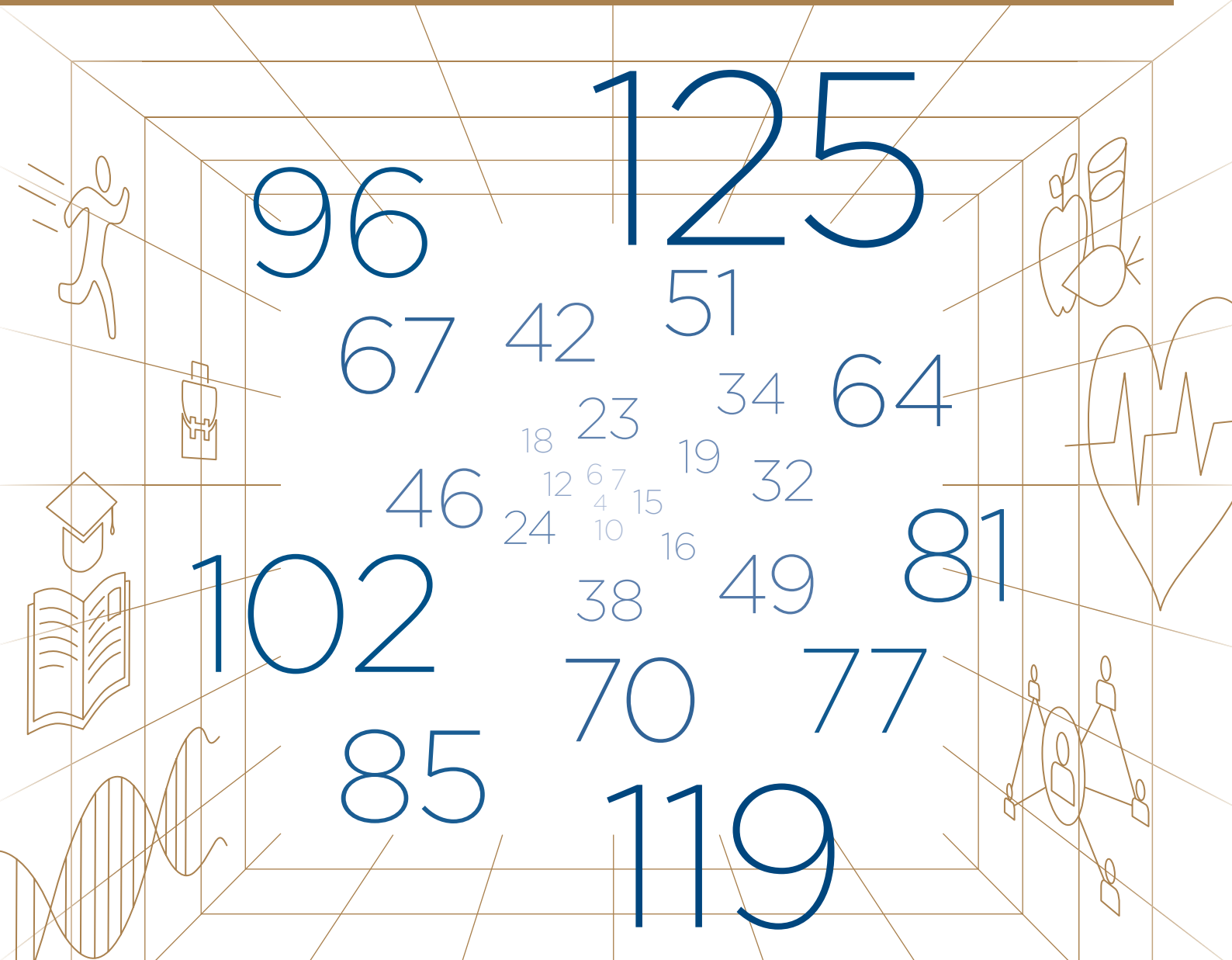




Leopoldina  
Nationale Akademie  
der Wissenschaften

# Report on Tomorrow's Science



## Ageing and the Life Course

Research for Longer Lives



## Research for Longer Lives

The field of research on ageing and the life course has gained enormously in importance due to the 40-year increase in average life expectancy and a pronounced diversification of the life course over the past 150 years. It is now necessary to shape these "longer lives" so that quality of life, productivity, and innovation can be maintained and extended in a society with a higher proportion of older adults. The increase in average (functionally healthy) life expectancy is a major achievement of sociocultural development, made possible by the developmental plasticity of the human species. Human ageing in this sense is not simply predetermined biologically, but rather it is the result of continued interactions between biology, individual decisions and lifestyles, and sociocultural context. If research is to do justice to this interactive nature of human ageing and provide explanations and predictions, an appropriately broad spectrum of disciplines needs to be involved, ranging from molecular biology, via medicine and behavioral sciences, to economics, sociology, and epidemiology.

