



Project Number: FP6-512020

Project acronym: *MiMage*

**Project title: Role of Mitochondria in Conserved Mechanisms
of Ageing**

Instrument: IP

**Thematic priority: Priority 1. Life sciences, genomics and
biotechnology for health**

Publishable Final Activity Report

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Project coordinator name: Heinz D. Osiewacz

Project coordinator organisation name: Johann Wolfgang Goethe-University

Status: Final

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1 Project execution

1.1 The strategy of *MiMage*: major goals and objectives

Ageing is the progressive and irreversible decline of physiological functions leading to an increase in morbidity and mortality. Although the ageing process itself has not been halted, in industrialised countries the mean lifespan of humans has increased significantly in the last century owing to improved standards of medical treatment and public health. Together with a decrease in birth rates this leads to a shift towards the elderly. Since this „**greying**” of populations is becoming a severe **social problem**, there is a vital need for fundamental research seeking to elucidate the complex mechanisms governing ageing processes. This knowledge subsequently can be used to develop efficient strategies to interfere with those processes of ageing leading to inabilities and disease.

In the past, ageing has been extensively studied in a number of **model organisms** and systems. Today it is clear that it is controlled by a **complex network of molecular pathways**, some of which are **conserved** from model systems like fungi to higher organisms, including mammals. Consequently, investigating such conserved mechanisms in any given system will generate meaningful and valuable general results.

Mitochondria, the organelles commonly addressed as the ‘power-plants’ of a eukaryotic cell, fulfil many essential functions and play a crucial role in ageing in all eukaryotic systems. However, the role of these organelles and particularly the links of mitochondrial pathways to well defined age-related pathways which, until now, are not related to mitochondrial function, remains a major unsolved issue. The overall aim of the *MiMage* project was to elaborate a more detailed view about the **role of mitochondrial functions in ageing and lifespan control** in biological systems. Of special interest was the discovery and experimental manipulation of **evolutionarily conserved mechanisms** shared between invertebrate and mammalian model systems. A range of experimental tractable organisms (*Saccharomyces cerevisiae*, *Podospora anserina*, *Caenorhabditis elegans*, *Drosophila melanogaster*, mouse, and rat) and cell culture systems are being studied.

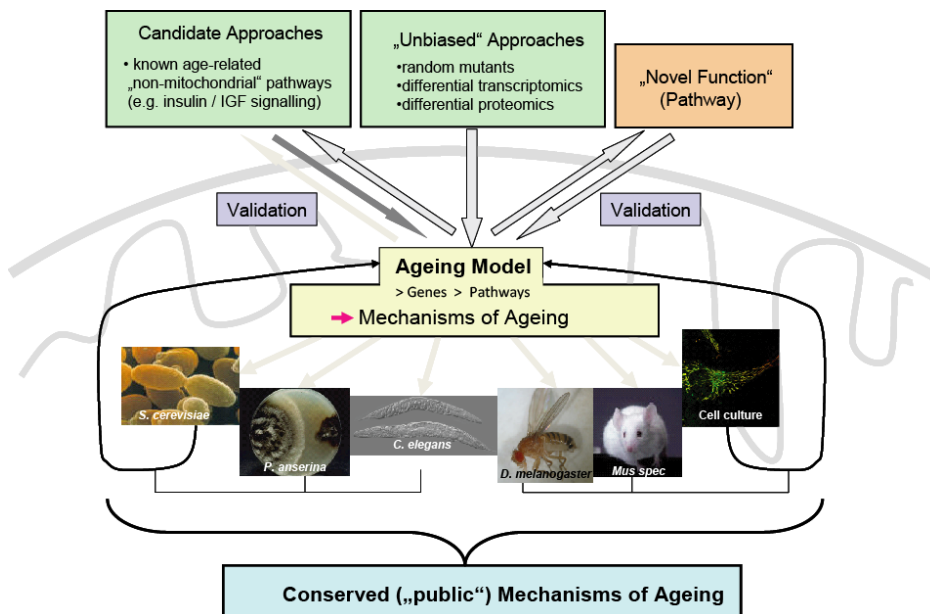


Fig. 1: The strategy of the *MiMage* consortium to identify and unravel conserved molecular mechanisms of ageing in which mitochondria play a major role.

In the project both, ‘*candidate*’ (*hypotheses driven*) as well as ‘*unbiased*’ (non-candidate) *approaches* (Fig. 1) were utilised. In the ‘*candidate*’ approach pathways (e.g., signalling pathways) which were known to affect lifespan and ageing in certain systems but which were not linked or only loosely linked to *mitochondrial functions*, were investigated. In the ‘*non-candidate*’ or ‘*unbiased*’ approach, available random lifespan mutants or differential gene expression (young vs. old; wild-type vs. longevity mutant) at the level of transcriptomes or proteomes were investigated. The data obtained from these investigations provided information leading to known or ‘novel’ traits (genes, pathways) which subsequently were validated in order to obtain robust information about the involved ageing mechanisms.

1.2 Coordinator contact details

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1.3 Contractors involved

No.	Name of partner (Team leader)	Participant name	Country
1	Heinz D. Osiewacz*	J. W. Goethe-University	Germany
3	Jürgen Bereiter-Hahn	J. W. Goethe-University	Germany
4	Michael Breitenbach	University of Salzburg	Austria
5	Norbert A. Dencher	TU Darmstadt	Germany
6	Rolf Hoekstra	Wageningen University	The Netherlands
7	Pidder Jansen-Dürr	Austrian Academy of Sciences	Austria
8	Thomas Nyström	Göteborg Universitet	Sweden
9	Annie Sainsard-Chanet	Centre National de la Recherche Scientifique	France
10	Tinna Stevnsner	University of Aarhus	Denmark
11	Jacques Vanfleteren	University of Gent	Belgium
12	André Schrattenholz	ProteoSys AG	Germany
13	Robert Tanguay	University Laval	Canada

* Coordinator of the *MiMage* project

1.4 Website and project logo

- The *MiMage* website can be found at: www.mimage.org (starting date: September 2005).
- The *MiMage* logo is









SIXTH FRAMEWORK PROGRAMME

ROLE OF MITOCHONDRIA IN CONSERVED MECHANISMS OF AGEING

The Aim: Identification and characterization of conserved mechanisms of ageing in which mitochondria play a major role

Project Duration: 1.1.2005 - 31.12.2009

Total Budget: 7.5 Mio. Euro

The Partners

<p>Robert Tanguay Laval Université Ste Foy, Canada</p> <p>André Schratzenholz ProteoSys AG Mainz, Germany</p> <p>Jacques Vanfleteren Ghent University Ghent, Belgium</p> <p>Tinna Stevnsner University of Aarhus Aarhus, Denmark</p> <p>Annie Sainsard-Chanet Centre de Génétique Moléculaire du CNRS Gif sur Yvette, France</p> <p>Thomas Nyström Göteborg University Göteborg, Sweden</p>	<p>Heinz D. Osiewacz J.W. Goethe-Universität Frankfurt, Germany Coordinator</p> <p>Jürgen Bereiter-Hahn J.W. Goethe-Universität Frankfurt, Germany</p> <p>Michael Breitenbach University of Salzburg Salzburg, Austria</p> <p>Norbert A. Dencher Technische Universität Darmstadt Darmstadt, Germany</p> <p>Rolf F. Hoekstra Wageningen University Wageningen, The Netherlands</p> <p>Pidder Jansen-Dürr Austrian Academy of Sciences Innsbruck, Austria</p>	
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The Models



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Markus Bucher
2005-2008



Andrea Hamann
Since 2008





Fig. 2: The *MiMage* consortium and the model systems used.

1.5 Research performed and main results achieved

Within **workpackage 1**, two main tasks were investigated: **Improvement of methods** to isolate functional mitochondria and measuring mitochondrial function and age-related impairment and the **development of a database**.

- Protocols to be used during the project were established for the isolation of **functional (coupled) mitochondria** of *P. anserina* and *C. elegans*, **measuring ROS generation** and the identification of **protein** and **lipid modifications**.
- Different crucial methods to be used during the project were established or optimised including methods to measure different metabolic parameters (e.g., NADP(H), ATP, ADP content), the redox status (GSSG/GSH), DNA repair, protein and lipid modification in organisms or systems (e.g., *C. elegans*, *P. anserina*) in which these methods were not established before. The synthetic superoxide dismutase (SOD) mimetic EUK-8 was purified in order to have a pure compound for measuring the effect of administration of this compound on lifespan of organisms.
- A method for isolation and purification of mitochondria suitable for **DNA repair** measurements from young *D. melanogaster* was developed. A suitable protocol was developed for *C. elegans* and for *D. melanogaster* to identify **mtDNA deletions**. Moreover, a method for studying **in situ carbonylation** in *D. melanogaster* is now available. Reliable assays for obtaining quantitative data of the **redox** and **energy status** in *C. elegans* and *P. anserina* (NADPH/NADP⁺ ratio, GSH) were generated.
- A major effort during the last two years of the project was work to develop and implement a strategy for **integrative data analyses**. The ground was laid by carefully defining the needs and prerequisites of a database by participation in various meetings and workshops (e.g., in Brussels), intensive interactions of partners with expertise in bioinformatics, interactions with all partners of the consortium to define the basic needs of a database, training at the *Center for Integrated Systems Biology of Ageing and Nutrition* (CISBAN) in Newcastle, UK, where a Systems Biology platform is under construction. The collected expertise was used to establish the ground of a database specifically suiting the *MiMage* consortium and was used to generate and to deposit data from the *MiMage* project. At the end of the project published data and data made available by different partners for inclusion in an open database were made available to public.

The technical platform provided in workpackage 1 allowed the investigations performed within the other workpackages.

Workpackage 2 was aimed at defining the impact of **ROS levels** on ageing and defining procedures to interfere with pathways based on cellular oxidative stress.

- The effect on ageing by **modulating the amount of mitochondrial ROS** was addressed in the different ageing models used in the consortium. Existing longevity mutants, new mutants selected by specific screens, or new strains specifically constructed by genetic engineering were investigated at the **biochemical**, the **metabolic**, the **cytologic** and the **molecular level**. In addition, the impact of exogenous oxidative stress and of ionophores on mitochondrial functions was investigated in selected systems.
- A comprehensive joint **proteomics study** analysing mitochondria from *P. anserina*, rat brain and human cell culture was successfully performed raising many novel data [Groebe et al. 2007 *Exp Gerontol* 42: 887-898]. Mitochondria of various *C. elegans* samples were analysed with native-PAGE.

Specifically the work performed in this workpackage made clear that a reductionistic approach concentrating on single components of the network involved in the control of ageing can lead to inappropriate conclusions because any specific manipulation may result in compensatory effects in pathways which are not analysed in a particular study. This knowledge strongly calls for broader approaches like they are taken in Systems Biology.

Within **workpackage 3** the mitochondrial function (mtDNA stability, mtDNA repair, heat shock proteins, mitochondrial dynamics, autophagy, apoptotic pathways) involved in ***maintenance of a 'healthy' population of mitochondria*** and the impact on ageing was determined and characterised.

- Pathways affecting the integrity of the mitochondrial DNA (e.g., DNA repair), the response to heat stress, and the dynamics of mitochondria were investigated.
- An analysis of degradation of mitochondria in ageing cells and after oxidative stress was performed. The phenotype of rejuvenation during production of progeny was further investigated.
- ***Mitochondrial dynamics*** was investigated in yeast, *P. anserina* and mammalian cell lines (HUVEC) and links to oxidative stress, signalling pathways and to apoptosis were investigated. The ***degradation of mitochondria*** by the autophagosomal/lysosomal pathway after targeted damage with different marker proteins in living cells was investigated. The role of the mitochondrial ATP/ADP translocator in the control of ***mtDNA maintenance*** was studied. The age-related ***mtDNA repair system*** in *P. anserina* and in mammals was investigated in detail. ***Recombination of mtDNA*** was analysed as a mechanism contributing to the maintenance of functional mitochondria. The role of the ***heat stress system*** in ageing was studied in *D. melanogaster* and *P. anserina*. The ***carbonylation status*** after oxidative stress of human control cell lines was compared to human Werner knock-down cells.
- The impact of the ***heat stress system*** in ageing was studied in detail and the links between DNA and protein maintenance in premature ageing syndromes were analysed.

Workpackage 4 addressed different ***signalling pathways*** (e.g., retrograde signalling, AMP/PKA, and insulin/IGF signalling) and their impact on mitochondrial function, lifespan control and ageing.

- A pathway signalling dysfunction of mitochondria to the nucleus, the retrograde response, was investigated in other systems than yeast where it is known to affect ageing processes. Other signalling pathways (e.g., insulin/IGF signalling) known to affect ageing were studied for their impact on mitochondrial function.
- The involvement of apoptosis in this signalling was investigated.

Workpackage 5 defined the impact and the molecular mechanisms by which ***dietary restriction*** (DR) affects mitochondrial function, lifespan and ageing.

- Selected mutants and strains in which candidate genes were 'knocked-out' were investigated.

In **workpackage 6** '*novel*' *age-related mitochondrial functions* linked to lifespan control and ageing were identified and evaluated.

- Longevity strains in which different pathways are affected were selected. Differential gene expression analysis identified novel functions (e.g. mitochondrial fission pathways) affecting longevity in specific systems.
- Candidate pathways (e.g., apoptotic pathways) were analysed for their role in lifespan control.
- Some common signatures of ageing arose from a *proteomic analysis* of *P. anserina*, *D. melanogaster*, *C. elegans*, and mammalian cell cultures. Among others components of the *energy transducing apparatus* (e.g., citric cycle, ATPase) were found to be differentially expressed during ageing. Components of *the apoptotic machinery* (e.g., TCTP/MMI1, cyclophylin D, VDAC) were identified as important candidates. The age-related *architecture of the inner mitochondrial membrane* was studied. Candidate components (e.g. AIF, AMID) of the mitochondrial branch of the apoptotic machinery were studied in some detail.
- As a follow-up of a comparative differential *proteome analysis* of *P. anserina*, *D. melanogaster*, *C. elegans*, rats and mammalian cell cultures, selected proteins (e.g. cyclophylin D, TCTP/MMI1, an *O*-methyltransferase (PaMTH1), ATP synthase, FAHD1) were analysed in more detail as members of an apoptotic, an energy transducing and a scavenging machinery with relevance for ageing. NADPH oxidases and their role on mitochondrial function in yeast and human cells were investigated. Additional attention was on the differential mitochondrial proteome analyses with samples from *C. elegans*, *D. melanogaster* and yeast.

