ICC2026

International Centenarian Consortium (ICC)
30th Annual Meeting

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Photo Album and Abstracts

"Centenarians as Pioneers of the Well-Aging Era"

June 9 (Tue) - 12 (Fri), 2026 | Wellpark Hotel, Gochang, Republic of Korea

Hosted by: Chonnam Nat'l Univ. Korean Centenarian Study Group

Sponsors: Academy for Health & Lifespan Research · 전남대학교병원 의생명연구원 CHONNAM NATIONAL UNIVERSITY HOSPITAL BIOMEDICAL RESEARCH INSTITUTE · 전남대학교 CHONNAM NATIONAL UNIVERSITY · 대한노인병학회 호남지회 THE HONAM GERIATRICS SOCIETY · 전북특별자치도 JEONBUK STATE · 자유문화도시 고창 · 고창문화관광재단 GOCHANG CULTURE & TOURISM FOUNDATION · WELLPARK HOTEL · 전남대학교 대학원 CHONNAM NATIONAL UNIVERSITY GRADUATE SCHOOL

International Centenarian Consortium (ICC)

30th Annual Meeting

1994-2026

Welcome Remarks

It is our great privilege to welcome you to the **30th Meeting of the International Centenarian Consortium (ICC)**, convened from 9 to 12 June 2026 in the historic city of Gochang, Republic of Korea.

This year marks a singular milestone: three decades of the ICC's enduring commitment to understanding the extraordinary individuals who reach one hundred years and beyond. Under the theme "Centenarians as Pioneers of the Well-Aging Era," we gather to celebrate this anniversary and to chart the future of longevity science together.

The scientific program reflects the remarkable breadth of our field. The meeting opens with a special lecture, Unique Findings in Korean Centenarian Study, followed by two plenary keynote sessions, Frontiers of Centenarian Science and Perspectives on Centenarian Science, which will illuminate the most pressing questions in human longevity, while six thematic sessions explore multi-omics and systems biology, resilience to age-related disease, worldwide cohorts, and the biological, social, and lifestyle foundations of healthy centenarian life. We are honored to host approximately 36 distinguished presenters from 13 countries across five continents.

For colleagues unable to attend in person, the program also includes online presentations, so that their work may be shared with the ICC community.

Beyond the lecture hall, we warmly invite you to experience the cultural heritage of Korea, from the historic Hanok Village of Jeonju to the serene landscapes and ancient sites of Gochang.

On behalf of the Organizing Committee, we extend our heartfelt gratitude to our speakers, participants, and partners. We are especially indebted to our Secretary General, Jae-Young Han, our Scientific Committee Chair, Jeonghwa Lee, and all members of the Organizing Committee, whose dedication has made this meeting possible. May this anniversary meeting deepen our shared understanding of exceptional longevity and advance our common vision of centenarians as pioneers of the well-aging era.

Kwangsung Park, M.D., Ph.D.
Congress Chair, 30th International Centenarian Consortium (ICC)
Director, Korean Centenarian Study Group

Sang Chul Park, M.D., Ph.D.
Advisory Committee Chair, 30th ICC
Distinguished Professor, Chonnam National University

Kyung Chul Yoon, M.D., Ph.D.
Organizing Committee Chair, 30th ICC
Director, Advanced Institute for Aging Science, Chonnam National University

Congratulatory Message

Some 30 years ago, several friends and colleagues from the Georgia, Swedish, and Hungarian centenarian studies sat down to share a meal at the Acapulco Mexico meeting of the International Congress of Gerontology and Geriatrics. There we entertained the idea of having meetings to share information among interested centenarian study researchers. The first meeting was held at the University of Georgia. We rented a farm house for colleagues to sleep over, present new data, and discuss common issues. Some colleagues stayed in the homes of Georgia researchers, and many colleagues stayed up late to discuss ideas in front of the farmhouse fireplace. The first Georgia meeting set the precedent for subsequent 29 meetings in different parts of the world. All meetings were self funded, with the hallmark of friendly exchanges and collaborations, and with an eye to foster young investigators and students.

As in aging and human development, many students and young investigators became mature contributing researchers. Many senior investigators left their marks in the advancement of centenarian research.

I have had the pleasure of attending the majority of the ICC meetings, making many good friends and colleagues from different countries throughout the years. I am proud to have had a small part in initiating the ICC meetings along with my good friend Bo Hagberg of Sweden and my long time colleague and collaborator Peter Martin.

I congratulate Dr. Kwangsung Park and his organizing committee in continuing the tradition of productive ICC meetings. I hope all participants will experience the unique joy and friendship in this special scientific venue.

