systems. On the one hand,
the inappropriate use of new technology in health and social care, as well as in public (e.g. e-governance) and private organisations, can lead to an unfruitful increase of costs and poor quality care. On the other hand, evidence suggests that new technology, when carefully implemented, can contribute to either contain costs (e.g. through a cut in transaction costs) or improve the quality of services and of users outcomes. Assuming a global and future-oriented perspective and a multi-disciplinary approach, technology assessment methodologies gain therefore a crucial relevance in the field of European social protection, in order to tackle existing risks and prevent potential damages caused by the uncritical and unguided application of new technologies. The heterogeneity of European countries plays, however, a major role in the identification of the most crucial research gaps, since traditional types of social risk, such as poverty, may still represent a main challenge for New Member States, especially those including large rural areas in Central and Eastern Europe. Future ageing research will therefore have to consider very carefully the heterogeneity currently characterising European Member States in different social protection areas.

Key Topics for Future European Ageing Research

Six challenges and the main research questions related to future European ageing research in the area of the quality and sustainability of social protection systems are listed below:

**Sustainability of social security systems**
Which measures can make current pension, health, social and long-term care systems more sustainable over time? What are the most effective social and economic policy models in this respect, and how are they interrelated?

Which role do education and training play, as non-material resources of social protection, in improving the sustainability of social security systems?

Which impacts would banning the mandatory retirement age have at micro, meso and macro level?

How can an adequate level of service quality be achieved, in times of budget constraints with an ever-growing population in need of long-term care?

Which trade-offs and alternatives pathways exist between the urgent need to reform and modernise current social protection systems and their long-term sustainability, especially in countries with most traditional welfare traditions?

Which role are the current trends of economic globalisation playing with regard to the sustainability of existing social security systems?

**Supporting informal carers**
How can family carers and private care workers become better integrated within the formal support system?

How can formal services support informal carers in their tasks and prevent them from stressful situations and burn-out?

To what extent can the support from formal services allow carers to remain in paid employment which has beneficial effects both from a social inclusion perspective as well as for the public purse?

How is migrant work in the elder care sector changing traditional formal and informal care patterns? And which measures can contribute to solve the problem of widespread undeclared work in this area?

**Improving access to services**
How can access to health and social care services be improved and better integrated, especially in deprived and sparsely populated areas?

How can formal public services support hard-to-reach segments of the older population?

Can ICT improve knowledge about the services available, and to some degree can it release some of the burden on social and health services?

See also: Inclusion and Participation in the Community and in the Labour Market.

**Efficiency, cost-effectiveness and quality of interventions**
How can improved transparency be achieved regarding the use of resources made within the public welfare systems? How
can the value-for-money in this sector be maximised?
Which strategies can increase the quality (from a users perspective) and cost-effectiveness (from a providers perspective) of interventions?
What are the most promising intervention in the field of preventive care and integrated care?
Which are the innovative interventions to support people coping with chronic diseases?
What is the potential of the omics technologies in developing new approaches for diagnosis and treatment of diseases?

ICT-supported informal caregiving
How can ICT-based tools support informal caregiving?
What is the role of ICT-based solutions in improving the quality of long-term care provided by informal carers, as well as their quality of life?
Which impact can ICT have in reducing the direct and indirect costs attached to informal caregiving?
Which ICT-solutions are most easily transferrable and implementable on a large scale, also in contexts in which no strong tradition nor digital competences exist in using ICT?

Reviewing and strengthening intergenerational solidarity and cooperation
Which changes are needed to ensure that todays social and demographic context will not weaken solidarity between generations in the long-term?
How can the contribution given by retired people to society be measured though their unwaged activities like grand-parenting and volunteering?
What are the good practices aimed at increasing older people participation to such activities after their retirement?
See also: Inclusion and Participation in the Community and in the Labour Market.

AGEING WELL AT HOME AND IN COMMUNITY ENVIRONMENTS

Importance of Theme

With increasing age, and particularly in very old age, people spend most of their time in the home. That is, all over Europe the home is the major place for ageing. The meaning of being at home and the sense of belonging and attachment to a circumscribed spatial terrain are crucial for identity and feelings of security among older adults. Increasingly with coming cohorts, not only the home but also community environments at large play an important role. However, the role of home and community environments for ageing well has not been sufficiently studied. Therefore, future ageing research must put a strong emphasis on the everyday environments of ageing, including not only the dwelling as such but also out-of-home environments as important arenas for activity and participation. Home and out-of-home environments have physical and spatial components, but also social components (treated in other sections of the Road Map). Considering perspectives for the future, we see new cohorts of ageing adults across Europe being mobile as never in history as well as increasingly using technical environments such as ICT for serving their quality of life. Accordingly physical-spatial-technical (PST) environments are focussed on as a research and practice area. PST environments thus include the full range of private living units, neighbourhoods, retirement communities, workplaces, shops and other service facilities, public transport facilities as well as long-term care institutions, hospitals, other health care facilities and products. It is clear that the human interchange with PST environments also deserves the consideration of legislation and policies (e.g. in terms of barrier-free environments), pension schemes, health and social care provision, transport solutions, age and cohort distribution, urban versus rural contexts, culture and ethnicity, segregation versus integration of older adults, and economical and environmental standard of a region or country. The development of PST environments supporting active ageing must also consider important subgroups of the ageing population such as e.g. older adults with dementia-related disorders or other severe care needs and those with a migration background. Particularly for such vulnerable subgroups, where the resources of the ageing individual may be very limited, the potential of PST environments to compensate and enhance the remaining potential for positive emotions, autonomous action, and leisure and social life deserves more research investments in Europe in the future. Traditionally,
research on ageing has focussed primarily on the ageing individual and population much less on PST environments and even less on the nature and potential of person-PST environment interactions. Moreover, while inter-disciplinary work is an asset and prerequisite for many research strands, research on ageing as related to PST environments is an area requiring inter-disciplinary research. Research on ageing as related to PST environments is also a domain par excellence to consider the interrelations between micro, meso and macro levels of analysis of ageing processes and outcomes. One example is the question, whether and how the course and outcome of ageing is also driven by contexts such as urban versus rural environments, various community contexts including deprived neighbourhoods, or national legislation and social policy. Another issue is gender, as more knowledge is needed on the differences between women and men regarding person-PST environment interactions, e.g. the perception of home, the function of home and the possibility of influencing the home environment and the neighbourhood, including the question of involvement in neighbourhood and city planning. It is of utmost importance to understand how ageing persons and user organisations representing senior citizens can be empowered to play an active role in shaping and designing housing, neighbourhoods, public transport, and health care and social services in urban and rural contexts, so that they better serve healthy ageing. This is indeed an issue of participation and democracy and the citizens right to influence her / his immediate living conditions. Research on ageing as related to PST environments also has critical implications for the consideration and practical treatment of end-of-life issues, because places of dying will remain among the crucial ethical challenges of our ageing societies. This is just one example to showcase that this area of research may evolve strong synergies with important ethical discourses within Europe. Multi- and inter-disciplinary research on ageing as related to PST environments has the potential to contribute with new conceptual, theoretical and empirical insights on processes of ageing, help to identify critical and frequently underrated antecedents of desirable outcomes of ageing, and through the findings, add to the identification of critical challenges related to improving quality of life of older adults all over Europe. For instance, an evidence-based and engaged consideration of the potential of environments supporting healthy and active ageing will help to decrease inequality among senior citizens (e.g. in terms of housing and transportation standards) within and between European countries. In this respect, the understanding of cultural differences regarding PST environments between countries, regions but also of ethnic groups regarding the design and use of space is important. This type of knowledge will show, for example, how different groups and individuals, as they age, perceive home and the sense of belonging. Such evidence might also serve as a basis for understanding their willingness to engage in the local society including voluntary engagement. The quality and meaning of home and community environments are also crucial for supporting the possibility to lead a healthy, active and meaningful life also in advanced age, and - while still not sufficiently targeted in research - will ultimately have an impact on the possibility to expand the number of healthy life years as we age.