Overall the project evolved very well according to the lines of the implementation plan leading to general conclusions about the role of mitochondrial pathways on ageing and lifespan control. One important main conclusion is that there is a lot of additional value available from this integrated EC programme. Much more knowledge can be gained from this and other, similar projects by integration of data and conclusions. Programmes utilizing Systems Biology approaches certainly are the right choice going in such a direction to provide a new momentum for projects going beyond-the state-of-the-art as it has been reached at the end of *MiMage*.

1.6 Achievements of the project related to the state-of-the-art

MiMage was one of three Integrated Projects within the 6th Framework of the European Community in which interdisciplinary approaches were taken to investigate the complex molecular network involved in the control of lifespan and ageing. The three IPs are partly overlapping but all have/had a specific goal. More specifically, *GeHa* is focusing on the genetics of healthy ageing in humans and *Proteomage* has a focus on conserved mechanisms of ageing based on advanced proteome analysis. The specific focus of *MiMage* was to investigate the *role of mitochondria* in conserved mechanisms of ageing using different well established, experimentally tractable biological systems including the yeast *S. cerevisiae*, the filamentous fungus *P. anserina*, the nematode *C. elegans*, the fruit fly *D. melanogaster*, and mammalian cell cultures. The scientific topics addressed were related to state-of-the-art issues in this field of gerontology (e.g., role of reactive oxygen species (ROS), quality control systems, signalling, dietary restriction).

Apart from the huge set of individual data which were generated and do represent a rich source for future ‘in-depth’ analyses, some general key conclusions towards a better understanding of the interacting molecular pathways governing ageing and lifespan were obtained. These can be grouped within the two following categories:

- Identification and definition of **common signatures of ageing** (e.g., changes in protein abundances and post-translational modification). From several independent studies it now is clear that, instead of an age-related modification (i.e., carbonylation) of the **bulk of all cellular proteins**, rather the modification and/or damage of **specific proteins** (e.g., aconitase, ATPase, VDAC) appears to be of special relevance for ageing.
- A **hierarchical system** with conserved modules involved in the control of functional mitochondria was identified in the different systems studied to be effective and of relevance for biological ageing, lifespan and healthspan control (Fig. 3). These pathways are effective at the (i) **molecular level** (e.g., ROS generation, ROS scavenging, DNA and protein quality control), (ii) at the **organellar level** (e.g., mitochondrial fission and fusion, autophagy), and at the **cellular level** (e.g., programmed cell death). Although these mechanisms may differ in detail among species it emerges that the more general molecular modules (molecular damage, different maintenance pathways) **are conserved among organisms**.

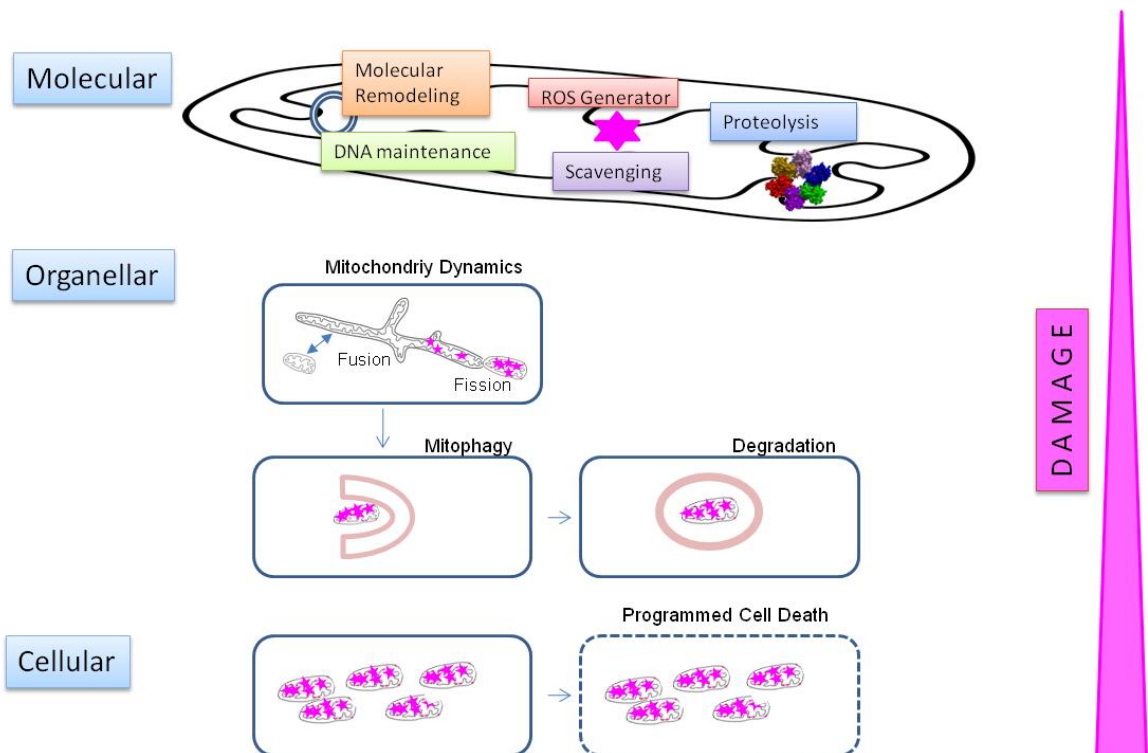


Fig. 3: Hierarchical order of events to cope with molecular damage (indicated by stars)

Apart from the large set of elaborated data (e.g., from proteome analyses) that remains a rich source of information for future ‘in-depth’ analyses ***THE major overall outcome of the MiMage project is the shaping of a more holistic view of events, pathways and interactions governing the ageing process.*** Moreover, in particular the overall evaluation and critical analyses of the work performed during the lifespan of *MiMage* revealed that an integration of available and new, complementing data in a broader approach than the usual reductionistic approaches taken in biology is of prime importance in the future. This conclusion urgently calls for real interdisciplinarian work in which different disciplines including experimental biologists, bioinformaticians and mathematical modellers work together using the huge amount of data that have been generated during the last decade in different collaborative project and critically evaluate and integrate them to generate valuable experimentally testable predictions and views. ***These conclusions urgently call for subsequent programmes and provide solid ground for perspectives towards the investigation of mechanisms of human ageing utilizing a Systems Biology approach.***

2 Dissemination and use

During the whole lifetime of *MiMage* special emphasis was taken to disseminate the work performed in the project both to the scientific community but also to politicians, stakeholders and the public.

(i) Specific main activities to raise public interest:

MiMage was represented at the AGEACTION conference “Changing Expectations of Life” at the spectacular Sage Gateshead hall in association with Newcastle University’s Institute for Ageing and Health (23 April 2007). The main goal of this conference was to raise attention to public, stakeholders and politicians on the upcoming problems arising from the ageing of European population.

Other dissemination activities took place in collaboration with the LINK-AGE collaborative project of the EC and by approaches taken by individual partners of *MiMage* in their home countries. Such activities were press releases, contributions to non-scientific journals, radio and TV contributions etc.

(ii) Training and dissemination to students and young researchers

- September 18-22, 2007, a joint summer school of LINK-AGE and *MiMage* was organised. The summer school took place in Les Diablerets, Switzerland, with about 70 participants, thereof 50 students (Fig. 4, flyer see Fig. 5).



Fig. 4: Group photo of participants of the *MiMage*/LINKAGE summerschool in Les Diablerets, Switzerland, Sept 18-22, 2007.



MiMage and LINK-AGE joint Summer School



Les Diablerets-
Switzerland
18-22 September 2007



Scope of the event

The aim of this summer school is to train young scientists in ageing research. For this purpose, the members of the *MiMage* project will give lectures introducing the model systems and specific relevant methods. In addition, invited experts will present their work from different fields of experimental gerontology. The lectures are expected to include a broad general introduction and are intended for students, not for faculties.

Furthermore, a major part of the programme will consist in poster presentations to give the students the opportunity to discuss their research data with others and with more experienced investigators. All participating students are requested to present their data on a poster. A poster competition will take place.

Besides the talks and the posters presentation, time will be devoted to discussions between students and the professors.

About the projects

MiMage and LINK-AGE are projects financed by the 6th Framework Programme of the European Commission within the Priority 1- LIFESCIHEALTH.

MiMage is an Integrated Project whose overall aim is to elaborate the role of mitochondrial function in ageing and lifespan control of biological systems.

LINK-AGE (Coordination and Consolidation of European Biogerontology: en route towards formation of a European College of Biogerontology) is a Coordination Action that aims at significantly extending existing European research networks in biogerontology.

Venue	Leisure time
Eurotel Victoria CH-1865 Les Diablerets, Switzerland	Swimming pool Sauna and Fitness on the spot,
Tel: +41-244923721 Fax: +41-24492371 www.eurotel-victoria.ch	Hiking Site-seeing Sun bathing

Contacts	
Dr. Markus Bucher <i>MiMage</i> Project Manager JW Goethe University Germany Tel: +49 (0) 6979829548 Fax: +49 (0) 6979829435 asm@miimage.org www.miimage.org	Dr. Béatrice Rayet LINK-AGE Manager Namur University Belgium Tel: +32 (0) 81724107 Fax: +32 (0) 81724135 beatrice.rayet@fundp.ac.be www.link-age.eu

Scientific topics

The two major scientific topics that will be discussed by the speakers are model systems and techniques-related fields in ageing research.

Schedule of the *MiMage*/Link-Age summer school *Models and Methods in Ageing Research*

	Tuesday 18 Sept	Wednesday 19 Sept	Thursday 20 Sept	Friday 21 Sept	Saturday 22 Sept
08:30 - 09:15		Multifactorial Events in <i>Drosophila</i> Longevity, or the Fly Is More Complex than You Think it Is Robert Arking	Protein oxidation, degradation and repair in ageing and oxidative stress Bertrand Friguet	Cellular senescence and immortalisation Parmjit Jat	Hormones, stem cells and prevention of ageing-associated skin diseases: Clinical relevance Christos Zouboulis
09:15 - 10:00		<i>Drosophila melanogaster</i> as a model system for the study of ageing, stress resistance, and neurodegenerative diseases Robert Tanguay	Visualizing mitochondria and their function Jürgen Bereiter-Hahn Mitochondrial reactive oxygen species detection Ricardo Gredilla	Spontaneous and induced senescence of human cells; their role in ageing and tumorigenesis Olivier Toustaint and Piddier Jansen-Dürr	Closing keynote lecture: The use of Mouse Models for Research in Aging Jan Hoeijmakers (-10:15)
10:00 - 10:30		Coffee break			Poster awards
10:30 - 11:15		Yeast mother cell-specific ageing Michael Breitenbach	Native 2D PAGE/DIGE based proteomics: powerful tools to elucidate the molecular mechanisms of ageing and age-related diseases Norbert A. Dencher General considerations for choosing an analytical method in Proteomic studies of age-related models: Resolution, differential quantification and statistics André Schratzenholz	Role of DNA damage and repair in aging Tinna Stevnsner and Wilhelm Bohr	Departure
11:15 - 12:00		<i>Podospora anserina</i> : a system to study mitochondrial-nuclear interactions controlling organismic ageing Heinz Osiewacz	The nematode <i>Caenorhabditis elegans</i> , a suitable ageing model Jacques Vanfleteren	Poly(ADP-ribosyl)ation and mammalian longevity Alexander Bürkle	
12:00 - 17:00	Registration (14:00-18:00)	Lunch / leisure time			
17:00 - 18:00		Introduction into posters (3 min each, 16 per day)			
18:00 - 18:30	Welcome drink	Meet the professor			
19:00 - 20:00		Dinner			
20:00 - 20:45	Welcome address Opening Keynote lecture: The making of mitochondria: protein translocases, chaperones and energy Walter Neupert (-21:15)	Human longevity: the recruitment of subjects and the study of centenarians Claudio Franceschi	Genes, Environment, and Chance in Aging and Life Span: How Much of Each? Tom Johnson	Theory of disposable soma and evolution of ageing: the 30 years Anniversary Tom Kirkwood	
20:45-22:00		Introduction into posters (continuation, 3 min each, 16 per day)			

Fig. 5: Flyer and programme of the *MiMage*/LINK-AGE summer school in 2007.

(iii) Dissemination to the scientific community

The main activities were contributions to conferences and publications in scientific journals (see list at the end of this report).

The Annual Meetings of the consortium partly were open to public and therefor disseminated knowledge also to the interested public (e.g., interested students)

Annual Meetings of *MiMage*

- At the beginning of the project the 1st Annual Meeting (Kick-Off Meeting) on the *Role of Mitochondria in Conserved Mechanisms on Ageing*, 24-25 February 2005, was hold in Frankfurt, Germany. This meeting was followed by Annual Meetings which – together with the project evaluation – took place in Frankfurt. In 2006, 2007 and 2009 these meetings were combined with scientific symposia on the *Role of Mitochondria in Conserved Mechanisms of Ageing* open to the public (flyers see Fig. 6, 7, 8, and 9).