This report seeks to answer the following central questions: Where does research in this field stand in Germany today? Can weaknesses be identified and how can they be remedied so that future research on ageing and the life course is better able to provide answers on how a longer lives can be optimized for individuals and society alike?

### Where Does Research in This Field Stand?

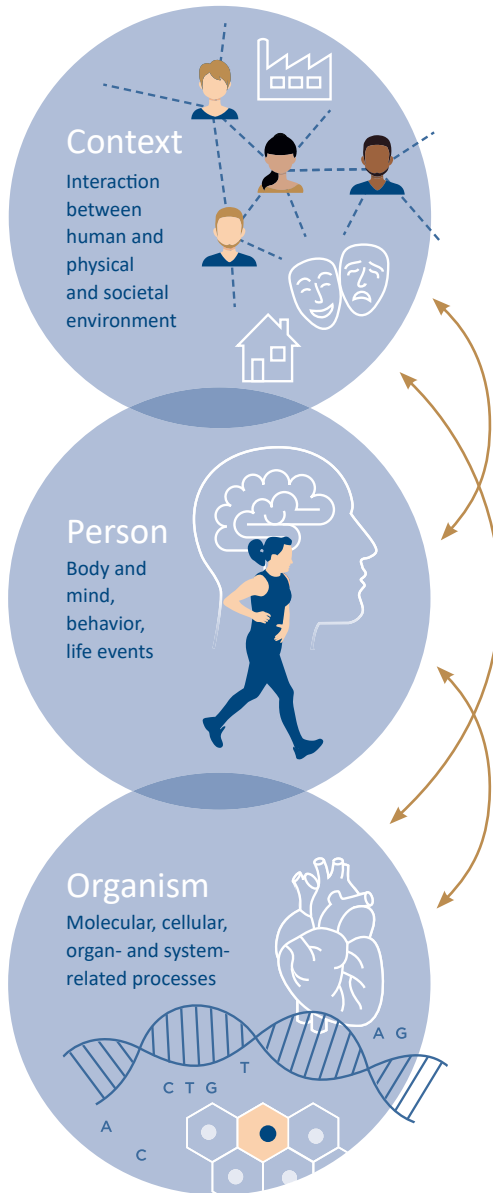
#### Topics and Funding Priorities

In accordance with the complexity of human ageing, the topics of research on ageing and the life course are highly diverse: they range from the cellular and molecular bases of the biology of ageing, to the experiences, actions, and functioning of ageing people, and on to the shaping of societal environments (health systems, education and work, cultural norms, social relationships, and the physical environment) in a society of longer lives. Within the limits set by the respective social environment and the world of institutions on the one hand and by genetics on the other, each person's lifetime and quality of life is modifiable. For example, research on ageing and the life course has dealt with the factors modifying quality of life and longevity, and it has also assessed the limits of this modifiability and whether and how these can be shifted. Increasingly rich scientific evidence has started to lead to successful preventive and sociopolitical measures.

Although this field of research is quite extensive in Germany, it still falls short of its potential. In order to further improve the available knowledge required for successfully shaping demographic ageing, the complex process of human ageing needs to be investigated using a broadly interdisciplinary approach as well as integrating research results originating in individual disciplines.

At present, this is not the case. Diseases and their molecular basis, as well as healthcare and technological assistance systems for old age are the research topics dominating most funding

## Biopsychosocial Model of Research on Human Ageing and the Life Course



strategies to date. Important as this research is, by itself it is neither a sufficient evidence base for shaping a society of longer lives and multifarious life courses nor for the support of active and healthy ageing. This narrow thematic range needs to be expanded, and even within the current funding priority domains of biomedicine and technological sciences, more differentiation is required. The neglect of other research areas and the fact that funded projects often failed to include all relevant disciplines hinder not only sustainable and effective growth of the field of research on ageing and the life course, but also societal change.

For example, in order to maintain competencies and functioning across the life course and into late life, it is insufficient to treat diseases; rather, their maintenance also requires research on the organization of work across a longer life, the further development of the educational system to foster lifelong learning, or the strengthening of individuals' health resources (which is not the same as treatment or prevention of illnesses). Equally, technology-oriented ageing research mainly targets the compensatory effect of technology in cases of loss of functioning, whereas the use of technology for maintaining or increasing functioning is hardly considered. In view of the large funds spent on the field of "technological assistance systems in old age," it is also worrying that there are hardly any systematic longitudinal studies testing the efficacy of developed technology with larger samples. Furthermore, strategies to move from prototype development and pilot studies to the market, and on into people's daily lives are unfortunately lacking.