Leonard W. Poon
Distinguished Research Professor Emeritus
Principal Investigator
Georgia Centenarian Study

Organization

Local Organizing Committee

Congress Chair	Kwangsung Park (Chonnam National University Medical School)
Advisory Committee Chair	Sang Chul Park (Distinguished Professor, Chonnam National University)
Organizing Committee Chair	Kyung-Chul Yoon (Chonnam National University Medical School)
Secretary General	JaeYoung Han (Chonnam National University Medical School)
Deputy Secretary General	Ho Seok Chung (Chonnam National University Medical School)
Chair of the Scientific Committee	Jeonghwa Lee (Chonnam National University)
Chair of the Finance Committee	Youngchun Ko (Gwangju Christian Hospital)
Member of the Organizing Committee	Jae Hong Shin (Vice President, Wellpark Hotel) Kun Ho Lee (Chosun University) Intak Kwon (Professor Emeritus, Jeonbuk National University) Kyung A Cho (Chonnam National University) Min Ho Shin (Chonnam National University Medical School) Clara Yongjoo Park (Chonnam National University)
Member of the Scientific Committee	Min-gu Kang (Bitgoeul Chonnam National University Hospital) Rooji Lee (Chonnam National University Hwasun Hospital) Euiheon Chung (GIST) Jungsoo Gim (Chosun University) Kyungmin Kim (Seoul National University) Kyuho Lee (Daegu University)
Member of the Advisory Board	Kyung Su Jeon (Professor Emeritus, Seoul National University) Mee Sook Lee (Professor Emeritus, Hannam University) Jung Jae Lee (Professor Emeritus, Seoul National University) Sam Ock Park (Professor Emeritus, Seoul National University) Gyounghae Han (Professor Emeritus, Seoul National University)

30 Years of Legacy:

A Visual History of the International Centenarian Consortium

I am pleased to present this photo album in celebration of the 30th anniversary of the International Centenarian Consortium. This album captures the congress venues, distinguished participants, and landmark moments that have defined each gathering over three remarkable decades.

This work would not have been possible without the invaluable contributions of Professor Leonard W. Poon of the University of Georgia and Professor Peter Martin of Iowa State University — the founding figures of the ICC — who generously provided most historical materials and offered their expert guidance throughout the entire process. I wish to express my deepest gratitude to both of them. I also extend my sincere thanks to all Congress Chairs who have led and shaped the ICC over the past thirty years, whose commitment and leadership have made our consortium what it is today.

It is my hope that the materials compiled here will serve as a foundation for a more comprehensive ICC history book in the future. While captions for individual photographs could not be included on this occasion, I trust they will be added when that fuller volume is prepared. Photographs from the 30th ICC will be uploaded to the ICC 2026 website upon conclusion of the meeting, so that they may be shared with all members and preserved as a resource for future history-making endeavors.

Once again, my heartfelt thanks go to Professor Poon and Professor Martin, without whom this photo album could never have come to fruition.

All the best,

Kwangsung Park, M.D., Ph.D.

Congress Chair of the 30th International Centenarian Consortium

Congress History

International Centenarian Consortium (ICC)
History of Meetings: 1994-2026

No.	Year	Congress Chair	Location	Centenarian Study Group
1st	1994	Leonard W. Poon	University of Georgia, USA	Georgia Centenarian Study
2nd	1995	Bo Hagberg	University of Lund, Sweden	Swedish Centenarian Study
3rd	1995	Peter Martin	Heidelberg, Germany	Heidelberg Centenarian Study
4th	1996	Michel Allard	Fontevraud, France	French Centenarian Study
5th	1997	Leonard W. Poon	Cincinnati, USA	Meeting at the GSA
6th	1998	Bo Hagberg	Bäckaskog, Sweden	Swedish Centenarian Study
7th	1999	Peter Martin	Hirschhorn, Germany	Heidelberg Centenarian Study
8th	2001	Leonard W. Poon	Vancouver, Canada	Meeting at the IAGG
9th	2002	Leonard W. Poon	Boston, USA	Meeting at the GSA
10th	2003	David Curb	Honolulu, USA	Honolulu Asia Aging Study
11th	2004	Bo Hagberg	Hanö, Sweden	Swedish Centenarian Study
12th	2005	Leonard W. Poon and Grace da Rosa	Rio de Janeiro, Brazil	Meeting at the IAGG
13th	2006	Sang Chul Park	Sunchang, Republic of Korea	Korean Centenarian Study
14th	2008	Leonard W. Poon	Atlanta, USA	Georgia Centenarian Study
15th	2009	Jean-Marie Robine	Paris, France	French Centenarian Study
16th	2010	Michel Poulain	Havana, Cuba	Cuban Centenarian Study
17th	2011	Karen Siu-Lan Cheung	Hong Kong	Hong Kong Centenarian Study
18th	2012	Bo Hagberg	Hanö, Sweden	Swedish Centenarian Study
19th	2013	Sang Chul Park	Sunchang, Republic of Korea	Korean Centenarian Study
20th	2014	Yasuyuki Gondo and Nobuyoshi Hirose	Osaka, Japan	Tokyo Centenarian Study
21st	2015	Michel Poulain	Sardinia, Italy	Italian Centenarian Study
22nd	2016	Oscar Ribeiro and Constança Paúl	Porto, Portugal	Portuguese Centenarian Study
23rd	2017	Leonard W. Poon and Peter Martin	University of California, Santa Cruz, USA	Georgia Centenarian Study
24th	2018	Perminder Sachdev and Henry Brodaty	Sydney, Australia	Sydney Centenarian Study
25th	2019	Daniela Jopp	Lausanne, Switzerland	Swiss Centenarian Study
—	2020		Cancelled due to COVID-19	—
26th	2021	Yasumichi Arai	Tokyo, Japan (held via Zoom due to COVID-19)	Tokyo Centenarian Study
—	2022		Cancelled due to COVID-19	—
27th	2023	Ingmar Skoog	Marstrand Island, Sweden	Swedish Centenarian Study
28th	2024	Henne Holstege	Texel Island, Amsterdam, Netherlands	100-plus Study
29th	2025	Thomas Perls	Brewster, Massachusetts, USA	New England Centenarian Study
30th	**2026**	**Kwangsung Park**	**Gochang, Republic of Korea**	**Korean Centenarian Study**