Fundamental Insights Crucial for Future Research

A plethora of empirical work supports the notion that physical, spatial and technical aspects of home and community environments are able to significantly support healthy and active ageing. For example, the home environment has been found to support autonomous functioning, even after controlling for confounders such as age, co-morbidity, and education. Similarly, technology has become a new resource for ageing persons. Currently and increasingly, the internet is being used as a tool for intergenerational exchange or a means to search for information on societal services, technologies such as sensor mats or GPS-based orientation systems are used to support frail older people, robot animals and ICT-based entertainment are being introduced to stimulate emotional life or cognitive capacity, and so on. Still, the scientific knowledge on relationships and interaction between the ageing individual and such environmental features is weak. Aspects of innovative power of research on ageing as related to PST environments lay in its strong potential to stimulate and drive new inter-disciplinary synergies (without neglecting the value of disciplinary approaches), its contextualised image of older adults as being proactive as regards their environments, and its emphasis on end-user orientation and participatory research (without neglecting scientific rigour and the value of basic and applied research approaches). With such perspectives serving as a platform for research on ageing as related to PST environments, there is a set of cross-cutting, fundamental insights crucial for future European research in the area as follows:

Emphasis on the diversity of ageing persons and PST environments: research on ageing as related to PST environments can
serve a better understanding of ageing and diversity. This applies, for example, to studies on housing conditions, quality of urban environments, deprived neighbourhoods, and the provision of assistive devices. Additionally, diversity appears in environments such as retirement communities, longterm care institutions, and prisons (in which a rapidly growing proportion of prisoners now belong to the older age segment), workplaces or leisure activity areas. Such environmental diversity interacts with the diversity at the person level, reflected for instance in gender, the distinction between the third and fourth age, ethnicity, and social class. Diversity also increasingly appears in technological and virtual places and contexts, where there are still marked differences in to what extent different subgroups of the ageing population use such resources. Important in terms of diversity are also differences within and between European countries in green issues such as air pollution or climate change. In sum, research on ageing as related to PST environments can significantly enhance the understanding of diversity and ageing issues in Europe.

Emphasis on the life course dynamics of person PST environment relations: it is crucial to understand the interaction with PST environments from a life course perspective. For example, many decisions taken earlier in life (e.g. residential decisions in middle adulthood) may have a strong influence on adaptation late in life. The concept of transitions in adult human development is also important and helpful for future research on PST environments. Turning points such as transitions from middle adulthood into late adulthood (such as retirement), and from early old age to advanced old age (such as relocation to a sheltered housing facility), imply major alterations in terms of potentials but also risks. A prime area targeting such transitions with high importance for our societies is the role of environmental design and optimisation for the ageing workforce. That is, to minimise the risks in terms of both health and economy a profound consideration of the role of PST environments in workplaces is needed in order to support the potential of the ageing workforce. At another level, transitions from normal cognitive ageing to mild cognitive impairment or dementia create significant changes, not the least from a person-PST environment interaction perspective. Moreover, thanks to the advancement of medical research many chronic and progressive diseases can now be treated, with positive effects on survival. Such developments result in more people living longer parts of their life with a disability that is, ageing with a disability is an experience shared by an increasing proportion of the population, increasing the need for research on person-PST environment interactions in such subgroups of the population.

Emphasis on future cohorts relations with PST environments: research on ageing as related to PST environments can also contribute to increase the understanding of forthcoming cohorts of older adults. In particular, new cohorts of older people appear with new environmental habits and lifestyles, which will shape the life course at large as people age in the future. A prime example is the expected use of new technology such as ICT but also robotics or GPS tracking technology.

Key Topics for Future European Ageing Research

Seven challenges and the main research questions related to future European ageing research in the area of physical-spatial-technical (PST) aspects of home and community environments are listed below:

- **Generation of differentiated knowledge on the enabling and constraining characteristics of PST environments at the home and community level**
  - What are the key enabling and constraining characteristics of PST environments for older adults, for example in terms of maintaining autonomy, well-being and identity?
  - How important is the role of home characteristics including home adaptation as compared to person factors such as multi-morbidity and functional limitations?
  - What role do major differentiating variables such as age, gender, ethnicity, mental status, functional impairment, region and culture play when it comes to the impact of PST environments on healthy ageing?
  - What are the effects of implementing an as focussed as possible policy to stay in your own home as long as possible to the ageing individual, to the care services, and to society at large?

- **Better understanding of the meanings of PST environments of older adults lives**
  - What do home environments and neighbourhoods mean for current cohorts of older adults, for example in terms of cognitive
and affective ties to the home, place attachment and their possible role of maintaining the ageing self and identity?

How does meaning of home and neighbourhood vary when it comes to the diversity of older adults, including mental status and ethnicity? Can such evidence be efficiently used for intervention purposes?

Is there evidence for cohort-related changes in what home environments and neighbourhoods mean to older adults?

Will technology, for example home-based robotic systems, be accepted better by future older adults as a means to support and enrich quality of life?

What meaning do specific places (e.g. kitchen, garden) hold as people age, and is there a change of the role and function of such places over time?

More research on the relationship between transport and ageing well

What are the transportation needs of the future ageing population of Europe, and how are these needs related to health and quality of life?

How can the needs in terms of out-of-home mobility of older adults with cognitive impairments be supported in optimal ways?

What kind of technology is needed to serve the transportation needs of older adults in optimal ways, and how can such technology be implemented most efficiently?

Work environments as key PST environments for ageing societies

What are the key elements of designing work environments in order to release older employees potential in the best way possible (e.g. in terms of health, cognitive functioning)?

What kind of role can technology play in order to optimally serve the needs and capabilities of older employees?

Is there a relation between the characteristics of the work environment and older adults innovativeness? How can such a linkage be optimised in the future?

See also: Inclusion and Participation in the Community and in the Labour Market.

Long-term care environments for vulnerable and frail older adults

How can long-term care environments be designed in the future to support optimal ageing in old and very old age even in the situation of much reduced resources (such as dementia)?

What synergies and possible risks are coming with future alliances between long-term care institutions and technology?

What are the most convincing alternatives to traditional long-term care solutions for older adults with different degrees of frailty? What potential and limits do they have?

PST environments as supporting healthy ageing and increased life expectancy

How can we create environments that optimise the exertion of physical activity in later life?