### Where in Research on Ageing and the Life Course Can We Expect Findings that Will Shape the Future?

How can we facilitate and maintain human capacities? How can diseases be successfully prevented? How do prenatal conditions affect the ageing process? What is the impact of social inequality on human ageing? These are examples of complex phenomena that unfold over long periods of time and are concurrently influenced by multiple life domains such as educa-

tion, employment, family, health, personal attitudes, and the physical environment. However, in Germany, the social, behavioral, technological, and biomedical sciences, and the humanities are still very much acting in silos. The humanities, social, and behavioral sciences are also much less represented in German research on ageing and the life course than they are—for example—in the United Kingdom, Sweden, or the Netherlands (as assessed by respective proportions of publications). Such benchmark countries have engaged in concerted strategic research support of centers, programs, research infrastructure, and targeted further academic training that has helped them to successfully establish and integrate research capacity for research on ageing and the life course across a broad range of relevant disciplines. This concerted effort has also been linked with developing specific research foci in each country. In view of its high complexity, programmatic support holds strong significance for ageing research. This also includes research-strategic discussions in and with the academic community, in order to

overcome discipline-related and geographical fragmentation on the one hand, and establish the ageing research sustainably in larger research structures such as universities, extramural research institutions, and funding agencies on the other.

Examples from other countries such as France, the Netherlands, the US, or the UK indicate that a central impulse by government or parliament in terms of a national program and a broad legislative debate are very important to attain productivity and orientation in ageing research.

## Recommendations for the Further Development of Research on Ageing and the Life Course Research in Germany

Which fields of action and instruments do we need to open up the research potential in Germany and catch up with the top tiers of international research? How can basic and applied research on ageing and the life course do justice to its role in shaping society and individual lives?

We see opportunities to strengthen the German research landscape in the following six fields.

### Strengthening Discipline-Specific Ageing Research: Topics, Infrastructure, and Training

Ageing and the life course are the topics that hold the strongest relevance for both research and society, although research in Germany in this field is under-represented in comparison to other fields, as well as compared to several other European countries and the US. Topics revolving around ageing and the life



#### Research Topics

- Funding of research on ageing and the life course

- Funding and incentives for biopsychosocial research (i.e. across the life, technological, social, behavioral sciences, and the humanities) as innovative research with elements of risk

- Targeted, consensus-based search for research gaps by task forces and funding agencies

#### Research Infrastructure

- Preconditions for research on old age/ageing (humans/ animals)

- Establishment of freely accessible resources for research on ageing and the life course (measurement instruments, mouse models of old age, etc.)

- Longitudinal studies up to very old age and beginning before birth/conception
- Long-term funding
- Methods Centers
- Multidisciplinary alliances of research institutions

#### Education and Training

- Expansion of discipline-specific professorships with a focus on ageing and the life course

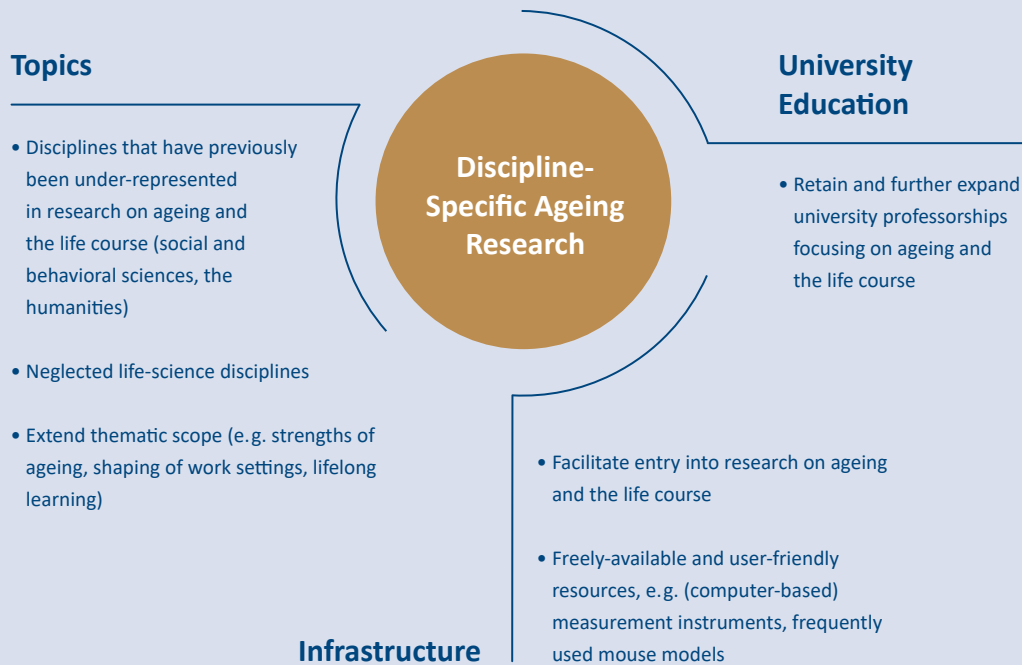
- Training in interdisciplinary research on ageing and the life course starting at the postdoc level