<p>In December 2004, the Johann Wolfgang Goethe University, Frankfurt am Main, as the coordinating institution and the European Commission signed a contract of an Integrated Project on The Role of Mitochondria in Conserved Mechanisms of Ageing (Acronym: <i>MiMage</i>). This research project is supported within the 6th Framework for a period of five years starting January 1, 2005. Twelve research teams from seven European countries and one associated team from Canada and the US each constitute a consortium of partners with complementary expertise in different research areas including biochemistry, cell biology, genetics, molecular biology, and physiology. Nine partners are from Universities, two from Research Centres and one partner is a Biotech Company.</p> <p>AGEING IN EUROPE. Ageing of biological systems as a complex process resulting in a progressive and non-reversible decline of physiological functions ultimately leads to an increase in morbidity and mortality. In humans, in the industrialised countries mean life span has dramatically increased over the last centuries. At the same time, birth rates are declining leading to a "greying" of Europe with an increasing portion of disabled and severely sick individuals. From these developments social tensions have developed and will grow further. The current health and social systems are unable to support the growing number of the elderly. Solving this immense problem requires well coordinated strategies: (i) political decisions to change the existing social and health systems and (ii) basic research to unravel the complex mechanisms of ageing as the basis to establish efficient interventions into age-related diseases.</p> <p>AGEING RESEARCH. Although ageing has been extensively studied over decades, in not a single biological system the mechanisms have been elucidated detailed enough. It is clear today that ageing is governed by a complex network of molecular pathways consisting of a few basic pathways ('public mechanisms of ageing') which are conserved from lower (e.g., fungi) to higher systems (e.g., mammals) and by additional pathways which are species or strain specific ('private mechanisms of ageing'). Unravelling the conserved mechanisms of ageing is performed via the analysis and comparison of ageing in different systems.</p> <p>MITOCHONDRIA IN CONSERVED MECHANISMS OF AGEING. Mitochondria have been demonstrated as cellular compartments which play a major role in ageing in a variety of systems. In these organelles, the generation of reactive oxygen species (ROS) during the process of energy transduction at the inner mitochondrial membrane is thought to play a key role since these</p>	<p>aggressive molecules lead to an progressive accumulation of damaged biomolecules (e.g., nucleic acids, proteins, lipids) ultimately resulting in cellular impairments. However, more recent data indicate that ageing cannot be solely traced back to the action of ROS. One of the unsolved questions today is the link of mitochondrial functions to different age-related pathways (e.g., signaling pathways) which previously have been identified as 'non-mitochondrial'.</p> <p>OBJECTIVES OF MIMAGE. The overall aim of the <i>MiMage</i> project is to elaborate a complete view of the mechanistic role of mitochondria in biological ageing. The strategy is to discover and experimentally manipulate mechanisms that show evolutionary conservation between invertebrate and mammalian model systems. A unique matrix of organisms (yeast, <i>Podospora anserina</i>, <i>Caenorhabditis elegans</i>, <i>Drosophila melanogaster</i>, mouse, rat) and cell cultures systems is studied. Specific age-related issues are raised and experimentally approached. Among others these are: (i) the effect of a the modulation of the mitochondrial ROS levels on ageing, (ii) the role of molecular and cellular pathways to maintain a "healthy" population of mitochondria, (iii) the nature and impact of age-related signaling pathways on mitochondrial functions, (iv) the effect of dietary restriction on mitochondrial activity, (v) the impact of 'novel' age-related mitochondrial functions. The effect of experimental interventions into the different pathways can be studied in the investigated ageing models in a conveniently short period of time since some of the systems are characterised by a short life span. The relevance of the identified pathways and interactions can subsequently be addressed in humans linking <i>MiMage</i> to other European programmes specially supporting research on human ageing.</p> <p style="text-align: center;">  JOHANN WOLFGANG GOETHE UNIVERSITÄT FRANKFURT AM MAIN </p> <p>Contact: Prof. Dr. Heinz D. Osiewacz Johann Wolfgang Goethe-University Faculty of Biology and Informatics Botanical Institute / BioCenter Marie-Curie-Str. 9 60439 Frankfurt a.M. Tel. +49-(0)69-798-29264 Fax +49-(0)69-798-29363 e-mail: osiewacz@em.uni-frankfurt.de</p>	<p style="text-align: center;"> 'Kick-off' Meeting EU Integrated Project „Role of Mitochondria in Conserved Mechanisms of Ageing“ (<i>MIMAGE</i>) </p> <p style="text-align: center;">  February 24-26, 2005 </p> <p style="text-align: center;"> JOHANN WOLFGANG GOETHE- UNIVERSITÄT Biozentrum, Hörsaal B3 Marie-Curie-Str. 9 60439 Frankfurt/Main GERMANY </p> <p style="text-align: center;">  </p>
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ORGANIZATION AND MANAGEMENT ISSUES

THURSDAY, FEBRUARY 24

12:00 **GET TOGETHER**
 13:00 **BRUNO EHMANN**
 -16:00 Organization – Management
 – Financial Issues – Reporting
 17:30 **DISCUSSION**
 19:00 **INFORMAL COME TOGETHER**



1ST SYMPOSIUM ON THE ROLE OF MITOCHONDRIA IN CONSERVED MECHANISMS OF AGEING

FRIDAY, FEBRUARY 25

09:00 **WELCOME ADDRESSES**

PROF. DR. JURGEN BEREITER-HAHN
 Vice-President of the Johann Wolfgang Goethe-University
DR. CHRISTIAN WIMMER
 Representative of the European Commission
PROF. DR. HEINZ D. OSIEWACZ
 Coordinator of MiMag

09:30 **MICHAEL BREITENBACH (SALZBURG)**
 Yeast ageing and mitochondrial function

10:00 **EVI HUETTER, HERMANN UNTERLUGGER (INNSBRUCK)**
 Mitochondrial function and ROS in senescent human cells

COFFEE BREAK

10:50 **MARINA JENDRACH (FRANKFURT)**
 Analysis of age- and ROS- induced changes in mitochondria of cultured cells

11:20 **CHRISTIAN SCHECKHUBER (FRANKFURT)**
 Age-related dynamics of mitochondria in *Podospora anserina*

11:50 **SEVERINE LORIN (GIF-SUR-YVETTE)**
 Respiration complexes and longevity in *Podospora anserina*

LUNCH

14:00 **NORBERT DENCHER, FRANK KRAUSE (DARMSTADT)**
 Towards the mitochondrial proteome and the supramolecular architecture of OXPHOS complexes: Evaluation of age- and stress- related modifications

14:30 **THOMAS NYSTRÖM (GÖTEBORG)**
 Oxidative damage of proteins: Generation, segregation, and genetic determinants

15:00 **ROBERT TANGUAY (QUEBEC)**
 Small heat shock proteins, ageing and resistance to oxidative stress

15:30 **TINNA STEVNSNER (AARHUS)**
 DNA repair in mammalian mitochondria and relations to ageing

COFFEE BREAK

16:20 **FONS DEBETS (WAGENINGEN)**
 Mitochondrial mechanisms of ageing: exploiting laboratory mutants and natural variation for the effect of calorie restriction and pAL2-1 homologues in *Podospora anserina*.

16:50 **KRYSTEL BRYIS (GHENT)**
 Isolation and preliminary characterization of *C. elegans* mitochondria

17:20 **ANDRE SCHRATTENHOLZ (MAINZ)**
 Proteomics and bioinformatics at ProteoSys

19:00 **SOCIAL EVENT**



SATURDAY, FEBRUARY 26

09:00 **MEETING OF THE GENERAL ASSEMBLY**

10:00 **ORGANIZATION OF WORK-PACKAGES**
 Scientific Issues (e.g., Deliverables, Milestones, Project Development), Reporting Issues

13:00 **LUNCH**

14:00 **MEETING OF THE PROJEKT MANAGEMENT BOARD**

14:30 **ORGANIZATION OF WORK-PACKAGES**
 -18:30 **END OF MEETING**

Fig. 6: Flyer and programme of the 1st Annual Meeting (Kick-Off Meeting) on the *Role of Mitochondria in Conserved Mechanisms on Ageing*, Frankfurt, February 24-25, 2005.

2ND SYMPOSIUM ON THE ROLE OF MITOCHONDRIA IN CONSERVED MECHANISMS OF AGEING

10:00 **WELCOME ADDRESS**
HEINZ D. OSIEWACZ, FRANKFURT
 Coordinator of MiMag

10:10 **Genes, Environment and Chance - All Play a Role in Determining Individual Life Span; How Much?**
TOM JOHNSON, BOULDER

10:40 **Retrograde Signalling in Yeast and Human**
MICHAŁ JAZWINSKI, NEW ORLEANS

COFFEE BREAK

11:40 **The reduced fitness of RAS overactive cells is partly due to ROS-dependent inactivation of the mitochondrial ATP/ADP translocator**
LYDIE HLAVATA, GÖTEBORG

12:00 **Ros production and longevity in a long-lived Ins/IGF-1 mutant of *C. elegans***
KRYSTEL BRYIS, GENT

12:20 **Mitochondrial free radical generation and lifespan control in the fungal ageing model *Podospora anserina***
JURGEN GRIEF, FRANKFURT

12:40 **Absence of complex III leads to 'eternity' and is not accompanied with deficiency in complex I activity in *P. anserina***
ANNIE SAINSAARD-CHANET, GIF/YVETTE, FRANCE

LUNCH

14:30 **The role of mitochondrial and non-mitochondrial ROS in cellular ageing**
EVELINE HÜTTER, INNSBRUCK

14:50 **Comparative profiling of mitochondrial proteomes: methods, development and first identifications of age-related differences from *Rattus* and *Podospora***
ANDRE SCHRATTENHOLZ, MAINZ

15:10 **A glimpse of the mammalian functional mitochondrial proteome and age-triggered alterations**
NORBERT A. DENCHER, DARMSTADT

15:30 **Functional analysis of YGR076C and YKL056C, two novel yeast ageing genes related to mitochondria**
EDITH BOGGRUBER, PETER LAUN, SALZBURG

15:50 **Calorie restriction and lifespan extension in *Podospora anserina***
ANNE VAN DIEPENINGEN, WAGENINGEN

COFFEE BREAK

17:20 **Exchange of mitochondrial inner membrane proteins during mitochondrial fusion**
MARINA JENDRACH, FRANKFURT

17:40 **Investigating the role of small stress proteins in ageing**
ROBERT TANGUAY, QUEBEC

18:00 **DNA repair in mammalian mitochondria**
WILL BOHR, BALTIMORE

18:20 **Maintenance of genomic stability by poly(ADP-ribose)ation, a DNA damage-driven protein modification linked with lifespan**
ALEXANDER BURKLE, KONSTANZ

20:00 **SOCIAL EVENT**

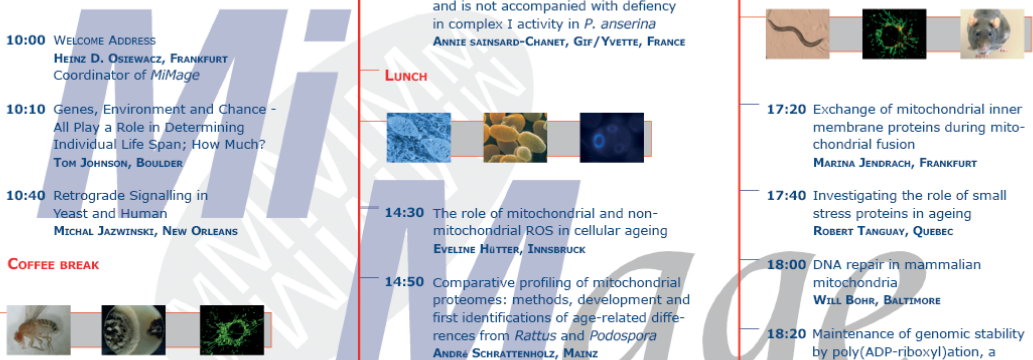


Fig. 7: Programme of the 2nd Annual Meeting on the *Role of Mitochondria in Conserved Mechanisms on Ageing*, Frankfurt, April 7-8, 2006.



Fig. 8: Programme of the 3rd Annual Meeting on the *Role of Mitochondria in Conserved Mechanisms on Ageing*, Frankfurt, March 19-21, 2007.

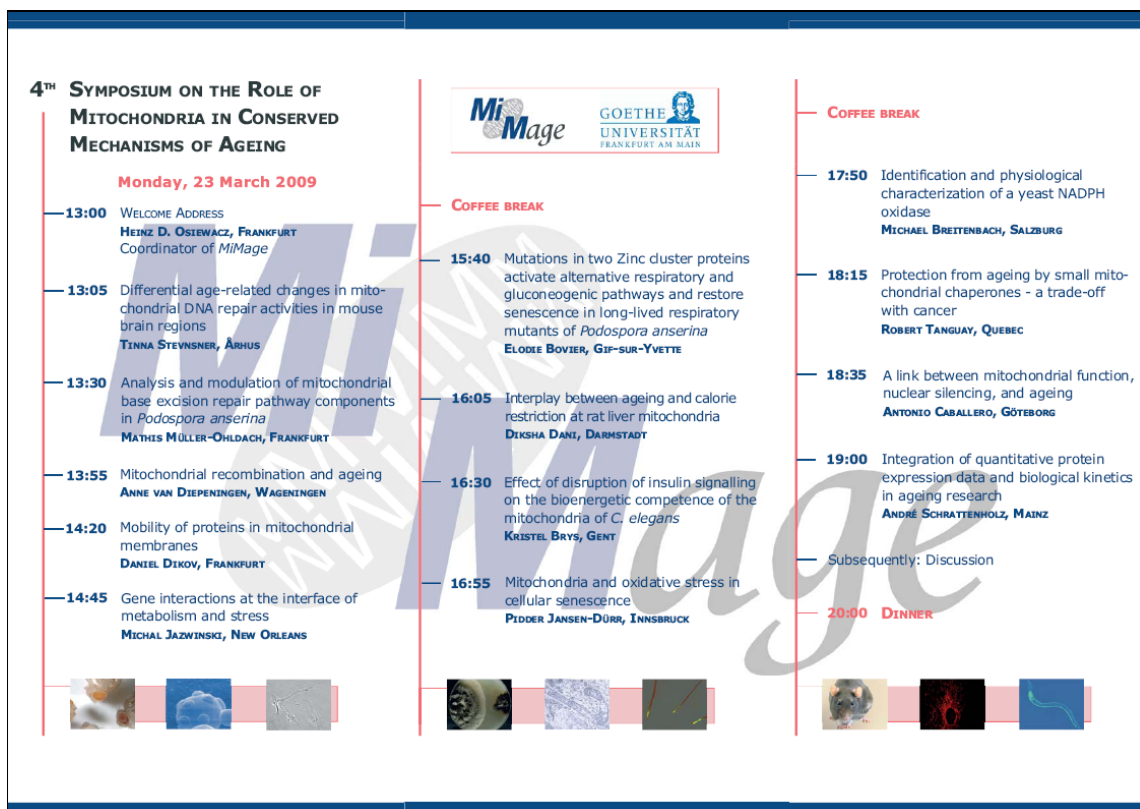


Fig. 9: Programme of the 4th Annual Meeting on the *Role of Mitochondria in Conserved Mechanisms on Ageing*, Frankfurt, March 23-25, 2009

International Conference on “Mitochondria in Ageing and Age-Related Disease” including a LINK-AGE Topic Research Group, Les Diablerets, Switzerland, 26 – 30 September 2009

- A final *MiMage* meeting was organized as an International Conference on “Mitochondria in Ageing and Age-Related Disease” including a LINK-AGE Topic Research Group Meeting in Les Diablerets, Switzerland.
- A number of highly renowned researchers in the field of ageing could be attracted as speakers: Douglas Wallace (Irvine, USA, Key Note Lecture); Dan Bogenhagen (Stony Brook, USA), Laurie Kaguni (East Lansing, USA), Alexander Bürkle (Konstanz, Germany), Judith Haendeler (Düsseldorf, Germany), Doug Turnbull (Newcastle upon Tyne, UK), Chris Meisinger (Freiburg, Germany), Lloyd Demetrius (Cambridge, USA and Berlin, Germany); Martin D. Brand (Novato, USA); Siegfried Hekimi (Montreal, Canada); Peter S. Rabinovitch (Seattle, USA); Thomas von Zglinicki (Newcastle upon Tyne, UK), S. Michal Jazwinski (Louisiana, USA); Thomas E. Johnson (Boulder, USA); Rodney L. Levine (Bethesda, USA); Bertrand Friguet (Paris, France); Thomas Langer (Cologne, Germany); Andreas Reichert (Frankfurt, Germany); Tomas A. Prolla (Madison, USA), Tom Kirkwood (Newcastle upon Tyne, UK, Closing Lecture). The members of the *MiMage* consortium presented their results to about 90 conference attendees from 14 countries all over the world (Fig. 10). 36 posters were presented to the conference topic.