How do we create mobilising environments that support health promotion and serve the empowerment of older adults?

What are the implications of and what elements and resources are needed to create age-friendly communities within urban and rural areas?

What kind of PST environments do best serve the maintenance and possibly the enhancement of cognitive functioning in old age?

Can virtual environments be used to stimulate healthy ageing, and in which ways?

Healthy home and community environments for very old age

What are key synergies between the characteristics of PST environments and older adults with dementia? Can such synergies be used better in the future and what is the potential?

How can places counteract the pronounced vulnerabilities of extreme old age? What can different European countries learn from each other in terms of the creation and design of such places?

How can optimal places for death and dying be created for old and very old adults and how can such environments support a possible new culture of death and dying in Europe at large?
UNEQUAL AGEING AND AGE-RELATED INEQUALITIES

Importance of the theme

While the life expectancy of EU citizens has risen steadily over recent decades, the gradient in life expectancy between more or less deprived populations and those with greater access to social and environmental resources continues to persist. Inequalities in life expectancy are systematically generated and grounded in social and economic factors. Within the EU, there is an uneven distribution of life expectancy and healthy life expectancy between Member States and between population groups within Member States. Health follows socio-economic gradients so that, put simply, the worst off experience the shortest lives and also live a greater proportion of those lives in worst health. Life course trajectories are socially embedded and strongly influenced by the accumulation of opportunities and risks. Some of these risks are structural and relate to the social environment and the way society is organised. Individuals exert little if any control over these factors, which de facto restrict the potentiality of individual human agency. Family lineages, in the first instance, set the background conditions of individuals early life and through them inequalities are transmitted between the generations. Along the life course, the ageing of individuals differs as a consequence of the unequal impact of life events: childhood, puberty, reproduction, and senescence. Inequalities are generated by biological, social, psychological, economic and ecological processes. Inequalities are paradox excellence a multi-dimensional concept which may refer to the financial, social, functional, spiritual, and cognitive sphere. Much attention has been paid so far to the social inequalities (and inequities, the normative concept applied to inequalities which are judged to be unfair and unjust) in health: social differences are well reflected in the health domain, with many of the common age-related health conditions being distributed unequally across socio-economic gradients so those with limited access to socio-economic resources also tend to experience the worst health.

Fundamental Insights Crucial for Future Research

Inequalities result from the interplay between genetic and key environmental determinants. Ageing contributes as a risk factor for inequality, along with other factors such as access to social, environmental and economic resources, class, gender, ethnicity, health risk-related behaviour (such as smoking, exercise and diet) and access to services. Many of these factors are open to intervention. The rate at which individuals and populations age is also dependent on interaction between these factors. There are large variations in income and other dimensions of socio-economic status (including social class) across the EU. For the population over 50 years of age, income difference analysis of SHARE showed that, for older people, average income exceeded €45,000 in three countries (Denmark, the Netherlands, Switzerland), was between €30,000 and €45,000 in Austria, France, Germany and Sweden, and was below €30,000 in Italy, Greece and Spain. The relationships between national average levels of income and poverty are revealed in the SHARE database for the distribution of poverty (defined as <60% median income) between EU countries among the over 50s shows that overall about a quarter of EU citizens over the age of 50 live in poverty with significant variation between Member States. For example at the extremes of the distribution the figure for Sweden is 17.2% and that for Italy is 27.7%. Similar statements can be made about the distribution of socio-economic resources within Member States. Such examples serve to illustrate the complexity of interactions between socio-economic and demographic factors and inequality across Europe. Health follows these socio-economic gradients so that, put simply, the worst off experience the worst health.

In addition to age and socio-economic deprivation, there are other important contributory factors to inequality such as the complex and contested dimensions of race and ethnicity. This is a challenging area to investigate for a number of reasons. It is undeniable that ethnic identities have important implications for peoples lives, with some ethnic groups apparently experiencing particular disadvantage in relation to both health and socio-economic status, reflecting distinct life course experiences and inequalities in health and longevity. In this regard across the EU, special mention must be made of migration, particularly with respect to the employment of migrant care workers and the integration of migrants into destination countries. A key issue here concerns ensuring the effective utilisation of health and social services, a particular priority for first generation migrants who may face significant language difficulties as well as discrimination in gaining full access to services.
People with a disability are at increased risk of many other health problems, and have shorter life expectancy than those without disability. These risks are elevated for both physical disability and learning disability. Sex and gender, are significant contributory factors to the mix of determinants of inequality. For example the health and longevity of men and women varies because of genetic and physiological differences. These differences are amenable to research not only at the level of international or intra-societal comparison in humans, but also at the biological level. It is increasingly recognised that sex and gender influences on health are complex, and that the health and longevity profiles of men and women deserve further research and analysis. Correlations between reproductive activity and lifespan have been seen in many organisms, particularly with regard to the actions of hormones as determinants of metabolism with ageing at the cellular and molecular level. This illustrates the importance of understanding the interactions between reproduction on the one hand and nutrition and metabolism on the other. Both are key determinants of ageing, and both are dependent on factors such as income, poverty and other dimensions of socioeconomic status. Among other things, research in this area promises to provide insights into the distribution of gender differences in ageing and reveal mechanisms (and therefore potentially targets for therapies) underlying the variation in the prevalence and treatment of specific diseases, and the response to drug (and other) treatments between men and women. The very old are the fastest growing section of the population in many countries and is also the group a high prevalence of functional limitation, which, even in advanced old age, is distributed along socio-economic gradients. This population group also faces increasing care needs including dependency on informal and institutional care which puts them at high risk of their rights being abused. There is a current lack of knowledge on the distribution and patterns of complex health problems and frailty in old age, including the biological factors (or biomarkers), which could predict the future onset of age-related disease and/or residual life expectancy, and what the very old consider is important in terms of quality of life and well-being. The very old are a group at relatively high risk of abuse and neglect, which varies in prevalence across the EU27.

Key Topics for Future European Ageing Research

There is considerable overlap between disciplines and research themes on the priorities for inequalities research. This is illustrated with reference to six broad research challenges and main research questions listed below:

Monitoring inequalities
How cumulative advantages and disadvantages shape opportunities and risks, which ultimately influence health and other outcomes in older age?
Do adverse circumstances in younger age have irreversible effects, or can early drawbacks be overcome at a later stage during the ageing process?
What are the compensatory mechanisms along the life course that reduce the adverse impact of risks and disadvantages?
What is the role of human agency and the impact of structural factors on inequalities in older age?
What factors can strengthen resilience to potential stressors and disadvantages?

Health in work and retirement
Can the workplace be considered as a suitable setting to develop effective healthy ageing interventions?
How can work-related health inequalities be prevented? And those accumulated during the working life be reversed or compensated after retirement?
Is there a link between inequalities in pension schemes and health status after retirement?
How does retirement affect health? Are there commonalities/differences between social groups and occupations?
See also: Inclusion and Participation in the Community and in the Labour Market.