- Acquisition of competencies in making use of interdisciplinary longitudinal studies or in applying different ageing paradigms in biology

Discipline-specific

Interdisciplinary

## Strengthening Discipline-Specific Ageing Research:



course should therefore be strengthened in discipline-specific research funding. Without broadly-based and excellent discipline-specific ageing research, internationally-competitive interdisciplinary research is impossible.

Discipline-specific research funding should therefore concentrate on those disciplines that are under-represented in research on ageing and the life course so far, such as the social and behavioral sciences, cultural studies, and domains of the life sciences that have not been included to date. Individual disciplines differ in their respective needs for further development. It is necessary to retain and further expand the professorships focusing on ageing and the life course. Likewise, it should be ensured that the central disciplines involved in research on ageing like biology, medicine, psychology, sociology, or economics represent the topic adequately in their curricula. In order to make it easier for researchers to enter into ageing and life-course research, it is advisable to make available freely-accessible and user-friendly resources; for example,

established (computer-based) measurement instruments or frequently used mouse models of old age, as is done by the National Institute on Aging / National Institutes of Health (NIA/NIH) in the US. The harmonization of measurement instruments and research paradigms would also benefit comparability of findings.

The thematic range of funding needs to be extended. So far, support has concentrated on selected subfields of the life and technological sciences. The neglect of other research domains (even within these fields) obstructs essential research on questions such as the maintenance of competencies and functioning into highest ages: in a society of longer lives with a proportion of people aged over 65 years, that currently stands at about 21 percent and will reach 32 percent by 2060. This challenge can not only be met by treating illnesses, but rather requires research efforts on—for instance—how to shape work to accommodate longer lives, as well as making lifelong learning an integral part of the education system. Furthermore, the concentration of re-

search funding on understanding and treating individual diseases needs to be complemented by funding incentives for research focusing on the conditions that foster the strengths and unleash the positive plasticity of ageing.

### Orienting Funding Programs Toward Interdisciplinarity

In Germany, research funding and research infrastructure for the social, behavioral, technological, biomedical sciences, and the humanities are largely characterized by strong compartmentation. This separation between the disciplines is without doubt necessary to promote excellence within discipline-specific ageing research, but it is not sufficient when it comes to breaking the frontiers of ageing research in the 21<sup>st</sup> century. Funding formats and research infrastructure bringing disciplines together must exist alongside to do justice to the complexity of human ageing and the life course. Cooperation and synergies—as exemplified by research on cognition or social inequality—can extend the boundaries of knowledge. This requires studying the biopsychosocial reality of human ageing in historical and cultural comparison, which can only be successful if interdisciplinary research is strengthened.

Special funding formats are needed to set incentives and opportunities for organizing interdisciplinary cooperation in new fields. Funding agencies and research institutions still have to develop appropriate processes and quality criteria for this type of research proposal. This concerns mechanisms of resource allocation and distribution and practical responsibility in disciplinarily-ordered faculties and research institutions, visibility in scientific journals and associations, granting of funds, and career opportunities for researchers.