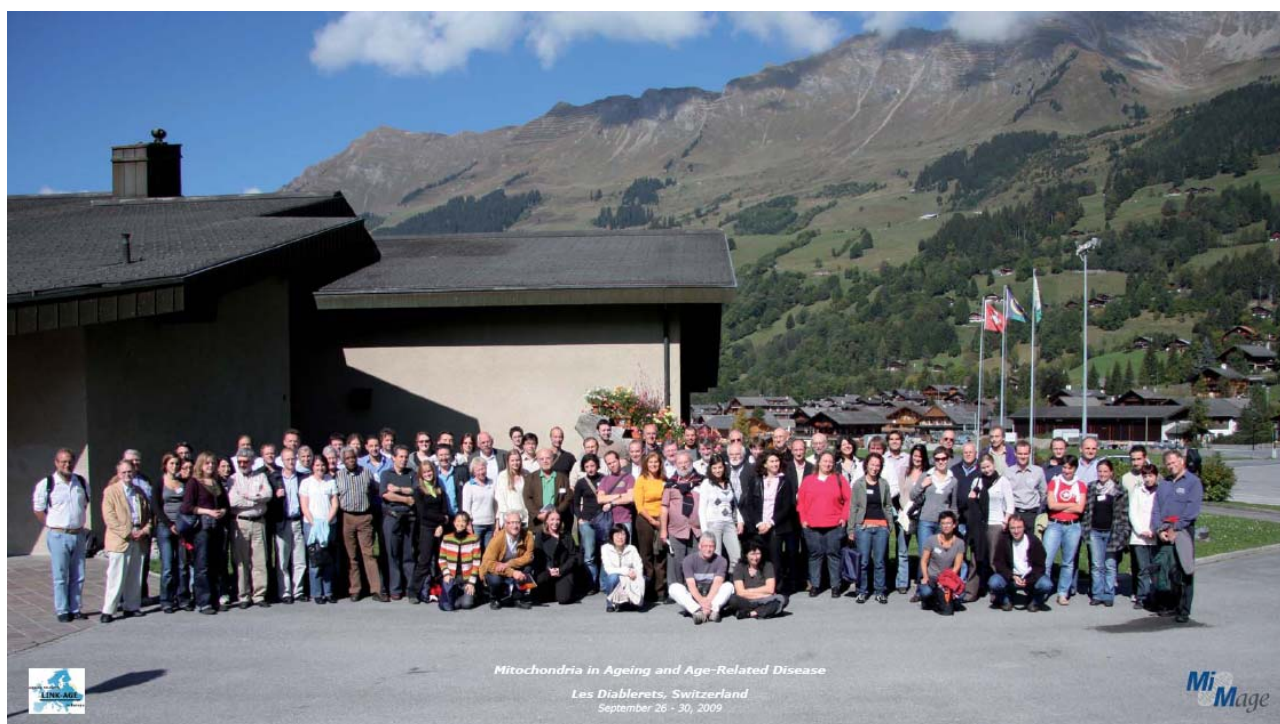


Fig. 10: Group picture of participants of the Final *MiMage* Conference on “Mitochondria in Ageing and Age-Related Disease” in Les Diablerets, Switzerland, September 26-30, 2009.

Publications in scientific journals

- Results of the project were published in various peer reviewed journals, such as ‘Cell’, ‘EMBO Journal’, ‘Nature Cell Biology’, ‘Journal of Cell Biology’, ‘Mechanisms of Ageing and Development’, ‘PloS One’, ‘Genetics’, ‘Biochimica et Biophysica Acta’, ‘Mutation Research’, ‘Aging’, ‘Electrophoresis’, ‘Biogerontology’, ‘Experimental Gerontology’ (Table 1). Two Special Issues with main contributions by *MiMage* partners were edited by the coordinator of *MiMage* serving as Guest Editor.

In 2008 a number of the results achieved so far were published in a Special Issue of the Biogerontology Journal on *Mitochondria and Aging*, Guest Editor: H. D. Osiewacz (Fig. 11).

Osiewacz HD (2008) Mitochondria in aging and age-related diseases (Editorial). Biotechnol J 3: 702-703.

Morrow G, Tanguay RM (2008) Mitochondria and ageing in *Drosophila*. Biotechnol J 3: 728-739.

Salvioli S, Capri M, Santoro A, Raule N, Sevini F, Lukas S, Lanzarini C, Monto D, Passarino G, Rose G, De Benedictis G, Franceschi C (2008) The impact of mitochondrial DNA on human lifespan: A view from studies on centenarians. Biotechnol J 3: 740-749.

Reeve AK, Krishnan KJ, Turnbull D (2008) Age related mitochondrial degenerative disorders in humans. Biotechnol J 3: 750-756.

Friguet B, Bulteau AL, Petropoulos I (2008) Mitochondrial protein quality control: Implications in ageing. Biogerontol J 3: 757-764.

Bereiter-Hahn J, Vöth M, Mai S, Jendrach M (2008) Structural implications of mitochondrial dynamics. Biogerontol J 3: 765-780.

Scheckhuber CQ, Rödel E, Wüsthube J (2008) Regulation of mitochondrial dynamics – characterization of fusion and fission genes in the ascomycete *Podospora anserina*. Biogerontol J 3: 781-790.

van Diepeningen AD, Debets AJM, Slakhorst SM, Hoekstra RF (2008) Mitochondrial pAL2-1 plasmid homologs are senescence factors in *Podospora anserina* independent of intrinsic senescence. Biogerontol J 3: 791-802.

Castelein N, Hoogewijs D, De Vreese A, Braeckman BP, Vanfleteren JR (2008) Dietary restriction by growth in axenic medium induces discrete changes in the transcriptional output of genes involved in energy metabolism in *Caenorhabditis elegans*. Biogerontol J 3: 803-812.

Unterluggauer H, Hütter E, Viertler HP, Jansen-Dürr P (2008) Insulin-like growth factor-induced signals activate mitochondrial respiration. Biogerontol J 3: 813-816.

Dani D, Dencher NA (2008) Native DIGE: A new look at the mitochondrial membrane proteome. Biogerontol J 3: 817-822.

Fig. 11: Cover page and publication list of the Special Issue of the Biotechnology Journal (Vol. 3, June 2008). Articles of members of the consortium are highlighted in bold.

A Special Issue on the *Mitochondria ion ageing and age-related disease. MiMage*” of the journal “Experimental Gerontology” is currently edited by Heinz D. Osiewacz serving as Guest Editor to the journal. This volume contains review and original articles of *MiMage* partners and in addition of a number of the invited speakers of the Final *MiMage* conference (Fig. 12) and most likely will appear printed July/August 2010.


	<p>Álvarez-Delgado C, Mendoza-Rodríguez CA, Picazo O, Cerbon M (2010) Different expression of α and β mitochondrial estrogen receptors in the aging rat brain. Interaction with respiratory complex V (doi:10.1016/j.exger.2010.01.015).</p>
	<p>Back P, Matthijssens F, Vlaeminck C, Braeckman BP, Vanfleteren JR (2010) Effects of sod gene overexpression and deletion mutation on the expression profiles of reporter genes of major detoxification pathways in <i>Caenorhabditis elegans</i> (doi:10.1016/j.exger.2010.01.014).</p>
	<p>Bereiter-Hahn J, Dikov D, Aulbach A, Muster B, Dröse S, Jendrach M (2010) Do UCP2 and mild uncoupling improve longevity?</p>
	<p>Bogenhagen D (2010) Does MtDNA Nucleoid Organization Impact Aging? (doi:10.1016/j.exger.2009.12.002)</p>
	<p>Brand M (2010) The sites and topology of mitochondrial superoxide production (doi:10.1016/j.exger.2010.01.003).</p>
	<p>Büchner N, Zschauer TC, Lukosz M, Altschmied J, Haendeler J (2010) Downregulation of mitochondrial Telomerase Reverse Transcriptase induced by H₂O₂ is Src kinase dependent (doi:10.1016/j.exger.2010.03.003).</p>
	<p>Diener T, Neuhaus M, Koziel R, Micutkova L, Jansen-Duerr P (2010) Role of endonuclease G in senescence-associated cell death of human endothelial cells (doi:10.1016/j.exger.2010.03.002).</p>
	<p>El-Khoury R, Sainsard-Chanet A (2010) Deletion of the mitochondrial NADH kinase increases mitochondrial DNA stability and life span in the filamentous fungus <i>Podospira anserina</i> (doi:10.1016/j.exger.2010.01.012).</p>
	<p>Frenzel M, Rommelspacher H, Sugawa MD, Dencher NA (2010) Ageing alters the supramolecular architecture of OxPhos complexes in rat brain cortex (doi:10.1016/j.exger.2010.02.003).</p>
	<p>Greaves LC, Barron MJ, Plusa S, Kirkwood TB, Mathers JC, Taylor RW, Turnbull DM (2010) Defects in multiple complexes of the respiratory chain are present in ageing human colonic crypts (doi:10.1016/j.exger.2010.01.013).</p>
	<p>Gredilla R, Bohr VA, Stevnsner TV (2010) Mitochondrial DNA repair and association with aging - an update (doi:10.1016/j.exger.2010.01.017).</p>
	<p>Groebe K, Klemm-Manns M, Schwall GP, Hübenthal H, Unterluggauer H, Jansen-Dürr P, Tanguay R, Morrow G, Schratzenholz A (2010) Age-dependent posttranslational modifications of voltage-dependent anion channel 1 (doi:10.1016/j.exger.2010.02.006).</p>
	<p>Kaguni LS, Oliveira MT, Garesse R (2010) Animal models of mitochondrial DNA transactions in disease and ageing (doi:10.1016/j.exger.2010.01.019).</p>
	<p>Kim HJ, Morrow G, Westwood JT, Michaud S, Tanguay RM (2010) Gene expression profiling implicates OXPPOS complexes in lifespan extension of flies over-expressing a small mitochondrial chaperone, Hsp22 (doi:10.1016/j.exger.2009.12.012).</p>
	<p>Klinger H, Rinnerthaler M, Lam Y, Laun P, Heeren G, Klocker A, Simon-Nobbe B, Dickinson RJ, Dawes IW, Breitenbach M Quantitation of (a)symmetric inheritance of functional and oxidatively damaged mitochondrial aconitase in the cell division of old yeast mother cells.</p>
	<p>Nelson B Cole, Mathew P Daniels, Rodney L. Levine, Geumsoo Kim (2010) Oxidative stress causes reversible changes in mitochondrial permeability and structure (doi:10.1016/j.exger.2010.01.016).</p>
	<p>Torgovnick A, Schiavi A, Testi R, Ventura N (2010) A role for p53 in mitochondrial stress response control of longevity in <i>C. elegans</i> (doi:10.1016/j.exger.2010.02.007).</p>
	<p>Ugidos A, Nyström T, Caballero A (2010) Perspectives on the mitochondrial etiology of replicative aging in yeast (doi:10.1016/j.exger.2010.02.002).</p>
	<p>van Diepeningen AD, Slakhorst SM, Koopmanschap AB, Ikink GJ, Debets AJM, Hoekstra RF (2010) Calorie Restriction in the filamentous fungus <i>Podospira anserina</i> (doi:10.1016/j.exger.2010.01.002).</p>
	<p>Wang J, Jiang JC, Jazwinski SM (2010) Gene regulatory changes in yeast during life extension by nutrient limitation (doi:10.1016/j.exger.2010.02.008).</p>
	<p>Weber TA, Reichert A (2010) Impaired quality control of mitochondria: aging from a new perspective.</p>
	<p>Zintel S, Schwitalla D, Luce K, Hamann A, Osiewacz HD (2010) Increasing mitochondrial superoxide dismutase abundance leads to impairments in protein quality control and ROS scavenging systems and to lifespan shortening (doi:10.1016/j.exger.2010.01.006).</p>

Fig. 12: List of accepted publications of the Special Issue “*MiMage*” of Experimental Gerontology. Publications of members of the consortium are highlighted in bold.

Table 1: List of *MiMAGE*-related publications.