Inequalities and discrimination in the labour market
The research priorities in this field are covered in the section on: Inclusion and Participation in the Community and in the Labour Market.
Inequalities and discrimination on health

In what ways does discrimination on the grounds of age have an impact on inequalities in health? What are the prevailing norms within the health and care sectors that potentially contribute to negative attitudes towards older people and inequalities? How do these attitudes deter effective health care interventions? How does the financial capacity of older people impact on their access to health care? Is there age discrimination within the financing of health care provision? Which are the prevailing risk factors for the exclusion of older people from health care provision? Are there any good practices addressing these risks? Are there age limits in clinical trials and pharmaceutical trials? Do such practices respond to the needs of the ageing population? Are there risks for older peoples health care provision?

Ageing and migration

What is the impact of migration trajectories in determining inequalities over the individual life course and within society? Which initiatives are most successful at national and regional level to address in a culturally sensible way the needs of migrants and minority ethnic elders? How can barriers of access to quality care services care for migrants and minority ethnic elders be prevented? And what are the roles played by professionals in this area? How can the collaboration between researchers, policy makers, practitioners and older migrants (organisations) be improved to inform ageing research, policies and practice, thus reducing migration-related disadvantages and increasing migrants contribution to society?

Focus on the very old

What methodological approaches allow achievement of a better inclusion of frail and dependent older people into clinical and socio-economic investigations? To what extent does the lack of representativeness of research samples in terms of older population limit the generalisability of results? To what extent do the very old population in Eastern Europe resemble or differ from its Western European counterparts? What are the similarities and specificities which can be found across countries? How prevalent is elder abuse and neglect across the EU27? What are the different kinds of abuse and neglect? How are they related? How is neglect and abuse experienced at the micro level? Do individual characteristics of the victim play a role in the detection, acknowledgement, prevention and tackling of elder abuse? What evidence is there for abuse and neglect within hospitals and long-term care settings? What are the features of the long-term care systems that have an impact on the prevalence of elder abuse and neglect? What is the link between the quality of care and the quality of the work of the healthcare workforce and elder abuse? Is the lack of support to caregivers (informal and professional) a contributory factor to elder abuse?

BIOGERONTOLOGY: FROM MECHANISMS TO INTERVENTIONS

Importance of Theme

The increase in life expectancy across Europe and the challenges that arise from population ageing need, at the most fundamental level, to be understood in terms of the biological mechanisms that sustain life and of the gradual compromise of these mechanisms which results in age-related morbidity, disability and death. Individual persons have many dimensions of being social, cultural, economic, medical, and others each of which is important for well-being. Underpinning each of these dimensions is the current state of the individual body as a biological organism. In parallel with the change in demography, there has occurred significant progress in one of the newest areas of biomedical research the biological study of ageing, or biogerontology. From a biological perspective, ageing is one of the most demanding objects of study. The ageing process
affects the functions of the body at all levels, from the smallest changes affecting individual molecules, through impacts on cellular integrity and function, to changes that influence the operation of whole organs and organ-systems. The ageing process is influenced by genes, with some tendency for longevity to run in families, but overall the genetic contribution is modest (around 25% of the whole complex of factors influencing longevity) and there is an overwhelming consensus among biogerontologists that ageing is not itself programmed by direct gene actions. Instead, ageing is caused by the accumulation through life of a wide variety of faults in molecules and cells. Indeed, gene actions are for the most part concerned with survival, regulating the numerous maintenance and repair systems that allow humans to survive as long as they do.

Key questions in biogerontology concern:

i. The nature of the mechanisms that cause the age-associated accumulation of damage
ii. How genetic and non-genetic factors, including lifestyle factors such as exercise and nutrition, influence the trajectory of health across the life course
iii. The deep connections between intrinsic biological ageing and the many diseases for which age is the dominant risk factor
iv. How medicine can develop new, biologically-informed ways to target age-related frailty
v. How interventions might be developed to improve health span faster than the growth in average longevity, and
vi. How the biological age of individuals can be monitored to provide a rapid feedback of data that can inform about the success of intervention strategies.

The FUTURAGE biogerontology theme is informed by previous EU actions in the field of biological ageing research, including among others AGEACTION, LINK-AGE and WhyWeAge. The importance for Europe of developing strength in biogerontology is that this field will be essential to provide the knowledge base for future improvements in age-related health, including initiatives that recognise the life course nature of ageing. While some goals concern improving the health and vitality of those who are old already, in order both to minimise the risk of high-cost dependency and to enhance the social and economic contributions of growing numbers of older citizens, others must address factors that apply from the earliest stages of life, even antenatally, to boost the lifelong trajectory of health and wellbeing. Europe has established significant strength in this rapidly expanding scientific field, which is of global significance. Nevertheless, the current effort is extremely modest with respect to the size of the challenge. Europe therefore faces three key challenges in biogerontology: 1) To integrate ongoing research most effectively; 2) To increase by a large factor the research capacity by training new researchers at all career stages; 3) To deliver international impact by securing adequate competitiveness with other regions and through strategic global collaborations.

Fundamental Insights Crucial for Future Research

Biological ageing is a complex process but one that has become scientifically tractable with the advent of new theoretical concepts and major technological advances in the biosciences. As recently as twenty years ago, leading biomedical scientists would sometimes dismiss ageing as just too complex for realistic analysis. This tendency has disappeared and been replaced by growing recognition that biogerontology is one of the most important emerging fields of research. The complexity has not gone away, however, and there will need to be a very substantial expansion of biogerontology research if insights are to progress to mature techniques to intervene successfully to enhance health in old age. Perhaps the most significant insight has been the recognition that the ageing process is much more malleable than used to be thought. The body is programmed for survival, not death; it was just never a high enough evolutionary priority to evolve the capacity for indefinite survival, given the hazardous conditions in which most organisms (including our human ancestors) lived their lives. Ageing thus results from the gradual accumulation of cellular and molecular faults. Genes influence longevity by conferring robustness on the body, and there is a general tendency for increased genetic robustness/longevity to be associated with some biological cost, such as somewhat reduced fertility. However, the length of life (and reproductive success) of an individual is strongly influenced by many factors, including lifestyle and chance. There is growing epidemiological evidence that factors such as nutrition can have important effects on ageing and health, and the mechanisms underlying such effects are beginning to be investigated. There is also evidence that exercise has generalised benefits for ageing and health, in addition to immediate effects on
cardiovascular and muscle function and on reducing the risk of obesity and diabetes. It is through the application of these non-genetic factors that the most immediate further improvements in ageing and health are likely to be generated, and there is particular reason to wish to focus such application on the most disadvantaged sectors of the population, in whom the adverse effects of unhealthy nutrition and lifestyle are most evident. Beyond the already known potential to improve ageing and health by modifying nutrition and lifestyle, it seems entirely reasonable to expect that advances will be made in biological measurement of age changes and eventually by direct intervention in mechanisms causing intrinsic ageing and age-related diseases. If the malleability in ageing mechanisms can be exploited, for example, to postpone neurodegeneration, osteoporosis, muscle waste and immune system decline, it should prove possible significantly to reduce the prevalence of these conditions across Europe. As will be described below, research is advancing in many of these areas although there are many scientific questions still requiring further research. In terms of how age affects the health of older people, there is still a significant lack of information of sufficient detail to inform biogerontological insights. Some national and European projects are beginning to address this shortfall but there is still great need for detailed, longitudinal studies that can capture data on biological measures related to underlying biology of ageing. Such studies need also to capture detailed health information that will enable connections to be made between biological mechanisms and age-related frailty and disease. The fact that biological mechanisms of ageing are influenced by social and environmental factors means that it is no longer acceptable for biogerontology and social gerontology to be conducted in isolation from each other.