### Using Funding Schemes of Established Funding Programs

Special conditions are needed so that researchers can not only work with divided re-

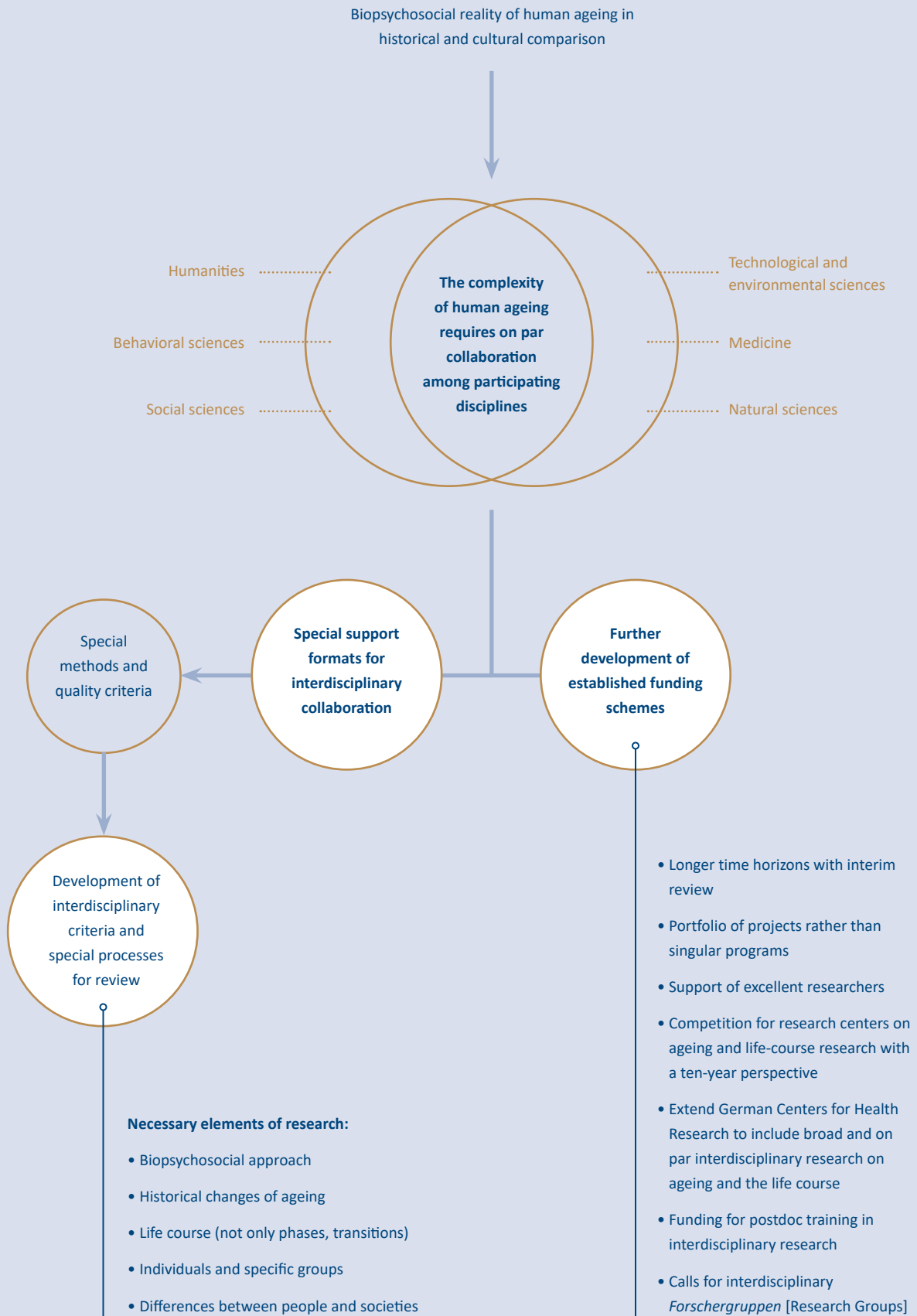
sponsibilities but also collaborate in an integrated fashion. These include adequate topics and geographical proximity or at least a coordinating infrastructure. We regard straightforward network funding (which is restricted to regular meetings and mutual information and does not include resources for intensive, integrated collaborative research projects) as a positive first step in this context, but it does by no means suffice. A new complex field of research requires sufficient start-up funds for coordination and integration to develop productively and to compete internationally. Institutionalized program funding is an important instrument to achieve that goal. A longer time horizon with interim review, a stable portfolio of projects rather than singular programs, and/or the support of excellent researchers have proven promising.<sup>1</sup> Short-term, smaller scale, mostly discipline-specific projects on ageing and the life course do exist. However, what is needed is a nationwide call for the establishment of research centers with a renewable ten-year perspective. This funding scheme for research on ageing and the life course has been successful in other European countries like Sweden, as well as the US. The German Health Centers (including satellite locations) have elaborated coordinating and integrative structures that allow for joint research. This approach could be used as a blueprint for the establishment and expansion of interdisciplinary ageing and life-course research encompassing a broad spectrum of disciplines representing a biopsychosocial approach.