Date	Research publications	Audience	Country	No.
5 Jan 2005	Scheckhuber C: Report on the 14th Annual Meeting of the German Society for Geriatric Research. - <i>Sci Aging Knowledge Environ</i> 1: 1.	Research	All	1
1 Apr 2005	Houthoofd K, Fidalgo M, Braeckman BP, Lenaerts I, Brys K, Matthijssens F, Hoogewijs D, De Vreese A, Van Eygen S, Munoz MJ, Vanfleteren JR: Metabolism, physiology and stress defense in three aging Ins/IGF-1 mutants of the nematode <i>Caenorhabditis elegans</i> . - <i>Aging Cell</i> 4: 87-95.	Research	All	11
8 Apr 2005	Jendrach M, Pohl S, Vöth M, Kowald A, Hammerstein P, Bereiter-Hahn J: Morpho-dynamic changes of mitochondria during ageing of human endothelial cells. - <i>Mech Ageing Dev</i> 126: 813-821.	Research	All	3
8 Apr 2005	Krause F, Reifschneider NH, Goto S, Dencher NA: Active oligomeric ATP synthases in mammalian mitochondria. - <i>Biochem Biophys Res Commun</i> 329: 583-590.	Research	All	5
17 May 2005	Walker G, Houthoofd K, Vanfleteren JR, Gems D: Dietary restriction in <i>C. elegans</i> : from rate-of-living effects to nutrient sensing pathways. - <i>Mech Ageing Dev</i> 126: 929-937.	Research	All	11
18 May 2005	Scheckhuber C, Osiewacz HD: MiMAGE: A Pan-European Project on the Role of Mitochondria in Aging. - <i>Sci Aging Knowl Environ</i> , Vol. 2005, Issue 20, pp. Pe14.	Research	All	1
May 2005	Houthoofd K, Braeckman BP, Lenaerts I, Brys K, Matthijssens F, De Vreese A, Van Eygen S, Vanfleteren J: DAF-2 pathway mutations and food restriction in aging <i>Caenorhabditis elegans</i> differentially affect metabolism. - <i>Neurobiol Aging</i> 26: 689-696.	Research	All	11
28 Jul 2005	Drakulic T, Temple MD, Guido R, Breitenbach M, Attfield PV, Dawes IW: Involvement of oxidative stress response genes in redox homeostasis, the level of reactive oxygen species, and ageing in <i>Saccharomyces cerevisiae</i> . - <i>FEMS Yeast Res</i> 5: 1215-1228.	Research	All	4
31 Aug 2005	Laun P, Ramachandran L, Jarolim S, Herker E, Liang P, Wang J, Weinberger M, Burhans DT, Suter B, Madeo F, Burhans WC, Breitenbach M: A comparison of the aging and apoptotic transcriptome of <i>Saccharomyces cerevisiae</i> . - <i>FEMS Yeast Res</i> 5: 1261-1272.	Research	All	4
1 Sep 2005	Houthoofd K, Johnson TE, Vanfleteren JR: Dietary restriction in the nematode <i>Caenorhabditis elegans</i> . - <i>J Gerontol Biol Sci</i> 60A: 1125-1131.	Research	All	11
Sep 2005	Nachin L, Nannmark U, Nyström T: Differential roles of the universal stress proteins in oxidative stress resistance, adhesion, and motility. - <i>J Bacteriol</i> 187: 6265-6272.	Research	All	8
Sep 2005	Christiansen M, Thorslund T, Jochimsen B, Bohr VA, Stevnsner T: The Cockayne Syndrome group B protein is a functional dimer. - <i>FEBS J</i> 272: 4306-4314.	Research	All	10
Sep 2005	Thorslund T, von Kobbe C, Harrigan JA, Christiansen M, Stevnsner T, Bohr VA: Cooperation of the Cockayne syndrome group B protein and poly(ADP-ribose) polymerase 1 in the response to oxidative stress. - <i>Mol Cell Biol</i> 25: 7625-7636.	Research	All	10

Date	Research publications	Audience	Country	No.
10 Oct 2005	Burnell A, Houthoofd K, O'Hanlon K, Vanfleteren JR: Alternate metabolism during the dauer stage of the nematode <i>Caenorhabditis elegans</i> . - <i>Exp Gerontol</i> 40: 850-856.	Research	All	11
Oct 2005	Kowald A, Jendrach M, Pohl S, Bereiter-Hahn J, Hammerstein P: On the relevance of mitochondrial fusions for the accumulation of mitochondrial deletion mutants: A modelling study. - <i>Aging Cell</i> 4: 273-283.	Research	All	3
Oct 2005	Zhou F, Wang F, Li F, Yuan J, Zeng H, Wei Q, Tanguay RM, Wu T: Association of hsp70-2 and hsp-hom gene polymorphisms with risk of acute high-altitude illness in a Chinese population. - <i>Cell Stress Chaperones</i> 10:349-56.	Research	All	13
4 Nov 2005	Hamann A, Krause K, Werner A, Osiewacz HD: A two-step protocol for efficient deletion of genes in the filamentous ascomycete <i>Podospora anserina</i> . - <i>Curr Genet</i> 48: 270-275	Research	All	1
23 Nov 2005	Scheckhuber C: Mitochondrial Dynamics in Cell Life and Death. - <i>Sci Aging Knowledge Environ</i> 47 : 36.	Research	All	1
Nov 2005	Jazwinski SM, Warner H, Helfand S, Driscoll M, Welsh DA, Faulkner J, Barzilai N, Breitenbach M, McCarter R, Brown WT, Greco N, Mountz J, Olshansky SJ: The biological sciences section program at the 57th annual meeting of the Gerontological Society of America. - <i>J Gerontol A Biol Sci Med Sci</i> 60: 1359-1365.	Research	All	4
Nov 2005	Papaconstantinou M, Wu Y, Singh N, Gianfelice G, Benderly M, Tanguay RM, Campos AR, Bédard PA: Menin is a regulator of the stress response in <i>Drosophila melanogaster</i> . - <i>Mol Cell Biol</i> 25: 9960-9972.	Research	All	13
Nov 2005	Poznanovic S, Wozny W, Schwall G, Sastri C, Hunzinger C, Stegmann W, Schratzenholz A, Buchner A, Gangnus R, Burgemeister R, Cahill MA: Differential radioactive proteomic analysis of microdissected renal cell carcinoma tissue by 54 cm isoelectric focusing in serial immobilized pH gradient gels. - <i>J Proteome Res</i> 4: 2117-2125.	Research	All	12
9 Dec 2005	Hu J, de Souza-Pinto NC, Haraguchi K, Hogue BA, Jaruga P, Greenberg MM, Dizdaroglu M, Bohr VA: Repair of Formamidopyrimidines in DNA Involves Different Glycosylases: Role of the OGG1, NTH1, and NEIL1 enzymes. - <i>J Biol Chem</i> 280: 40544-40551.	Research	All	10
Dec 2005	Hampel B, Wagner M, Teis D, Zwerschke W, Huber LA, Jansen-Dürr P: Apoptosis resistance of senescent human fibroblasts is correlated with the absence of nuclear IGF1R-3. - <i>Aging Cell</i> 4: 325-330.	Research	All	7
12 Jan 2006	Muftuoglu M, Sharma S, Thorslund T, Stevnsner TV, Sørensen MM, Brosh RM, Bohr V: Cockayne syndrome group B protein has novel strand annealing and exchange activities. - <i>Nucleic Acids Res</i> 34: 295-304.	Research	All	10
Jan 2006	Hütter E, Unterluggauer H, Garedew A, Jansen-Duerr P, Gnaiger E: High-resolution respirometry - a modern tool in aging research. - <i>Exp Gerontol</i> 41: 103-109.	Research	All	7
3 Mar 2006	Bergeron A, Jorquera R, Orejuela D, Tanguay RM: Involvement of endoplasmic reticulum stress in hereditary tyrosinemia type I. - <i>J Biol Chem</i> 281: 5329-5334.	Research	All	13
5 Mar 2006	Hunzinger C, Wozny W, Schwall GP, Poznanović S, Stegmann W, Zengerling H, Schoepf R, Groebe K, Cahill MA, Osiewacz HD, Jägemann N, Bloch M, Dencher NA, Krause F, Schratzenholz A: Comparative profiling of the mammalian mitochondrial proteome: multiple aconitase-2 isoforms including N-formylkynurenine modifications as part of a protein biomarker signature for reactive oxidative species. - <i>J Proteome Res</i> 5:625-633.	Research	All	1, 5, 12

Date	Research publications	Audience	Country	No.
15 Mar 2006	Santer F, Bacher N, Moser B, Morandell D, Ressler S, Firth SM, Spoden GA, Sergi C, Baxter RC, Jansen-Dürr P, Zwerschke W: Nuclear insulin-like growth factor binding protein-3 induces apoptosis and is targeted to ubiquitin/proteasome-dependent proteolysis. - <i>Cancer Res</i> 66: 3024-3033.	Research	All	7
30 Mar 2006	Lorin S, Dufour E, Sainsard-Chanet A: Mitochondrial metabolism and aging in the filamentous fungus <i>Podospira anserina</i> - <i>Biochim Biophys Acta</i> 1757: 604-610.	Research	All	9
4 Apr 2006	Neal S, Karunanithi S, Best A, Ken-Choy So A, Tanguay RM, Atwood HL, Westwood JT: Thermoprotection of synaptic transmission in a <i>Drosophila</i> heat shock factor mutant is accompanied by increased expression of Hsp83 and Hsp40. - <i>Physiol Genomics</i> 25: 493-501.	Research	All	13
Apr 2006	Morrow G, Heikkila JJ, Tanguay RM: Differences in the chaperone-like activities of the four main small heat shock proteins of <i>Drosophila melanogaster</i> . - <i>Cell Stress Chaperones</i> 11: 51-60.	Research	All	13
16 May 2006	Hernebring M, Brolen G, Aguilaniu H, Semb H, Nyström T: Elimination of damaged proteins during differentiation of embryonic stem cells. - <i>Proc Natl Acad Sci USA</i> 103: 7700-7705.	Research	All	8
27 May 2006	Braeckman BP, Demetrius L, Vanfleteren JR: The dietary restriction effect in <i>C. elegans</i> and humans: is the worm a one-millimeter human? - <i>Biogerontology</i> 7: 127-133.	Research	All	11
May 2006	Dencher NA, Goto S, Reifschneider NH, Sugawa M, Krause F: Unraveling age-dependent variation of the mitochondrial proteome. - <i>Ann NY Acad Sci</i> 1067: 116-119.	Research	All	5
May 2006	Gredilla R, Grief J, Osiewacz: Mitochondrial free radical generation and lifespan control in the fungal aging model <i>Podospira anserina</i> . - <i>Exp Gerontol</i> 41: 439-447.	Research	All	1,10
May 2006	Hampel B, Fortschegger K, Ressler S, Chang MWF, Unterluggauer H, Breitwieser A, Fitzky B, Sommergruber W, Jansen-Duerr P, Lepperdinger G, Voglauer R, Grillari J: Increased expression of extracellular proteins as a hallmark of human endothelial cell in vitro senescence. - <i>Exp Gerontol</i> 41: 474-481.	Research	All	7
May 2006	Krause F, Scheckhuber, CQ, Werner A, Rexroth S, Reifschneider NH, Dencher NA and Osiewacz HD: OXPHOS supercomplexes: Respiration and lifespan control in the aging model <i>Podospira anserina</i> . - <i>Ann NY Acad Sci</i> 1067: 106-115.	Research	All	1,5
May 2006	Reifschneider NH, Goto S, Nakamoto H, Takahashi R, Sugawa M, Dencher NA, Krause F: Defining the mitochondrial proteomes from five rat organs in a physiologically significant context using 2D blue-native/SDS-PAGE. - <i>J Proteome Res</i> 5: 1117-32.	Research	All	5
May 2006	Rinnerthaler M, Jarolim S, Heeren G, Palle E, Perju S, Klinger H, Bogengruber E, Madeo F, Braun RJ, Breitenbach-Koller L, Breitenbach M, Laun P: MMI1 (YKL056c, TMA19), the yeast orthologue of the translationally controlled tumor protein (TCTP) has apoptotic functions and interacts with both microtubules and mitochondria. - <i>Biochim Biophys Acta</i> 1757: 631-638.	Research	All	4
2 Jun 2006	Schäfer E, Seelert H, Reifschneider NH, Krause F, Dencher NA, Vonck J: Architecture of active mammalian respiratory chain supercomplexes. - <i>J Biol Chem</i> 281: 15370-15375.	Research	All	5
12 Jun 2006	Rasmussen LJ, Stevnsner T, Bohr VA: DNA-reparation - en grundlæggende faktor i aldring og cancerudvikling. - Ugeskr Laeger 12: 2332-2335.	Research	DK	10

Date	Research publications	Audience	Country	No.
28 Jun 2006	Scheckhuber C, Osiewacz HD: The Role of Mitochondria in Conserved Mechanisms of Aging. - <i>Sci Aging Knowl Environ</i> , Vol. 2006, Issue 10: p. 15.	Research	All	1
30 Jun 2006	Krause F: Detection and analysis of protein-protein interactions in organellar and prokaryotic proteomes by native gel electrophoresis: (Membrane) protein complexes and supercomplexes. - <i>Electrophoresis</i> 27, 2759-2781.	Research	All	5
Jun 2006	Fiedler M, Ressler S, Campo-Fernandez B, Laich A, Jansen L, Widschwendter A, Viertler HP, Bacher N, Morandell D, Muller-Holzner E, Durst M, Jansen-Dürr P, Zwerschke W: Expression of the high-risk human papillomavirus type 18 and 45 E7 oncoproteins in cervical carcinoma biopsies. - <i>J Gen Virol</i> 86: 3235-3241.	Research	All	7
21 Jul 2006	Burhans DT, Ramachandran L, Wang J, Liang P, Patterton HG, Breitenbach M, Burhans WC: Non-random clustering of stress-related genes during evolution of the <i>S. cerevisiae</i> genome. - <i>BMC Evol Biol</i> 6, 58.	Research	All	4
Jul 2006	Niu P, Liu L, Gong Z, Tan H, Wang F, Yuan J, Feng Y, Wei Q, Tanguay RM, Wu T: Overexpressed heat shock protein 70 protects cells against DNA damage caused by ultraviolet C in a dose-dependent manner. - <i>Cell Stress Chaperones</i> 11: 162-169.	Research	All	13
Jul 2006	Stöckl P, Hütter E, Zwerschke W, Jansen-Dürr P. Sustained inhibition of oxidative phosphorylation impairs cell proliferation and induces premature senescence in human fibroblasts. - <i>Exp Gerontol</i> 41:674-682.	Research	All	7
15 Aug 2006	Ressler S, Bartkova J, Bartek J, Scharffetter-Kochanek K, Jansen-Dürr P, Wlaschek M: p16INK4A qualifies as a robust in vivo biomarker of cellular aging in human skin. - <i>Aging Cell</i> 5: 379-389.	Research	All	7
Aug 2006	Dante S, Hauß T, Dencher NA: Cholesterol inhibits the insertion of the Alzheimer's peptide Aβ(25-35) in lipid bilayers. - <i>Eur Biophys</i> 35: 523-531.	Research	All	5
Aug 2006	Ramachandran L, Burhans DT, Laun P, Wang J, Liang P, Weinberger M, Wissing S, Jarolim S, Suter B, Madeo F, Breitenbach M, Burhans WC: Evidence for ORC-dependent repression of budding yeast genes induced by starvation and other stresses. - <i>FEMS Yeast Res</i> 6: 763-776.	Research	All	4
10 Oct 2006	Laquel-Robert P, Sellem CH, Sainsard-Chanet A, Castroviejo M: Identification and biochemical analysis of a mitochondrial endonuclease of <i>Podospora anserina</i> related to curved-DNA binding proteins. <i>Biochim Biophys Acta</i> 1770: 527-542.	Research	All	9
Oct 2006	Houthoofd K, Vanfleteren JR: The longevity effect of dietary restriction in <i>Caenorhabditis elegans</i> . <i>Exp Gerontol</i> 41: 1026-1031.	Research	All	11
23 Nov 2006	Laun P, Rinnerthaler M, Bogengruber E, Heeren G, Breitenbach M: Yeast as a model for chronological and reproductive aging - A comparison. <i>Exp Gerontol</i> 41: 1208-1212.	Research	All	4
Nov 2006	Busch KB, Bereiter-Hahn J, Wittig I, Schagger H, Jendrach M: Mitochondrial dynamics generate equal distribution but patchwork localization of respiratory Complex I. <i>Mol Membr Biol</i> 23:509-520.	Research	All	3
Nov 2006	Gan D, Hedayati M, Stevnsner T, Bohr V: Human premature aging diseases: molecular biology to clinical diagnosis. In: Rattan S, Kassem M (eds.): <i>Prevention and Treatment of Age-related Diseases</i> . - Springer Publ, Dordrecht, The Netherlands.	Research	All	10