Key Topics for Future European Ageing Research

The recently completed EU FP7 project WhyWeAge aimed to identify key elements of a European road map for research in biogerontology. Eleven scientific topics for future European research in the area of biogerontology were identified. These form the biogerontological theme in FUTURAGE and are summarised as follows (greater detail can be found in the WhyWeAge final report):

Biomarkers of ageing
Can we identify a practically useful set of biomarkers of ageing capable of predicting future health and longevity in individual humans?
Can we identify similar markers for non-human models that will facilitate translation of research on interventions from models to humans?
How can we deliver the most effective infrastructure to underpin ageing biomarker research and development within Europe?

Telomere erosion, DNA damage and mitochondrial dysfunction
What are the exact mechanisms by which telomere erosion, DNA damage and mitochondrial dysfunction contribute to cellular ageing?
How do these mechanisms interact?
How do the effects of these mechanisms at the cellular level give rise to age-related dysfunction and disease of tissues and organs?
How can this knowledge be harnessed towards safe and effective intervention at the molecular and cellular level?

Oxidative stress, protein damage and protein maintenance
Which proteins are most susceptible to damage and why, and how do protein modifications contribute to breakdown in protein homeostasis?
How extensive are protein modifications in cells during ageing, and can we enhance techniques to detect random modification of proteins as powerful as those which now exist for DNA?
What factors are responsible for protein aggregation and how exactly do protein aggregates contribute to age-related cellular pathology?
What factors underlie age-related changes in protein synthesis and degradation and how might these most effectively be targeted?
Systems biology of ageing
How do the multiple mechanisms of cellular and molecular interact to drive age-related pathobiology?
How do the multiple maintenance and repair pathways interact to sense and respond to damage of the various kinds?
How do the above two networks interact and where might be nodes that offer opportunities to target interventions that can improve health in old age?
How best to configure and implement European infrastructure to support systems biology of ageing?
How to generate the added value from currently disintegrated research activity by delivering the necessary integration for effective progress in systems biology of ageing?

Inflammation and impaired immune functions
How does inflammation contribute to age-related pathology and how can these processes be targeted to reduce adverse effects of inflammaging?
What mechanisms underlie age-related deterioration of immune functions and how can effective function be maintained for as long as possible?
What is the role of chronic infections such as with cytomegalovirus (CMV) in contributing to immune dysfunction?
How can immune risk be defined using suitable biomarkers and can the immune risk profile be modified?

Metabolic factors
How is metabolic homeostasis affected by diet, age and other factors?
What metabolic sensing and signaling pathways have beneficial effects in animal models and might these exert similar effects in humans?
How are metabolic gene regulatory networks configured and can systems biology reveal specific targets for effective interventions?
How and in which organs do effects of metabolism exert their effects on ageing?
How do neuro-endocrine signals influence and interact with metabolic factors affecting ageing?
How do fat tissue and associated signals influence and interact with metabolic factors affecting ageing?
What biological mechanisms contribute to the sex/gender differences in ageing and longevity?

Nuclear receptors
What is the nature of the cross-talk between nuclear receptor signals and metabolic signalling pathways?
To what extent do epigenetic modifications affect nuclear receptors and their impacts on ageing and health?
What are the roles of nuclear receptors in the control of biological rhythms and their dysregulation during ageing?
What links exist between metabolic signalling through nuclear receptors and homeostatic control of somatic stem cell functions?

Age-related disorders of blood circulatory (vascular) system
What is the role of known molecular/cellular mechanisms of ageing (e.g. oxidative damage, cell senescence) in the aetiology of vascular stiffness and vascular calcification?
How to identify protective genetic traits and their relationships to mechanisms of vascular cytoprotection?

Muscle weakness, sarcopenia and physical exercise
What are the prevalence, causes and functional consequences of sarcopenia?
What are the roles of muscle protein breakdown, oxidative stress and accumulation of modified proteins in muscle ageing?
What are the most effective physical, nutritional and pharmacological strategies to combat sarcopenia and sarcopenic obesity?
What are the effects of exercise, inactivity and inflammation on age-related regulation of skeletal muscle mass and function?
Age-related modifications of skin and elastic tissues
What causes the changes in extracellular matrix during ageing?
How does intrinsic ageing affect stem cell functions within skin?
What are the most effective nutritional and pharmaceutical strategies to combat skin ageing?
What are the effects of exercise, inactivity and inflammation on age-related regulation of skeletal muscle mass and function?

Connecting biogerontology with clinical ageing research
Do common ageing mechanisms contribute to multiple age-related diseases?
How can we explain mechanistically the differential vulnerability to different age-related diseases, including inverse epidemiological associations?
What mechanisms underlie age-related frailty, and how can this syndrome best be prevented or delayed?

IMPLEMENTING THE ROAD MAP

The Road Map could not be concerned purely with scientific research priorities and had to give some attention to the implementation process. Of course we hope that its thematic priorities will be taken up quickly by research funders and policy makers at all levels. In particular the Road Map should be followed to prioritise ageing in Framework Programme 8, which was the consistent call from all stakeholders throughout the FUTURAGE process. But, even if this happened, it would not be enough to secure the future of ageing research in Europe and ensure that its full potential, in scientific, economic and societal terms, is realised. In particular there are four important aspects, or pillars, of implementation which demand attention. They are: infrastructure, capacity building, user involvement and knowledge exchange.

Ageing Research Infrastructure

The priority given to ageing research between Europe and North America is often contrasted. The higher levels of funding per capita in the latter, compared to the former, as well as more successful exploitation, are attributed to the existence of national research institutes. In the case of the US the National Institute of Aging has coordinated, prioritised and encouraged research in this field for 35 years. It even funds longitudinal research in other countries, including European ones. By comparison, with the notable exception of SHARE, what Europe has managed to achieve with respect to coordinated effort is very limited indeed and always project based and, therefore, short life. (This is in direct contrast to the world leading quality of a great deal of Europe’s ageing research, in areas such as social gerontology, biogerontology, epidemiology and cognition.) The European Forum on Population Ageing Research (FORUM) 2002-2005 was the first initiative to seek to coordinate ageing research across the Member States. This was followed by two stages of the European Research Area in Ageing (ERA-AGE), 2005-2008 and 2009-2012. Both have made important contributions, especially ERA-AGE which has developed and funded Europe’s first post-doctoral programme in the ageing field, FLARE, and mounted Europe’s first joint programme of ageing research, based on the EIPAHA priority and supported by nine countries. Despite this notable record ERA-AGE lacks the resources to properly coordinate ageing research and ensure its maximum exploitation. It may be that the JPI More Years, Better Lives can fulfil this role but that remains an open question and the need for action is urgent. What scientists have been calling for since the first European Forum, organised by the FORUM project, is a European Institute of Ageing. In practice this could take the form of a virtual institute with appropriate infrastructure, along the lines of the successful Canadian Institute of Aging. It is needed urgently to accomplish three tasks. First it is essential to coordinate existing and future research initiatives on ageing, as ERA-AGE has sought to do. This discourages duplication between countries and regions, builds cumulatively on previous experience and encourages joint projects. It tries to realise the potential of Europe as a geographic research laboratory. An important and so far neglected aspect of this coordination concerns the harmonisation of definitions, protocols and ethical guidelines. To facilitate pan-EU ageing research harmonisation of legislation pertinent to clinical trials and clinical research is a necessity since the current lack of uniform trial guidelines and ethics protocols, mainly attributed to the great differences in legislation between countries, pose a serious obstacle when dealing with study design, patient recruitment, handling of
samples and data acquisition. The use of validated classification schemes, such as the International Classification of Functioning Disability and Health (ICF) and/or assessment tools, for instance GerontoNet or the Resident Assessment Interview Minimum Data set (RAI-MDS) might resolve some of this and should be encouraged. Special efforts have to be made to promote networking opportunities and enhance exchange capabilities within and between European countries. Much greater benefit needs to be derived from sharing data from BioBanks and registries, easier access to hard-to-find patient samples including ones from frail older adults, and systematic analysis of larger amounts of data.