Furthermore, it would be helpful to develop more attractive funding formats that enable collaboration across many disciplines over longer periods of time. In analogy to support by the Howard Hughes Medical Institute

1 Examples for this are the long-term support ranging from projects to professorships on the part of the Robert Bosch Stiftung or the research support provided by the Deutsche Rentenversicherung (the German pension insurance system), each in a narrow thematic/discipline-specific field; other examples are the Swedish aging research centers and the centrally available and extensive range of standardized measurement instruments and training courses in the use of interdisciplinary longitudinal data on offer via the British Cohort and Longitudinal Studies Enhancement Resources (CLOSER) or the National Institutes of Health (NIH) in the US.



## Orient Funding Programs Towards Interdisciplinarity

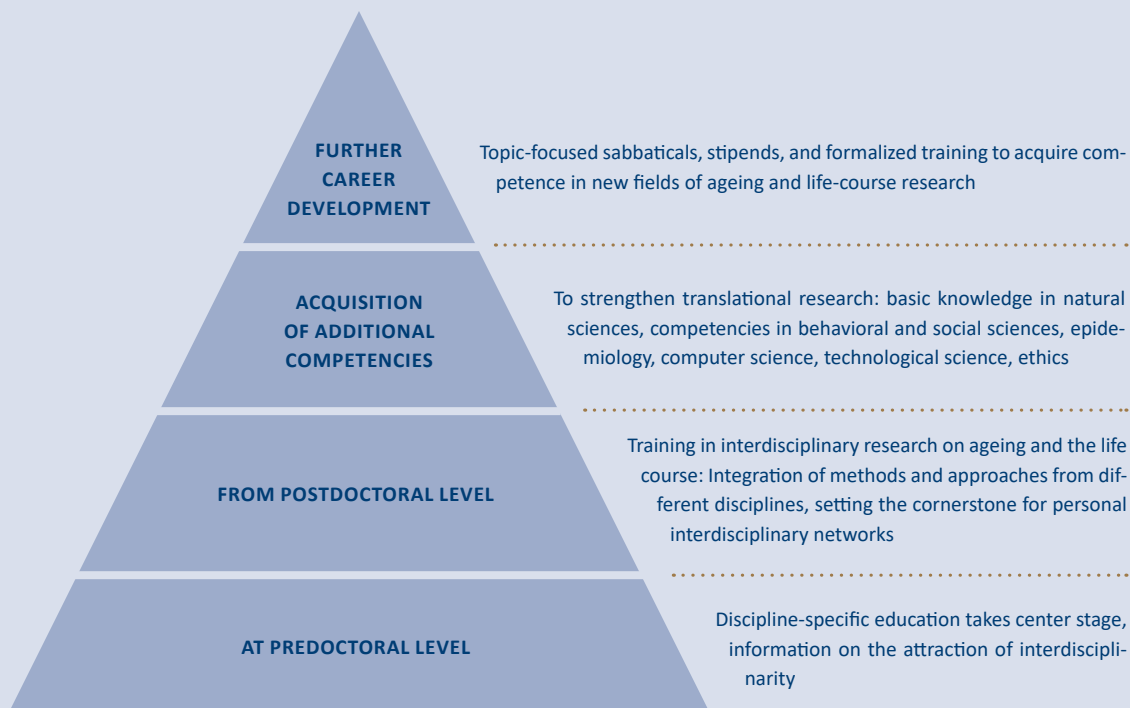


(HHMI)—which completely funds individual researchers within their institutions for five years—broad interdisciplinary research groups could be sponsored, while individual scientists are based in different institutions; for instance, using a virtual institute format. This model could also include attractive funding schemes for postdoctoral training. In this context, it would make sense for the German Research Foundation (DFG) to make additional specific calls for *Forschergruppen* [Research Groups] in order to strengthen an entire interdisciplinary research area (as was the case for public health). The success of such a research group could provide the basis for universities to subsequently establish broad interdisciplinary research centers revolving around ageing and life-course topics. Furthermore, interdisciplinary ageing research that has demonstrated excellence in integrating a broad spectrum of relevant disciplines could be made visible and honored by launching a high-ranking award for interdisciplinary research.