Date	Research publications	Audience	Country	No.
20 Dec 2006	Ralser M, Heeren G, Breitenbach M, Lehrach H, Krobitsch S: Triose Phosphate Isomerase Deficiency Is Caused by Altered Dimerization-Not Catalytic Inactivity-of the Mutant Enzymes. - <i>PLoS ONE</i> 1: e30.	Research	All	4
Dec 2006	Breitenbach M, Wolbert W, Weiss AM: The ongoing debate in EMBO reports concerning the SENS program. <i>Rejuvenation Res</i> 9, 494-495.	Research	All	4
Dec 2006	Fredriksson A, Nyström T: Conditional and replicative senescence in <i>Escherichia coli</i> . - <i>Curr Opin Microbiol</i> 9: 612-618.	Research	All	8
Dec 2006	Morrow G, Tanguay RM: Small heat shock proteins, ageing and age-related diseases. – In: <i>Stress Response: a molecular biology approach</i> , Sreedhar AS, Srinivas UK (eds.), Research Signpost, Kerala, India, pp. 61-80.	Research	All	13
Dec 2006	Osiewacz HD, Scheckhuber CQ: Impact of ROS on ageing of two fungal model systems: <i>Saccharomyces cerevisiae</i> and <i>Podospora anserina</i> . – <i>Free Radic Res</i> 40: 1350-1358.	Research	All	1
Jan 2007	Braeckman BP, Vanfleteren JR: Genetic control of longevity in <i>C. elegans</i> . – <i>Exp Gerontol</i> 42: 90-98.	Research	All	11
Jan 2007	Campo-Fernández B, Morandell D, Santer FR, Zwerschke W, Jansen-Dürr P: Identification of the FHL2 transcriptional coactivator as a new functional target of the E7 oncoprotein of human papillomavirus type 16. – <i>J Virol</i> 81: 1027-1032.	Research	All	7
Jan 2007	Houthoofd K, Gems D, Johnson TE, Vanfleteren JR,: Dietary restriction in the nematode <i>Caenorhabditis elegans</i> . – <i>Interdiscip Top Gerontol</i> 35: 98-114.	Research	All	11
Jan 2007	Orejuela D, Bergeron A, Morrow G, Tanguay RM: Small heat shock proteins in physiological and stress-related processes. - <i>Cell Stress Proteins, Series "Protein Reviews" Calderwood S (ed.), Springer, New York, pp. 137-171.</i>	Research	All	13
Jan 2007	Scheckhuber CQ, Erjavec N, Tinazli A, Hamann A, Nyström T, Osiewacz HD: Reducing mitochondrial fission results in increased life span and fitness of two fungal ageing models. – <i>Nat Cell Biol</i> 9: 99-105.	Research	All	1,8
20 Feb 2007	Brys K, Vanfleteren JR, Braeckman BP: Testing the rate-of-living/oxidative damage theory of aging in the nematode model <i>Caenorhabditis elegans</i> – <i>Exp Gerontol</i> 42: 845-851.	Research	All	11
Feb 2007	Maas MF, Hoekstra RF, Debets AJ: Hybrid mitochondrial plasmids from senescence suppressor isolates of <i>Neurospora intermedia</i> . – <i>Genetics</i> 175: 785-94.	Research	All	6
5 Mar 2007	Hütter E, Skovbro M, Lener B, Prats C, Rabol R, Dela F, Jansen-Dürr P: Oxidative stress and mitochondrial impairment can be separated from lipofuscin accumulation in aged human skeletal muscle. - <i>Aging Cell</i> 6: 245-256.	Research	All	7
16 Mar 2007	Houthoofd K, Vanfleteren JR: Public and private mechanisms of life extension in <i>Caenorhabditis elegans</i> . – <i>Mol Genet Genomics</i> 277: 601-617.	Research	All	11
22 Mar 2007	Unterluggauer H, Hütter E, Voglauer R, Grillari J, Vöth M, Bereiter-Hahn J, Jansen-Dürr P, Jendrach M: Identification of cultivation-independent markers of human endothelial cell senescence in vitro. <i>Biogerontology</i> 8: 383-97.	Research	All	3,7
1 Apr 2007	Fredriksson Å, Ballesteros M, Peterson CN, Persson O, Silhavy TJ, Nyström T: Decline in ribosomal fidelity contributes to the accumulation and stabilization of the master stress response regulator sigmaS upon carbon starvation. – <i>Genes Dev</i> 21: 862-874.	Research	All	8

Date	Research publications	Audience	Country	No.
2 Apr 2007	Maas MF, Hoekstra RF, Debets AJ: A mitochondrial mutator plasmid that causes senescence under dietary restricted conditions. - <i>BMC Genet</i> 8: 9.	Research	All	6
3 Apr 2007	Schwaßmann H, Rexroth S, Seelert H, Dencher NA: Metabolism controls dimerization of the chloroplast F ₀ F ₁ ATP synthase in <i>Chlamydomonas reinhardtii</i> . - <i>FEBS Lett</i> 581: 1391-1396.	Research	All	5
Apr 2007	Chiocchetti A, Zhou J, Zhu H, Karl T, Haubenreisser O, Rinnerthaler M, Heeren G, Oender K, Bauer J, Hintner H, Breitenbach M, Breitenbach-Koller L: Ribosomal proteins Rpl10 and Rps6 are potent regulators of yeast replicative life span. - <i>Exp Gerontol</i> 42: 275-286.	Research	All	4
Apr 2007	Dencher NA, Frenzel M, Reifschneider NH, Sugawa M, Krause K: Proteome alterations in rat mitochondria caused by aging. - <i>Ann NY Acad Sci</i> 1100:291-298.	Research	All	5
Apr 2007	Lenaerts I, Eygen SV, Vanfleteren JV: Adult-Limited Dietary Restriction Slows Gompertzian Aging in <i>Caenorhabditis elegans</i> . - <i>Ann NY Acad Sci</i> 1100: 442-448.	Research	All	11
9 Jun 2007	Ramadass R, Bereiter-Hahn J: Photophysical Properties of DASPMI as Revealed by Spectrally Resolved Fluorescence Decays. - <i>J Phys Chem B</i> 111: 7681-7690.	Research	All	3
17 Jun 2007	Desler C, Munch-Petersen B, Stevnsner T, Matsui SI, Kulawiec M, Singh KK, Rasmussen LJ: Mitochondria as determinant of nucleotide pools and chromosomal stability. - <i>Mutat Res</i> 625: 112-124.	Research	All	10
26 Jun 2007	Erjavec N, Nyström T: Sir2p-dependent protein segregation gives rise to a superior reactive oxygen species management in the progeny of <i>Saccharomyces cerevisiae</i> . - <i>Proc Natl Acad Sci USA</i> 104: 10877-10881.	Research	All	8
Jun 2007	Houthoofd K, Vanfleteren JR: Public and private mechanisms of life extension in <i>Caenorhabditis elegans</i> . - <i>Mol Genet Genomics</i> 277: 601-617.	Research	All	11
Jun 2007	Schrattenholz A, Groebe K: What does it need to be a biomarker? Relationships between resolution, differential quantification and statistical validation of protein surrogate biomarkers. - <i>Electrophoresis</i> 28: 1970-1979.	Research	All	12
11 Jul 2007	Hamann A, Brust D, Osiewacz HD: Deletion of putative apoptosis factors leads to lifespan extension in the fungal ageing model <i>Podospora anserina</i> . - <i>Mol Microbiol</i> 65: 948-958.	Research	All	1
11 Jul 2007	Imam SZ, Indig FE, Cheng WH, Saxena SP, Stevnsner T, Kufe D, Bohr VA: Cockayne syndrome protein B interacts with and is phosphorylated by c-Abl tyrosine kinase.- <i>Nucleic Acids Res</i> 35: 4941-4951.	Research	All	10
14 Jul 2007	Weissman L, de Souza-Pinto NC, Stevnsner T, Bohr VA: DNA repair, mitochondria, and neurodegeneration. - <i>Neuroscience</i> 145: 1318-1329.	Research	All	10
17 Jul 2007	Groebe K, Krause F, Kunstmann B, Unterluggauer H, Reifschneider NH, Scheckhuber CQ, Sastri C, Stegmann W, Wozny W, Schwall GP, Poznanović S, Dencher NA, Jansen-Dürr P, Osiewacz HD, Schrattenholz A: Differential proteomic profiling of mitochondria from <i>Podospora anserina</i> , rat and human reveals distinct patterns of age-related oxidative changes. - <i>Exp Gerontol</i> 42: 887-898.	Research	All	1, 5, 7, 12
Jul 2007	Maas MF, Sellem CH, Hoekstra RF, Debets AJ, Sainsard-Chanet A: Integration of a pAL2-1 homologous mitochondrial plasmid associated with lifespan extension in <i>Podospora anserina</i> . - <i>Fungal Genet Biol</i> 44: 659-671.	Research	All	6, 9

Date	Research publications	Audience	Country	No.
Jul 2007	Sellem CH, Marsy S, Boivin A, Lemaire C, Sainsard-Chanet A: A mutation in the gene encoding cytochrome c(1) leads to a decreased ROS content and to a long-lived phenotype in the filamentous fungus <i>Podospora anserina</i> . - <i>Fungal Genet Biol</i> 44: 648-658.	Research	All	9
17 Aug 2007	Cahill MA, Vogt JA, Servos J, Wozny W, Schwall GP, Groebe K, Schratzenholz A, Stegmann W: Metabolically stable isotope labeling prior to electrophoretic protein separation reveals differences in fractional synthesis rates between mitochondrial aldehyde dehydrogenase isoforms. - <i>J Chromatogr A</i> 1161: 67-70.	Research	All	12
17 Aug 2007	Weissman L, Jo DG, Sørensen MM, de Souza-Pinto NC, Markesbery WR, Mattson MP, Bohr VA: Defective DNA base excision repair in brain from individuals with Alzheimer's disease and amnesic mild cognitive impairment. - <i>Nucleic Acids Res</i> 35: 5545-5555.	Research	All	10
7 Sept 2007	Santer FR, Moser B, Spoden GA, Jansen-Dürr P, Zwerschke W: Human papillomavirus type 16 E7 oncoprotein inhibits apoptosis mediated by nuclear insulin-like growth factor binding protein-3 by inducing its ubiquitin/proteasome-dependent degradation. - <i>Carcinogenesis</i> 28: 2511-2520.	Research	All	7
14 Sept 2007	Marques I, Dencher NA, Videira A, Krause F: Supramolecular organization of the respiratory chain in <i>Neurospora crassa</i> mitochondria. - <i>Eukaryot Cell</i> 6: 2391-2405.	Research	All	5
15 Sep 2007	Stöckl P, Zankl C, Hütter E, Unterluggauer H, Laun P, Heeren G, Bogengruber E, Herndler-Brandstetter D, Breitenbach M, Jansen-Dürr P: Partial uncoupling of oxidative phosphorylation induces premature senescence in human fibroblasts and yeast mother cells. - <i>Free Radic Biol Med</i> 43: 947-958.	Research	All	4, 7
1 Oct 2007	Erjavec N, Larsson L, Grantham J, Nyström T: Accelerated aging and failure to segregate damaged proteins in Sir2 mutants can be suppressed by overproducing the protein aggregation-remodeling factor Hsp104p. - <i>Genes Dev</i> 21: 2410-2421.	Research	All	8
10 Oct 2007	Schäfer E, Dencher NA, Vonck J, Parcej DN: Three-Dimensional Structure of the Respiratory Chain Supercomplex I ₁ III ₂ IV ₁ from Bovine Heart Mitochondria. - <i>Biochemistry</i> 46: 12579-12585.	Research	All	5
6 Nov 2007	Laun P, Bruschi CV, Dickinson JR, Rinnerthaler M, Heeren G, Schwimbersky R, Rid R, Breitenbach M: Yeast mother cell-specific ageing, genetic (in)stability, and the somatic mutation theory of ageing - <i>Nucleic Acids Res</i> : 35:7514-7526.	Research	All	4
14 Dec 2007	Nyström T: A Bacterial Kind of Aging. - <i>PLoS Genet</i> 3: e224.	Research	All	8
21 Dec 2007	Ralser M, Wamelink MM, Kowald A, Gerisch B, Heeren G, Struys EA, Klipp E, Jakobs C, Breitenbach M, Lehrach H, Krobitsch S: Dynamic rerouting of the carbohydrate flux is key to counteracting oxidative stress. - <i>J Biol</i> 6: 10.	Research	All	4
22 Jan 2008	Hoogewijs D, Houthoofd K, Mathijssens F, Vandesompele J, Vanfleteren JR: Selection and validation of a set of reliable reference genes for quantitative <i>sod</i> gene expression analysis in <i>C. elegans</i> - <i>BMC Mol Biol</i> 9: 9.	Research	All	11
Jan 2008	Rid R, Simon-Nobbe B, Langdon J, Holler C, Wally V, Pöll V, Ebner C, Hemmer W, Hawranek T, Lang R, Richter K, MacDonald S, Rinnerthaler M, Laun P, Mari A, Breitenbach M: <i>Cladosporium herbarum</i> translationally controlled tumor protein (TCTP) is an IgE-binding antigen and is associated with disease severity. - <i>Mol Immunol</i> 45: 406-18.	Research	All	4