Second, the absence of a comprehensive European database of ageing research is holding back the exploitation of much of the excellent, high quality research that European scientists produce. An infrastructure to maintain such a database and to enable the more rapid than at present translation of research into tangible impact is a serious vacuum (see below). Third it is essential to build the European capacity in ageing research (see below). Funding for a European virtual institute of ageing need not rely only on EU sources and should welcome national and regional contributions and affiliations. Business sponsorship could also play an important role in securing the economic sustainability of this vital European resource.

Capacity Building

Capacity building is a fundamental requirement for the successful implementation of the Road Map. Again this has been flagged as an urgent need by European scientists since the FORUM project. (Ageing is evident among the senior cohort of researchers and it is they that have led the calls for support for doctoral, post-doctoral and mid-career programmes.) In some countries it is clear that there is a dire lack of ageing research capacity and career structure for scientists in the field. The FLARE programme is a model post-doctoral programme: 3 year fellowships entailing mandatory geographical and disciplinary mobility funded by nine countries. It should be expanded to include more countries and a larger number of fellowships than the current 15 to form the basis of a systematic investment in early career researchers in this field, especially in Central and Eastern Europe. An institute of ageing could also provide encouragement to Member States to develop joint career paths for researchers and notice boards for scientists looking for job or training opportunities. A second critical aspect of capacity building is the gap between Member States in their research infrastructures. The variable capacity in clinical science, especially geriatrics, is a clear example. There are differences in research capacity, not only in life expectancy, between the East and West. If the EIPAHA target of increasing healthy life expectancy by an average of 2 years by 2020 is to be achieved it is crucial to focus special efforts on the New Member States (NMS). This includes research effort. An institute of ageing research could be the pivot for building capacity in the NMS based on sharing expertise and infrastructure and promoting good practice, as ERA-AGE has begun to do. Providing infrastructure, support and training to those countries with relatively low ageing research capacity would serve very well future European initiatives in this field. There is a third aspect of capacity building, among users, which is dealt with in the next section.

User Involvement

Another important pillar of the Road Maps implementation is the engagement of end users. For this reason the FUTURAGE project allotted significant space for discussion and interaction with users: on the one hand, two workshops dedicated to user involvement gathered 79 delegates (older and disabled people, carers, NGOs, academics and researchers, policy makers and business persons) from over 20 countries to debate the priorities and the concerns around user engagement; on the other hand, this topic has been considered as a cross-cutting issue throughout the whole project, thus ensuring that users were engaged also in the various scientific workshops and at all stages of discussion, guaranteeing that they could contribute to development of the research priorities across the different thematic groups. User involvement means to concretely engage users at all stages, to design with them their role throughout the process, to take into account their needs and concerns throughout the whole process, to carefully encourage, recruit, support and train them. This implies the need for sufficient resources, which are not only related to research funding, but also to human support. User involvement implies the sharing of research outcomes with the users who take part in the activities, as well as involving them in the evaluation and eventual follow-up. User involvement means compliance with ethical requirements and contributing to users quality of life, mostly
following a multi-disciplinary and inter-disciplinary approach. Users are not a homogeneous category (various aspects must be taken into account, such as age, gender, cognitive and physical abilities, social and cultural background, income, level of education and literacy, ethnic and geographic origin). The involvement of multiple actors (including caregivers, professionals, insurers, decision makers, political leaders) is equally important.

Implementing the principle of user involvement
Given that there cannot be one single model of user involvement which applies everywhere in Europe, and that the academic disciplines, the study design, the objective of the research and other factors, such as the available resources, also impact on the methodology of user involvement, implementation would be most effective if it could be based on a policy to support and strengthen user involvement in ageing research across Europe and which would carefully take into account these aspects of diversity. Such a policy, to apply to the whole EU, encompassing principles and guidelines for user involvement, could ensure the delivery of more appropriate and effective responses to the challenges of an ageing Europe, with a direct and positive impact on the quality of research, along with greater potential for knowledge transfer and with a beneficial effect on the economic competitiveness of Europe, where solutions designed for all are the result of a conscious and more informed market pull and a coherent business push. Involving users also means including them in research projects at all stages: and this should be a requirement in the various funding schemes. Ensuring that resources can be used only if users are effectively engaged in the research is an important step for the concrete implementation of user involvement throughout Europe. Another important element leading to the improvement of user involvement in European ageing research is to support the growth and development of NGOs and user organisations, particularly in new and candidate countries where these developments are often fragile. This step will ensure more awareness about user engagement and more representativeness and engagement of users in very different disciplines and domains. It was clear from the Road Map process that user involvement is key for the achievement of the other three implementation pillars: it not only has the potential to improve (multi-disciplinary and inter-disciplinary) research quality in this field, ensuring that more of European ageing research is world-class, but it also has the potential to increase research productivity, delivering data and providing evidence in which there is a wide sense of ownership. It underpins the improvement of knowledge transfer, including dissemination, implementation, and the development of better products and services; market deployment of the developed products and services, as well as user acceptance, are facilitated because real world needs and problems are addressed. Furthermore research which engages with its user community subsumes a life course approach, as ageing occurs across the life span and is not an isolated end-of-life phenomenon.

Knowledge Exchange
Going hand in hand with user engagement, knowledge exchange or knowledge transfer is a vital element of ageing research but one which has been neglected. Too often the results of research take years to come to the attention of those who can employ them to improve the experience of later life. Various factors contribute to this unfortunate situation, including the lack of expertise among and disinterest of some scientists in the impact of their work beyond academia and the absence of dedicated funding to support such work. Experiences differ widely across the EU Member States with some research funders focussing exclusively on science and others developing a range of initiatives to support knowledge exchange. Europe urgently needs to become much smarter at exploiting the results of the research it produces, starting with the outputs from its Framework Programmes. The innovation potential of much of the high quality ageing research in Europe is being blocked by this lack of attention to knowledge exchange and impact. A specific problem in the ageing field is the over-emphasis on technology push and neglect of market and societal pull. The result is a stockpile of highly innovative gadgets that are not used by the target population, while critical needs go unmet because of lack of awareness or lack of effective demand. The US has taken strong action to encourage rapid knowledge translation and the Roybal centres provide a potential model. The pilot EIPAHA should provide the framework to remove barriers to successful innovation in this field. What is required is a new priority for knowledge exchange coupled with user engagement. Project funding should rest not only on scientific excellence but also on the quality of the knowledge exchange and user engagement plans. Dedicated funding should be reserved for these vital activities. To progress the growth of expertise in this neglected element of ageing research and ensure that it is
spread evenly across EU countries there is a need for a specific resource that provides support and examples of good practice in knowledge exchange/user engagement. As argued earlier this is one of the main reasons why Europe urgently needs an institute on ageing, dedicated to high quality science, capacity building, user involvement and knowledge exchange.