## Education and Training in Interdisciplinary Research on Ageing and the Life Course

Discipline-specific education needs to be at the center of attention up to PhD level to guarantee broad and deep discipline-specific knowledge and skills. However, from the postdoc level onwards, training in interdisciplinary research focused on the challenges of research on ageing and the life course needs to be available. Such programs—which have proven themselves internationally—promote a basic understanding of other disciplines (with their different perspectives, tools and language addressing the same research question) and help to diminish mutual prejudices, they support the ability to integrate methods and approaches of several disciplines and can set the cornerstone for personal interdisciplinary networks. The thematic focus on ageing and the life course together with a thorough foundational disciplinary education are important preconditions for such postdoctoral

## Education and Training in Interdisciplinary Research on Ageing and the Life Course



training. Furthermore, in order to strengthen translational research, it is pivotal to acquire competencies in the behavioral, social, technological, and computer sciences, epidemiology, ethics, etc. in addition to the basics in the natural sciences. For later career development, instruments such as topic-centered sabbaticals, stipends or formalized training courses should be used to gain specific competencies in the fields of research on ageing and the life course.

### Models and Development of Quality Criteria

In order to analyze the interactions of cells and organisms, social groups, and societal institutions across the lifespan, it is essential that those involved agree on a joint “meta-theoretical point of view.” In ageing and life-course research, the minimal consensus could comprise:

- selecting a biopsychosocial approach;
- taking historical changes of human ageing into account;
- examining both the individual and aggregates of individuals;
- taking into account the large differences among people and societies; and
- studying the life course (in addition to separate phases or transitions).

Developing such a model (or several) should be supported. It can serve as a starting point for the development of interdisciplinary review criteria, but also promote the standardization of data collection. Advancing models and quality criteria spawns new research as well as enhancing existing work.

### Establishing Data Collection and Analysis, Method Centers, and Training Programs for Interdisciplinary Researchers

Research integrating across disciplines can and should make use of the opportunity to link diachronic, population-wide, with experimental approaches, as this has sometimes been done in the German Socio-Economic Panel (GSOEP) by integrating a classical population survey approach with paradigms of behavioral economics or neuropsychology, although there has not yet been a thorough link with paradigms in molecular biology. This would be extremely fruitful as a spring board to join the life sciences, with the social, and behavioral sciences, and it could expand on the current prioritization of the life and medical sciences. A specific funding impulse for interdisciplinary longitudinal studies involving multiple disciplines on equal terms would be helpful in this context.

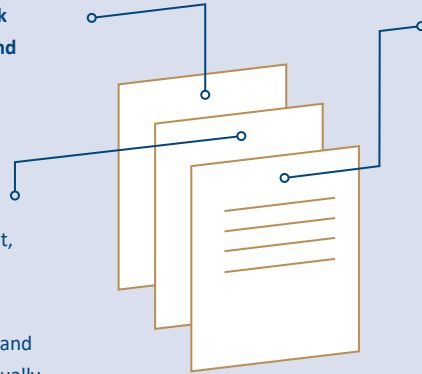
We see innovation potential in the long-term funding of cohort studies. The adult cohort of the National Educational Panel Study (NEPS) should be followed into very old age because it holds central significance to understanding the educational and occupational trajectories of adults in Germany. In the long run, it would be very important to initiate cohort-comparative longitudinal studies that begin before—or at least at—conception and reach until the end of life. Biomedical, behavioral and social-science variables need to be equally represented in the data collection. An umbrella organization combining national longitudinal studies has proved very successful in the UK (Cohort and Longitudinal Studies Enhancement Resources – CLOSER). Such an association promotes joint data analyses and the development of competence among researchers. As the starting capital of such an association, the large German studies would benefit from stronger national and international visibility and use of their data, but also from analyses that connect the different data sets. Hence, the development of (interdisciplinary and diachronic-experimental) data sets and

## Building up Data Collection and Analysis as well as Methods Centers

Make use of new options to link diachronic, population-wide, and experimental data

Long-term funding of cohort studies:

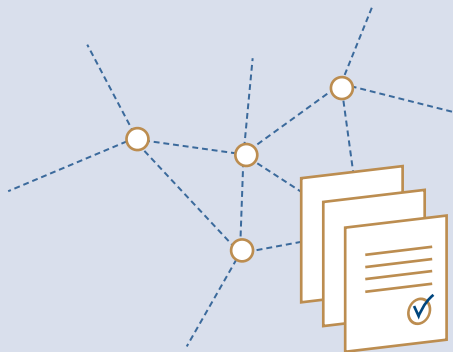
- that begin before, or at least at, conception and reach until the end of life
- where biomedical, behavioral and social-science variables are equally represented



Umbrella organization combining national longitudinal studies:

- joint data analyses
- joint development of competence
- greater national and international visibility and use of data
- better interlacing of analyses across studies
- further development of data sets and analyses

## Evaluating Application-Oriented Research and Making Output Available



- Systematically summarize, evaluate, and publicize research results
- Evaluate measures and programs to enhance evidence basis for policy-making, in both research funding and respective policy fields
- Policy- or implementation research for life-course-related policy-making

analyses as well as the training for researchers at different career stages should become a new task for these methods centers. The breadth of required methods and paradigms is too large to be covered by a single center. An integrating education and training center for interdisciplinary longitudinal studies could also be established by announcing a DFG Priority Programme [Schwerpunktprogramm].