Date	Research publications	Audience	Country	No.
12 Feb 2008	El-Khoury R, Sellem CH, Coppin E, Boivin A, Maas MF, Debuchy R, Sainsard-Chanet A, 2008: Gene deletion and allelic replacement in the filamentous fungus <i>Podospora anserina</i> . - <i>Curr Genet</i> 53: 249-258.	Research	All	9
15 Feb 2008	Dante S, Hauß T, Brandt A, Dencher NA: Membrane fusogenic activity of the Alzheimer's peptide AB(1-42) demonstrated by small-angle neutron scattering. - <i>J Mol Biol</i> 376: 393-404.	Research	All	5
20 Feb 2008	Michaud S, Lavoie S, Guimond MO, Tanguay RM: The nuclear localization of <i>Drosophila</i> Hsp27 is dependent on a monopartite arginine-rich NLS and is uncoupled from its association to nuclear speckles. - <i>Biochim Biophys Acta</i> 1783 :1200-1210.	Research	All	13
Feb 2008	Krause F, Seelert, H: Detection and analysis of protein-protein interactions in organellar and prokaryotic proteomes by blue-native and colorless-native gel electrophoresis. - <i>Curr Protoc Protein Sci Chapt 14: Unit 14.11</i> .	Research	All	5
4 Mar 2008	Laun P, Heeren G, Rinnerthaler M, Rid R, Kössler S, Koller L, Breitenbach M: Senescence and apoptosis in yeast mother cell-specific aging and in higher cells: A short review. - <i>Biochim Biophys Acta</i> 1783: 1328-1334.	Research	All	4
4 Mar 2008	Unterluggauer H, Mazurek S, Lener B, Hütter E, Eigenbrodt E, Zwerschke W, Jansen-Dürr P: Premature senescence of human endothelial cells induced by inhibition of glutaminase. - <i>Biogerontol</i> 9: 247-259.	Research	All	7
26 Mar 2008	Castelein N, Hoogewijs D, De Vreese A, Braeckman BP, Vanfleteren JR: Dietary restriction by growth in axenic medium induces discrete changes in the transcriptional output of genes involved in energy metabolism in <i>Caenorhabditis elegans</i> . - <i>Biotechnol J</i> 3: 803-812.	Research	All	11
26 Mar 2008	Unterluggauer H, Hütter E, Viertler HP, Jansen-Dürr P: Insulin-like growth factor-induced signals activate mitochondrial respiration. - <i>Biotechnol J</i> 3: 813-816.	Research	All	7
Mar 2008	Hlavatá L, Nachin L, Ježek P, Nyström T: Elevated Ras/PKA activity in <i>Saccharomyces cerevisiae</i> reduces proliferation rate and lifespan by two different ROS-dependent routes. - <i>Aging Cell</i> 7: 148-157.	Research	All	8
Mar 2008	Lenaerts I, Walker GA, Van Hoorebeke L, Gems D, Vanfleteren JR: Dietary restriction of <i>Caenorhabditis elegans</i> by axenic culture reflects nutritional requirement for constituents provided by metabolically active microbes. - <i>J Gerontol A Biol Sci Med Sci</i> 63:242-252.	Research	All	11
Apr 2008	Muck C, Micutkova L, Zwerschke W, Jansen-Dürr P: Role of insulin-like growth factor binding protein-3 in human umbilical vein endothelial cell senescence. - <i>Rejuvenation Res</i> 11: 449-453.	Research	All	7
Apr 2008	Soškić V, Groebe K, Schrattenholz A: Nonenzymatic posttranslational protein modifications in ageing. - <i>Exp Gerontol</i> 43: 247-257.	Research	All	12
20 Apr 2008	van Diepeningen AD, Debets AJ, Slakhorst SM, Hoekstra RF: Mitochondrial pAL2-1 plasmid homologs are senescence factors in <i>Podospora anserina</i> independent of intrinsic senescence. - <i>Biotechnol J</i> 3: 791-802.	Research	All	6
21 Apr 2008	Scheckhuber CQ, Rödel E, Wüstehube J: Regulation of mitochondrial dynamics - characterization of fusion and fission genes in the ascomycete <i>Podospora anserina</i> . - <i>Biotechnol J</i> 3: 781-790.	Research	All	1
25 Apr 2008	Hamann A, Brust D, Osiewacz HD: Apoptosis pathways in fungal growth, development and ageing. - <i>Trends Microbiol</i> 16: 276-283.	Research	All	1

Date	Research publications	Audience	Country	No.
30 Apr 2008	Stevnsner T, Muftuoglu M, Aamann MD, Bohr VA: The role of Cockayne Syndrome group B (CSB) protein in base excision repair and aging. - <i>Mech Ageing Dev</i> 129: 441-448.	Research	All	10
30 Apr 2008	Dani D, Dencher NA: Native-DIGE: A new look at the mitochondrial membrane proteome. - <i>Biotechnol J</i> 3: 817-822.	Research	All	5
30 Apr 2008	Morrow G, Tanguay RM: Mitochondria and ageing in <i>Drosophila</i> . - <i>Biotechnol J</i> 3: 728-739.	Research	All	13
1 May 2008	Lepperdinger G, Berger P, Breitenbach M, Fröhlich KU, Grillari J, Grubeck-Loebenstien B, Madeo F, Minois N, Zwerschke W, Jansen-Dürr P: The use of genetically engineered model systems for research on human aging. - <i>Front Biosci</i> 13: 7022-7031.	Research	All	4, 7
6 May 2008	Espagne E, Lespinet O, Malagnac F, Da Silva C, Jaillon O, Porcel BM, Couloux A, Aury JM, Ségurens B, Poulain J, Anthouard V, Grossetete S, Khalili H, Coppin E, Déquard-Chablat M, Picard M, Contamine V, Arnaise S, Bourdais A, Berteaux-Lecellier V, Gautheret D, de Vries RP, Battaglia E, Coutinho PM, Danchin EG, Henrissat B, Houry RE, Sainsard-Chanet A, Boivin A, Pinan-Lucarré B, Sellem CH, Debuchy R, Wincker P, Weissenbach J, Silar P: The genome sequence of the model ascomycete fungus <i>Podospora anserina</i> . - <i>Genome Biol</i> 9: R77.	Research	All	9
9 May 2008	Soškić V, Klemm M, Proikas-Cezanne T, Schwall GP, Poznanović S, Stegmann W, Groebe K, Zengerling H, Schoepf R, Burnet M, Schratzenholz A: A connection between the mitochondrial permeability transition pore, autophagy, and cerebral amyloidogenesis. - <i>J Proteome Res</i> 7: 2262-2269.	Research	All	12
14 May 2008	de Souza-Pinto NC, Wilson DM 3rd, Stevnsner TV, Bohr VA: Mitochondrial DNA, base excision repair and neurodegeneration. - <i>DNA Repair (Amst)</i> 7: 1098-1109.	Research	All	10
21 May 2008	Seelert H, Krause F: Preparative isolation of protein complexes and other bioparticles by elution from polyacrylamide gels. - <i>Electrophoresis</i> 29: 2617-2630.	Research	All	5
May 2008	Tanguay RM, Morrow G: Neural expression of small heat shock proteins influences longevity and resistance to oxidative stress. - In: <i>Asea AA, Brown IR (eds.): Heat Shock Proteins in the Brain: Implications for Neurodegenerative Diseases and Neuroprotection. Springer; New York, Stuttgart.</i>	Research	All	13
2 Jun 2008	Bereiter-Hahn J, Vöth M, Mai S, Jendrach M: Structural implications of mitochondrial dynamics. - <i>Biotechnol J</i> 3: 765-780.	Research	All	3
3 Jun 2008	Oender K, Trost A, Lanschuetzer C, Laimer M, Emberger M, Breitenbach M, Richter K, Hintner H, Bauer JW: Cytokeratin-related loss of cellular integrity is not a major driving force of human intrinsic skin aging. - <i>Mech Ageing Dev</i> 129: 563-571.	Research	All	4
4 Jun 2008	Matthijssens F, Back P, Braeckman BP, Vanfleteren JR: Prooxidant activity of the superoxide dismutase (SOD)-mimetic EUK-8 in proliferating and growth-arrested <i>Escherichia coli</i> cells. - <i>Free Radic Biol Med</i> 45: 708-715.	Research	All	11
14 Jun 2008	Jendrach M, Mai S, Pohl S, Vöth M, Bereiter-Hahn J: Short- and long-term alterations of mitochondrial morphology, dynamics and mtDNA after transient oxidative stress. - <i>Mitochondrion</i> : 8: 293-304.	Research	All	3
Jun 2008	Schratzenholz A, Šoškić V: What does systems biology mean for drug development? - <i>Curr Med Chem</i> 15: 1520-1528.	Research	All	12

Date	Research publications	Audience	Country	No.
18 Jul 2008	Ramadass R, Bereiter-Hahn J: How DASPMI reveals mitochondrial membrane potential: fluorescence decay kinetics and steady-state anisotropy in living cells. - <i>Biophys J</i> : 95: 4068-4076.	Research	All	3
24 Jul 2008	Kunstmann B, Osiewacz HD: Over-expression of a SAM dependent methyltransferase leads to an extended life span of <i>Podospora anserina</i> without impairments in vital functions. - <i>Aging Cell</i> : 7: 651-662.	Research	All	1
25 Jul 2008	Bukowy Z, Harrigan JA, Ramsden DA, Tudek B, Bohr VA, Stevnsner T: WRN Exonuclease activity is blocked by specific oxidatively induced base lesions positioned in either DNA strand. - <i>Nucleic Acids Res</i> 36: 4975-4987.	Research	All	10
11 Aug 2008	Gredilla R, Garm C, Holm R, Bohr VA, Stevnsner T: Differential age-related changes in mitochondrial DNA repair activities in mouse brain regions. - <i>Neurobiol Aging</i> DOI:10.1016/j.neurobiolaging.2008.07.004.	Research	All	10
23 Aug 2008	Sander M, Avlund K, Lauritzen M, Gottlieb T, Stevnsner T, Wewer U, Bohr VA: Aging-From molecules to populations. - <i>Mech Ageing Dev</i> : 129: 614-623.	Research	All	10
17 Sep 2008	Scheckhuber CQ, Osiewacz HD: <i>Podospora anserina</i> - A model organism to study mechanisms of healthy ageing. <i>Mol Gen Genom</i> 280: 365-374.	Research	All	1
27 Sep 2008	Boivin A, Gaumer S, Sainsard-Chanet A: Life span extension by dietary restriction is reduced but not abolished by loss of both SIR2 and HST2 in <i>Podospora anserina</i> . - <i>Mech Ageing Dev</i> : 129: 714-721.	Research	All	9
14 Nov 2008	Unterluggauer H, Micutkova L, Lindner H, Sarg B, Hernebring M, Nyström T, Jansen-Dürr P: Identification of Hsc70 as target for AGE modification in senescent human fibroblasts. - <i>Biogerontology</i> 10: 299-309.	Research	All	7, 8
19 Nov 2008	Erjavec N, Cvijovic M, Klipp E, Nyström T: Selective benefits of damage partitioning in unicellular systems and its effects on aging. - <i>Proc Natl Acad Sci USA</i> 105: 18764-18769.	Research	All	8
1 Dec 2008	Doonan R, McElwee JJ, Matthijssens F, Walker G, Houthoofd K, Back P, Vanfleteren JR, Gems D: Against the oxidative damage theory of aging: superoxide dismutases protect against oxidative stress but have little or no effect on lifespan in <i>C. elegans</i> - <i>Genes & Dev</i> 22: 3236-3241.	Research	All	11
24 Dec 2008	Maas MF, Krause F, Dencher NA, Sainsard-Chanet A: Respiratory complexes III and IV are not essential for the assembly/stability of complex I in fungi. - <i>J Mol Biol</i> 387: 259-269.	Research	All	5, 9
2008	Osiewacz HD, Scheckhuber CQ: Reactive oxygen species in molecular pathways controlling aging in the filamentous fungus <i>Podospora anserina</i> . In: Miwa S, Beckman KB, Muller FL (eds) <i>Oxidative stress in aging. From model systems to human diseases</i> . Humana Press, Totowa: 53-65.	Research	All	1
7 Jan 2009	Schon EA, Dencher NA: Heavy breathing: energy conversion by mitochondrial respiratory chain supercomplexes. <i>Cell Metabolism</i> 9: 1-3.	Research	All	5
29 Jan 2009	Muftuoglu M, de Souza-Pinto NC, Dogan A, Aamann M, Stevnsner T, Rybanska I, Kirkali G, Dizdaroglu M, Bohr VA: Cockayne syndrome group B protein stimulates repair of formamidopyrimidines by NEIL1 DNA glycosylase. <i>J Biol Chem</i> 284: 9270-9279.	Research	All	10
5 Feb 2009	Soerensen M, Christensen K, Stevnsner T, Christiansen L: The Mn-superoxide dismutase single nucleotide polymorphism rs4880 and the glutathione peroxidase 1 single nucleotide polymorphism rs1050450 are associated with aging and longevity in the oldest old. <i>Mech Ageing Dev</i> 130: 308-314.	Research	All	10