FURTHER INFORMATION

Full information on the results of the project are contained in the FUTURAGE Road Map for European Ageing Research, available from www.futurage.group.shef.ac.uk/road-map.html

Potential Impact:

Strategic and societal impact

The importance of the unprecedented increase in longevity and the overall ageing of Europe’s population is widely recognised by European and national policy makers. Although this remarkable socio-demographic change is the result of Europe’s success in social and economic development it, more or less, presents major policy challenges particularly in terms of health, social care and pensions. These challenges will continue to sharpen over the course of this century. The rising urgency of these challenges is reflected in the initiatives which have been initiated at a European level during the life of FUTURAGE, including the European Innovation Partnership pilot project on Active and Healthy Ageing, the Joint Programme Initiative for Demographic Change More Years Better Lives and the grand challenge of the Europe 2020 strategy. Member States, their regions and local areas are also developing focussed initiatives to address local issues. The Road Map speaks directly to all these agendas.

During the life of the project FUTURAGE has engaged with an extraordinarily broad range of stakeholders, and the breadth of input is reflected in the breadth of the document. The Road Map was not designed purely by scientists nor is it aimed at the scientific community alone. Indeed it seeks to integrate a wide range of stakeholder interests in the ageing research and general ageing fields. The constant feedback loops built into the preparation process ensure that the major research topics of importance are included; the high quality of the participants involved including most of Europe’s leading scientists in the ageing field; and the experience of the Theme Leaders and Coordination Team.

The Road Map promulgates the need for ageing research to play a leading role in Europe’s response to demographic change by identifying the scientific approaches required to answer questions such as What is the nature of the ageing process: what causes it and what factors can modify it?; What factors explain the continuing increase in longevity and how can the disability-free period be extended? How can the growing ageing population of Europe maintain economic activity and health, well-being and quality of life? In addition to the scientific disciplines the road map is definitive in its inclusiveness of older people. During the FUTURAGE process they have been transformed from subjects to participants and the need for this to continue in during future ageing research is built in to the Road Map. As well as enhancing the legitimacy of ageing research it ensure the support of this important group of citizens for the necessary scientific research.

FUTURAGE has drawn together the necessary combination of Europe’s scientific expertise across all of the 26 relevant scientific disciplines, complemented by a high degree of reflection and cross-examination from a wide range of stakeholder perspectives, including policy makers, practitioners, business people, older people and their NGOs. A high level of consensus was achieved, among the various stakeholders and between the scientific disciplines, about the research priorities contained in the Road Map. FUTURAGE has used this consensus to develop, in the Road Map, a framework which clearly identifies the action necessary to exploit Europe’s scientific expertise to address these major social, economic, health and quality of life issues.

It is a fully developed and comprehensive road map, with a clear direction of travel and sign-posts towards the end goal, that not only has credibility in scientific terms but is also backed by the major stakeholders that will be responsible for its implementation or will have to respond to its outputs if the ageing challenge is to be met. This is what FUTURAGE has
Thus the Road Map sets out the major research priorities for European ageing research over the next 10 or so years. It also calls for new approaches to ageing research which are more multi-disciplinary, life course focussed, user engaged and have a big emphasis on knowledge exchange. Furthermore it calls for a new vision of ageing which promotes its positive possibilities rather than deficits, inclusion and full citizenship rather than exclusion. Therefore the Road Map challenges all stakeholders in ageing research - policy makers and research funders; NGOs, practitioners, business people; scientists; and older people - to work in unison to ensure that research maximises its impact on the well-being of all Europeans as they age.

As well as these major impacts in terms of science, policy, practice, product development and participation FUTURAGE has had a number of, more incidental impacts. These include the generation of new and extended databases, new scientific partnerships, new contacts between research funders and other stakeholders and a new template for user involvement in research.

Global Policy Priorities
The concept of active ageing already has a major European and global profile. The European Year of Older People in 1993 represented the first proclamation by Europe of a new active and participative discourse in ageing. This was expanded into an outline of a European approach to active ageing during 1999, the United Nations (UN) Year of Older People. The EC’s policy document and the special conference it staged on the topic of active ageing set a radical vision of this concept and how it would be implemented across a broad field of national and European responsibilities. In addition there is close affinity too between the Road Map and the WHO’s strategy for realising active ageing. The WHO’s approach to active ageing also contributes to the growth of the discourse on older people as active participants in society that had been signalled so strongly at European level in 1993, was reiterated in the European response to the UN Year of Older People in 1999 and will be centre-stage in 2012. The priority of active ageing was adopted by the UN’s Madrid International Action Plan on Ageing (MIAPA) in 2002, along with the principle of older peoples right to participate.

European Policy Priorities
The Road Map was not designed purely by scientists nor is it aimed at the scientific community alone. Indeed it seeks to integrate a wide range of stakeholder interests in the ageing research and general ageing fields. It was prepared with major EU policy priorities in mind. Thus the Road Map aims to contribute to the Europe 2020 strategy objective to develop a competitive and resource-efficient economy based on knowledge and innovation. The FUTURAGE partners identified research priorities that could contribute to the European smart and inclusive growth objective by investigating ways of helping people to participate longer in society and adapting good quality responsive services for people as they age. The agreed priorities could also support European sustainable growth by exploring approaches to improving older peoples health and participation, thus reducing social protection costs as well as enhancing quality of life. The priorities identified by the Road Map are also completely in line with the goals of the pilot EIPAHA recently launched by the European Commission. Extending healthy life years in Europe had already emerged as a hot topic from the FUTURAGE consultation process before this announcement was made. Therefore the Road Map includes key areas in which research could support the goal of raising the average healthy lifespan in the EU.