### Evaluating Application-Oriented Research and Making Output Available

Application-oriented and basic research should reciprocally be linked with each other.

Beyond healthcare, this concerns technology, education, labor market research, urban development, social, and culture policy, etc. The essence of findings from longitudinal studies should be publicized widely and inform the continued development of the welfare state, which requires that findings are pruned and placed in perspective. For policy-making to become evidence-based, it is essential that both in the area of research policy and policy-making in general, agenda setting and legislation are systemically evaluated. So far, there is a lack of policy or implementation research to encourage, assess, and anchor ageing- and lifecourse-related policy-making. Moreover, policy-making and society would benefit if the results of the many research

fields were comprehensively and systematically summarized and publicized. Many topics such as societal cohesion (see research on social inequality) or individual cognitive development and quality of life across the life course concern all members of society and require timely interventions, as from a policy perspective they can only be shaped in the medium or long term. This requires a continued dialogue with researchers and the application of scientific findings. The British What Works centers can be considered successful models for the testing and pre-processing of research results. One option would be to entrust a government departmental research institution with such a task, as these are experienced in application-oriented research and policy advice, at least regarding department-specific questions. Research Institutes of the Leibniz or Fraunhofer Association would also be possible candidates due to their greater independence.





## Authors

### Members of the Leopoldina's Standing Commission on Demographic Change

Josef Ehmer (Department of Economic and Social History, University of Vienna; International Research Center "Work and Human Lifecycle in Global History", Humboldt Universität zu Berlin), Alexia Fürnkranz-Prskawetz ML (Institute of Statistics and Mathematical Methods in Economics, Technische Universität Wien; Wittgenstein Centre for Demography and Global Human Capital, Univ. Vienna, IIASA, VID/ÖAW), Gerd Kempermann (German Center for Neurodegenerative Diseases, Dresden; Center for Regenerative Therapies, Technische Universität Dresden (Lead)), Karl Ulrich Mayer ML (Past President of the Leibniz Association; Max Planck Institute for Human Development; Yale University), Cornel Sieber (Institut für Biomedizin des Alterns, Friedrich-Alexander-Universität Erlangen-Nürnberg), Johannes Siegrist (Heinrich-Heine-Universität Düsseldorf), Ursula M. Staudinger ML (Technische Universität Dresden (Lead)), Katja Patzwaldt (Bundesinstitut für Bevölkerungsforschung, Berliner Büro im I-Punkt des Statistischen Bundesamtes)

### Further Members of the Leopoldina's Standing Commission on Demographic Change

Hans Bertram ML (Department of Social Sciences, Humboldt-Universität zu Berlin), Monique M.B. Breteler ML (German Center for Neurodegenerative Diseases, Bonn), Axel Börsch-Supan ML (Munich Center for the Economics of Aging (MEA), Max Planck Institute for Social Law and Social Policy, München), Klaus Diedrich ML (Klinik für Frauenheilkunde und Geburtshilfe, University Hospital Schleswig-Holstein), Joachim Dudenhausen ML (Charité – Universitätsmedizin Berlin), Wolfgang Holzgreve ML (Universitätsklinikum Bonn (Spokesperson)), Ulrich Keil (Institute of Epidemiology and Social Medicine, Münster University Hospital), Ulman Lindenberger ML (Lifespan Psychology, Max Planck Institute for Human Development, Berlin), Regina Riphahn ML (Friedrich-Alexander-Universität Erlangen-Nürnberg), Kerstin Schill (Cognitive Neuroinformatics, University of Bremen), Thomas Strowitzki (Gynäkologische Endokrinologie und Fertilitätsstörungen, Universitätsklinikum Heidelberg), Ludger Wößmann ML (ifo Center for the Economics of Education, München)

### Contact:

German National Academy of Sciences Leopoldina  
Department Science – Policy – Society  
Phone: +49(0)345 472 39 867  
E-mail: politikberatung@leopoldina.org

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### German National Academy of Sciences Leopoldina

Jägerberg 1 | 06108 Halle (Saale)  
Phone: (0345) 472 39-600  
Fax: (0345) 472 39-919  
E-mail: leopoldina@leopoldina.org

[www.leopoldina.org](http://www.leopoldina.org)