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26 Feb 2009	Sukhorukov VM, Bereiter-Hahn J: Anomalous diffusion induced by cristae geometry in the inner mitochondrial membrane. <i>PLoS One</i> 4:e4604.	Research	All	3
Feb 2009	Hamann A, Osiewacz HD: Apoptose – Programmierter Zelltod auch im Reich der Pilze. <i>BIOSpektrum</i> 15: 20-22.	Research	Germany	1
Feb 2009	Braeckman BP, Houthoofd K, Vanfleteren JR: Intermediary metabolism. <i>Wormbook</i> 16: 1-24.	Research	All	11
2 Mar 2009	Sellem CH, Bovier E, Lorin S, Sainsard-Chanet A: Mutations in two zinc cluster proteins activate alternative respiratory and gluconeogenic pathways and restore senescence in long-lived respiratory mutants of <i>Podospora anserina</i> . <i>Genetics</i> 182: 69-78.	Research	All	9
9 Mar 2009	De Souza-Pinto NC, Mason PA, Hashiguchi K, Weissman L, Tian J, Guay D, Lebel M, Stevnsner TV, Rasmussen LJ, Bohr VA: Novel DNA mismatch-repair activity involving YB-1 in human mitochondria. <i>DNA Repair (Amst)</i> 8: 704-719.	Research	All	10
10 Mar 2009	Seelert H, Dani DN, Dante S, Hauß T, Krause F, Schäfer E, Frenzel M, Poetsch A, Rexroth S, Schwaßmann HJ, Suhai T, Vonck J, Dencher NA: From protons to OXPHOS supercomplexes and Alzheimer's disease: structure-dynamics-function relationships of energy-transducing membranes. <i>Biochim Biophys Acta</i> 1787: 657-671.	Research	All	5
31 Mar 2009	Maddukuri L, Speina E, Christiansen M, Dudzinska D, Zaim J, Obtulowicz T, Kabaczyk S, Komisarski M, Bukowy Z, Szczegielniak J, Wojcik A, Kusmierk JT, Stevnsner T, Bohr VA, Tudek B: Cockayne syndrome group B protein is engaged in processing of DNA adducts of lipid peroxidation product trans-4-hydroxy-2-nonenal. <i>Mutat Res</i> 666: 23-31.	Research	All	10
Mar 2009	Kunstmann B, Osiewacz HD: The S-adenosylmethionine dependent O-methyltransferase PaMTH1: a longevity assurance factor protecting <i>Podospora anserina</i> against oxidative stress. <i>Aging</i> 1: 328-334.	Research	All	1
9 Apr 2009	Tondera D, Grandemange S, Jourdain A, Karbowski M, Mattenberger Y, Herzig S, Da Cruz S, Clerc P, Raschke I, Merkwirth C, Ehse S, Krause F, Youle R, Chan DC, Alexander C, Bauer C, Langer T, Martinou JC: SLP-2 is required for stress-induced mitochondrial hyperfusion. – <i>EMBO J</i> 28: 1589–1600.	Research	All	5
30 May 2009	Soerensen M, Gredilla R, Müller-Ohldach M, Werner A, Bohr VA, Osiewacz HD, Stevnsner T: A potential impact of DNA repair on ageing and lifespan in the ageing model organism <i>Podospora anserina</i> : Decrease in mitochondrial DNA repair activity during ageing. <i>Mech Ageing Dev</i> 130: 487-496.	Research	All	1, 10
13 Jul 2009	Heeren G, Rinnerthaler M, Laun P, von Seyerl P, Kössler S, Klinger H, Jarolim S, Simon-Nobbe B, Hager M, Schüller C, Carmona-Gutierrez D, Breitenbach-Koller L, Mück C, Jansen-Dürr P, Criollo A, Kroemer G, Madeo F, Breitenbach M: The mitochondrial ribosomal protein of the large subunit, Afo1p, determines cellular longevity through mitochondrial back-signaling via TOR1. <i>Aging</i> 1: 622-636.	Research	All	4, 7
13 Aug 2009	Robitaille H, Simard-Bisson C, Larouche D, Tanguay RM, Blouin R, Germain L: The small heat-shock protein Hsp27 undergoes ERK-dependent phosphorylation and redistribution to the cytoskeleton in response to dual leucine zipper-bearing kinase expression. <i>J Invest Dermatol</i> 130: 74-85.	Research	All	13
14 Aug 2009	Lener B, Koziel R, Pircher H, Hütter E, Greussing R, Herndler-Brandstetter D, Hermann M, Unterluggauer H, Jansen-Dürr P: The NADPH oxidase Nox4 restricts the replicative lifespan of human endothelial cells. <i>Biochem J</i> : 423:363-374.	Research	All	7

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17 Aug 2009	El-Khoury R, Sainsard-Chanet A: Suppression of mitochondrial DNA instability of adPEO-associated ANT1 mutations in <i>Podospora anserina</i> . <i>Genetics</i> 183: 861-871.	Research	All	9
25 Sep 2009	Suhai T, Heidrich NG, Dencher NA, Seelert H: Highly sensitive detection of ATPase activity in native gels. <i>Electrophoresis</i> 30:3622-3625.	Research	All	5
4 Oct 2009	Eisenberg T, Knauer H, Schauer A, Büttner S, Ruckstuhl C, Carmona-Gutierrez D, Ring J, Schroeder S, Magnes C, Antonacci L, Fussi H, Deszcz L, Hartl R, Schraml E, Criollo A, Megalou E, Weiskopf D, Laun P, Heeren G, Breitenbach M, Grubeck-Loebenstien B, Herker E, Fahrenkrog B, Fröhlich K-U, Sinner F, Tavernarakis N, Minois N, Kroemer G, Madeo F: Induction of autophagy by spermidine promotes longevity. <i>Nat Cell Bio</i> : DOI:10.1038/ncb1975.	Research	All	4
6 Oct 2009	Rid R, Oender K, Trost A, Bauer JW, Hintner H, Ritter M, Jakab M, Costa I, Reischl W, Richter K, MacDonald S, Jendrach M, Bereiter-Hahn J, Breitenbach M: H ₂ O ₂ -dependent translocation of TCTP into the nucleus enables its interaction with VDR in human keratinocytes: TCTP as a further module in calcitriol signalling. <i>J Steroid Biochem Mol Biol</i> DOI:10.1016/j.jsbmb.2009.09.015.	Research	All	3, 4
6 Nov 2009	Dani D, Shimokawa I, Komatsu T, Higami Y, Warnken U, Schokraie E, Schnölzer M, Krause F, Sugawa M, Dencher NA: Modulation of oxidative phosphorylation machinery signifies a prime mode of anti-ageing mechanism of calorie restriction in male rat liver mitochondria. <i>Biogerontology</i> DOI:10.1007/s10522-009-9254-y.	Research	All	5
30 Nov 2009	Wadhwa R, Ryu J, Gao R, Choi IK, Morrow G, Kaur K, Kim I, Kaul SC, Yun CO, Tanguay RM: Pro-proliferative functions of Drosophila small mitochondrial heat shock protein 22 in human cells. <i>J Biol Chem</i> 285:3833-3839.	Research	All	13
Nov 2009	Scheckhuber CQ, Mitterbauer R, Osiewacz HD: Molecular basis of and interference into degenerative processes in fungi: potential relevance for improving biotechnological performance of microorganisms. <i>Appl Microbiol Biotechnol</i> 85: 27-35.	Research	All	1
3 Dec 2009	Strecker V, Mai S, Muster B, Beneke S, Bürkle A, Bereiter-Hahn J, Jendrach M: Aging of different avian culture cells: Lack of ROS-induced damage and quality control mechanisms. <i>Mech Ageing Dev</i> 131:48-59.	Research	All	3
18 Dec 2009	van Diepeningen AD, Maas MF, Huberts DH, Engelmoer DJ, Slakhorst SM, Koopmanschap AB, Krause F, Dencher NA, Sellem CH, Sainsard-Chanet A, Hoekstra RF, Debets AJ: Calorie restriction causes healthy life span extension in the filamentous fungus <i>Podospora anserina</i> . <i>Mech Ageing Dev</i> 131: 60-68.	Research	All	5, 6, 9
29 Dec 2009	Kim HJ, Morrow G, Westwood JT, Michaud S, Tanguay RM: Gene expression profiling implicates OXPHOS complexes in lifespan extension of flies over-expressing a small mitochondrial chaperone, Hsp22. <i>Exp Gerontol</i> DOI:10.1016/j.exger.2009.12.012.	Research	All	13
2009	Brust D, Hamann A, Osiewacz HD: Apoptosis in fungal development and ageing. In: Anke T, Weber D (eds) <i>The Mycota XV. Physiology and Genetics, 1st edition</i> , pp. 63-78.	Research	All	1
2009	Osiewacz HD, Scheckhuber CQ: The basis of biological aging: Theories, models and mechanisms. In: Alt KW, de Jong W, Röder B (eds) <i>Reflections on old age and ageing in past and present. Biological and cultural perspectives: in press</i> .	Research	All	1

Date	Research publications	Audience	Country	No.
2009	Wernicke C, Hellmann J, Zięba B, Kuter K, Ossowska K, Frenzel M, Dencher NA, Gille G, Rommelspacher H: 9-Methyl- β -carboline has restorative effects in an animal model of Parkinson's disease. <i>Pharmacol Rep: in press.</i>	Research	All	5
2009	Depuydt G, Vanfleteren JR & Braeckman BP: Protein metabolism and lifespan in <i>C. elegans</i> . In: "protein metabolism and homeostasis in ageing". N. Tavernarakis (Ed.), <i>Landis Bioscience: in press.</i>	Research	All	11
2009	Osiewacz HD, Brust D, Hamann A, Kunstmann B, Luce K, Müller-Ohldach M, Scheckhuber C, Servos J, Strobel I: Mitochondrial pathways governing stress resistance, life and death in the fungal aging model <i>Podospora anserina</i> . <i>Ann NY Acad Sci: in press.</i>	Research	All	1
11 Jan 2010	Van Diepeningen AD, Slakhorst SM, Koopmanschap AB, Ikink GJ, Debets AJ, Hoekstra RF: Calorie restriction in the filamentous fungus <i>Podospora anserina</i> . <i>Exp Gerontol DOI: 10.1016/j.exger.2010.01.002.</i>	Research	All	5
14 Jan 2010	Zintel S, Schwitalla D, Luce K, Hamann A, Osiewacz HD: Increasing mitochondrial superoxide dismutase abundance leads to impairments in protein quality control and ROS scavenging systems and to lifespan shortening. <i>Exp Gerontol DOI:10.1016/j.exger.2010.01.006.</i>	Research	All	1
18 Jan 2010	Hackl M, Brunner S, Fortschegger K, Schreiner C, Micutkova L, Mück C, Laschober GT, Lepperdinger G, Sampson N, Berger P, Herndler-Brandstätter D, Wieser M, Kühnel H, Strasser A, Rinnerthaler M, Breitenbach M, Mildner M, Eckhart L, Tschachler E, Trost A, Bauer JW, Papak C, Trajanoski Z, Scheideler M, Grillari-Voglauer R, Grubeck-Loebenstein B, Jansen-Dürr P, Grillari J: miR-17, miR-19b, miR-20a and miR-106a are down-regulated in human aging. <i>Aging Cell DOI:10.1111/j.1474-9726.2010.00549.x.</i>	Research	All	4, 7
20 Jan 2010	Back P, Matthijssens F, Vlaeminck C, Braeckman BP, Vanfleteren JR Effects of <i>sod</i> gene overexpression and deletion mutation on the expression profiles of reporter genes of major detoxification pathways in <i>Caenorhabditis elegans</i> . <i>Exp Gerontol DOI:10.1016/j.exger.2010.01.014.</i>	Research	All	11
20 Jan 2010	Gredilla R, Bohr VA, Stevnsner T: Mitochondrial DNA repair and association with aging – an update. <i>Exp Gerontol DOI:10.1016/j.exger.2010.01.017.</i>	Research	All	10
22 Jan 2010	Liu B, Larsson L, Caballero A, Hao X, Öling D, Grantham J, Nyström T: The polarisome is required for segregation and retrograde transport of protein aggregates. <i>Cell 140: 257-267.</i>	Research	All	8
22 Jan 2010	El-Khoury R, Sainsard-Chanet A: Deletion of the mitochondrial NADH kinase increases mitochondrial DNA stability and life span in the filamentous fungus <i>Podospora anserina</i> . <i>Exp Gerontol DOI:10.1016/j.exger.2010.01.012.</i>	Research	All	9
12 Feb 2010	Ugidos A, Nyström T, Caballero A: Perspectives on the mitochondrial etiology of replicative aging in yeast. <i>Exp Gerontol DOI:10.1016/j.exger.2010.02.002.</i>	Research	All	8
14 Feb 2010	Frenzel M, Rommelspacher H, Sugawa MD, Dencher NA: Ageing alters the supramolecular architecture of OxPhos complexes in rat brain cortex. <i>Exp Gerontol DOI:10.1016/j.exger.2010.02.003.</i>	Research	All	5
24 Feb 2010	Aamann MD, Sorensen MM, Hvitby C, Berquist BR, Muftuoglu M, Tian J, de Souza-Pinto NC, Scheibye-Knudsen M, Wilson Iii DM, Stevnsner T, Bohr VA. <i>FASEB J DOI:10.1096/fj.09-147991.</i>	Research	All	10

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26 Feb 2010	Groebe K, Klemm-Manns M, Schwall GP, Hübenthal H, Unterluggauer H, Jansen-Dürr P, Tanguay R, Morrow G, Schratzenholz A: Age-dependent posttranslational modifications of voltage-dependent anion channel 1. <i>Exp Gerontol</i> DOI:10.1016/j.exger.2010.02.006.	Research	All	7, 12, 13
5 Mar 2010	Diener T, Neuhaus M, Koziel R, Micutkova L, Jansen-Duerr P: Role of endonuclease G in senescence-associated cell death of human endothelial cells. <i>Exp Gerontol</i> DOI:10.1016/j.exger.2010.03.002.	Research	All	7
9 Mar 2010	Van Diepeningen AD, Goedbloed DJ, Slakhorst SM, Koopmanschap AB, Maas MF, Hoekstra RF, Debets AJ: Mitochondrial recombination increases with age in <i>Podospora anserina</i> . <i>Mech Ageing Dev</i> DOI:10.1016/j.mad.2010.03.001.	Research	All	6