Moreover we hope the Road Map will contribute to the 2012 European Year for Active Ageing and Solidarity Between Generations. As we emphasise below active ageing is the centrepiece of the Road Map. FUTURAGE partners consider this European Year as an important opportunity to investigate innovative solutions to the current economic and social challenges facing our ageing population. In order to increase older peoples participation in society, including the labour market, as well as to promote healthy ageing, further research is needed in the priority research fields highlighted in the Road Map. Also, being aware of the discussion on the European Institute of Innovation and Technology (EIT) FUTURAGE recommends the inclusion of ageing in the Strategic Innovation agenda of the EIT. This will help to ensure that the results of the research on ageing are better translated into effective actions.
The European Pact for Mental Health and Well-being, launched in June 2008, includes, as one of its five priority areas, mental health and older people and, therefore, is of direct relevance to the Road Maps priority theme on mental capacity. There is also a high level of symmetry between the approach and content of the Road Map and other prominent EU policies and initiatives. The White Paper Together for Health: A Strategic Approach for the EU 2008-2013, overlaps in various places with the Road Map, even though our work was conducted independently of it. For example, the significance of shared health values in Europe, such as universality, access to good quality care, equity and solidarity, the importance of citizen empowerment, reducing inequalities in health and the commitment that health policy must be based on the best scientific evidence derived from sound data and information, and relevant research. Similar synergies are found between the Road Map and the Demographic Report 2010. These include the promotion of active ageing, increasing healthy life years and the integration of migrants. The Road Map also speaks directly to the Digital Agenda for Europe in recognising the potential of Information and Communication Technologies (ICT) to offset some of the impact of later life loss of function and to promote social inclusion among older people (although there is an entirely separate road map project on ageing and ICT development, BRAID, with which close links were established).

Other European projects
FUTURAGE was not the first European road map project in the ageing field and others have been commissioned subsequently. By virtue of its disciplinary spread, however, it does claim to the most comprehensive one. The WhyWeAge road map for biogerontological research was the first of its kind and it was amalgamated with FUTURAGE.

Close links were also established with the BRAID project (Bridging Research in Ageing and ICT Development). BRAID has also adopted active ageing as a guiding concept to illuminate four different life settings: independent living, health and care, occupation and recreation. These aspects of life also feature the sections on research priorities but in the BRAID project the emphasis is on the use of ICT to improve the quality of later life.

In the field of Ambient Assisted Living, the AALIANCE (The European Ambient Assisted Living Innovation Platform), similar to BRAID, seeks to utilise the rapid developments in ICT to enhance the lives of people as they age. Specifically the focus of the AALIANCE project is on the commercial delivery of Ambient Assisted Living (AAL) solutions based on advanced ICT technologies for the areas of ageing at work, ageing at home and ageing in society. It provides a framework for stakeholders, led by key leaders in industry (including Bosch, Phillips, Nokia and Vodafone), to define research and development (R&D) priorities through a road map document, time-frames and action plans in the field. FUTURAGE kept in close touch with AALIANCE during the development of this ageing research Road Map and AAL is using the Road map to refresh its research agenda. One of the key partners in FUTURAGE, Age Platform Europe, was also a partner in AALIANCE.

Early signs of impact
Although the acid test of FUTURAGE will be the extent to which the Road Map informs plans and priorities for FP8 and assists European policy makers and researchers to maximise the effects of ageing research there are already some positive signs of its influence at both European and national levels.

The FUTURAGE Road Map development template has been replicated by the ROAMER project in a successful Framework Programme 7 application to prepare a similar one for mental health research (A Roadmap for Mental Health in European Research). The FUTURAGE project also assisted the Joint Programming Initiative (JPI) More Years Better Lives by sharing early drafts of the Road Map to support its priority setting exercise. It is clear that several applications to recent FP7 calls (Health and Social Sciences and Humanities) have made extensive references to the Road Map.

The Road map has also been used at national levels as a reference point for the development of research priorities or the evaluation of existing ones; the Canadian Insitute on Aging is using it to refresh its research agenda. In February 2012 the UKs National Institute for Health Research Comprehensive Clinical Research Network Age & Ageing specialty group has adopted
FUTURAGE priorities on healthy ageing into its statement of scope. The Road Map has been translated into Bulgarian and is also being translated into Russian.

Main dissemination activities
As FUTURAGE was structured around an ongoing consultation process project dissemination activities were continual and wide ranging from the very first month. Invitations to contribute to national consultations, scientific/user workshops and the Stakeholder Forums were made to many more people than those who were available to attend.

The project website provided a focal point for the project, as a constantly-updated resource of project activities and progress. News, reports and promotional material were all available to any visitor and during the life of the project a total of 17000 visits were made to the website, 71 per cent of which were from new visitors, showing ongoing generation of interest in the project. Visits to the website have been generally steady at an average of 25-30 per day, with small peaks of interest related to specific events. The launch of the Road Map caused a substantial increase in visits to the website and since the 17 October 2011 there have been 7282 visits to the website, which accounts for over 40 per cent of all visits, demonstrating that the promotional work undertaken for the final and ultimate stage of the project was highly effective.

To spread news to the widest possible audience extensive use was made of the project mailing list, third party researcher mailing lists (through jiscmail), news channels of the Commission (Cordis wire) and partners local and national mailing lists. In addition every news item on the website was available via an RSS feed.

A suite of promotional material was developed to support the project, including branded event folders, newsletters, leaflets and project updates. All were available in hard copy at events, and placed online. Particular focus was placed on communicating the complex iterative structure of the Road Map through a flow-chart diagram. Developed by one of our partners, this was a powerful tool to explain the project to our audience, and particularly to show the specific set of inputs and outputs which would result from any given event. A leaflet was developed with the sole purpose of sharing this diagram, and an interactive version was placed on the website. Each stage of this interactive version (available at http://futurage.group.shef.ac.uk/road-map-structure.html) is linked to the relevant information on the website, allowing visitors to more clearly navigate and understand how our activities fit together.

The key output of the project - the final Road Map document was professionally designed to be as attractive and appealing a document as possible. Although inevitably a text heavy document, the layout, font and format were consciously chosen to be easy to read, and maps and diagrams were included where possible. A 12-page summary version of the Road Map was also produced to provide a short overview of the key elements of the Road Map. In total 1300 of the full Road Map and 3000 summaries were produced; by the end of the project 1100 copies of the full Road Map and 2100 copies of the summary had been distributed to: launch conference attendees; all FUTURAGE partners for local dissemination to key national stakeholders; the Council of Scientists; the European Commission; MEPs of the InterGroup on Ageing and; in response to specific requests. The hard copies have been distributed to almost 40 different countries. The remaining copies will be used to support ongoing dissemination efforts at, for example, IAGG 2013, ERA-AGE 2 events, and to respond to continued interest in the project.

In addition to the hard copies distributed both these documents are permanently available in pdf format on the project website. An electronic flip-book version of the Road Map has also been created to allow for more naturalistic viewing than allowed by the pdf; this is also permanently available on the website.

The FUTURAGE launch conference was a focal point for dissemination activities with a set of branded promotional items created for just for this event to ensure that the project name and website has a profile beyond the end of the project. All delegates attending received a delegate pack including a hard copy of both versions of the Road Map, a memory stick containing a pdf version of the Road Map, pen, mouse mat, lanyard, 2012 calendar and notebook. FUTURAGE and the launch
of the Road Map at the European Parliament was the primary feature on the home page of the University of Sheffield, the coordinator of the project and one of the UKs leading research institutions with an international student, staff and research profile. During the time the project was profiled over 250,000 views were made of the home page from across the globe.

In total over the life of the project almost 200 individual dissemination activities have been undertaken by all partners in the project.

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Related information

| Result In Brief | A comprehensive approach to ageing research |
| Documents and Publications | final1-futurage-rp2-final-report-section-4-1-supplementary.pdf |

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