International Centenarian Consortium (ICC)
ICC History Album

The International Centenarian Consortium (ICC) is a group of centenarian researchers from around the world who have met every year since 1994. The purpose of these meetings is to share recent information and research on centenarians and to foster collaboration among different centenarian research teams.

Accomplishments of the ICC include:
- Sharing of research ideas and results
- Development of joint research protocol
- Joint grant proposal writing
- Joint publications (books and special issues)

Since 1994, the International Centenarian Consortium have met to share recent information and research on centenarians and to foster collaboration among different centenarian research teams.

The first discussion of forming an international consortium of centenarian researchers was held at the XV International Congress of Gerontology in Acapulco in 1989 where Leonard W. Poon and Peter Martin representing the Georgia Centenarian Study at University of Georgia met with Bo Hagberg who represented the Swedish Centenarian Study at the University of Lund, Sweden.

A follow-up meeting was held at the XVI International Congress of Gerontology in Budapest in 1993 with representatives from the Georgia, Hungarian, Japanese, Swedish centenarian studies. The first meeting of the ICC was held in 1994 in a farmhouse in U. S. Georgia with representatives from the French, Georgia, Hungarian, Japanese, and Swedish Centenarian Studies.

Additional meetings were held in Lund, Heidelberg, Tokyo, Honolulu, Hano, Seoul, Atlanta, Paris, Cuba, Hong Kong, and Osaka. Meetings were also organized as part of the International Congress of Gerontology in Paris, Vancouver and Rio de Janeiro, and as part of the annual meeting of the Gerontological Society of America in Boston and Cincinnati.

Adopted from https://research.hs.iastate.edu/international-centenarian-consortium/about-us/

1st Congress

Place: Athens, USA
Date: 1994
Chairman: Leonard W. Poon
Hosted by: University of Georgia Gerontology Center

2nd Congress

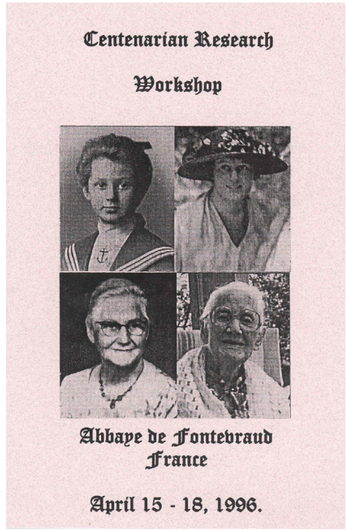
Place: University of Lund, Sweden
Date: 1995
Chairman: Bo Hagberg Hosted by: Swedish Centenarian Study

3rd Congress

Place: Heidelberg, Germany
Date: 1996
Chairman: Peter Martin Hosted by: Ursula LehrHeidelberg Centenarian Study

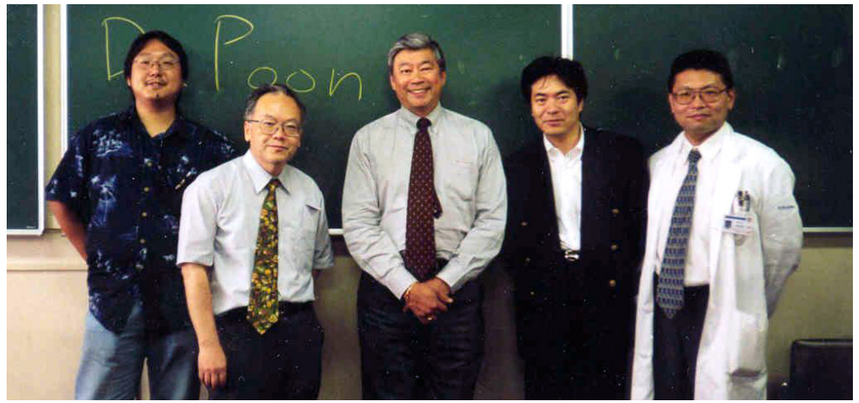
4th Congress

Place: Fontevraud, France
Date: 1996
Chairman: Michel Allard
Hosted by: the Ipsen Foundation, French Centenarian Study



5th Congress

Place: Cincinnati, USA
Date: 1997
Chairman: Leonard W. Poon
Hosted by: Meeting at the Gerontological Society of America

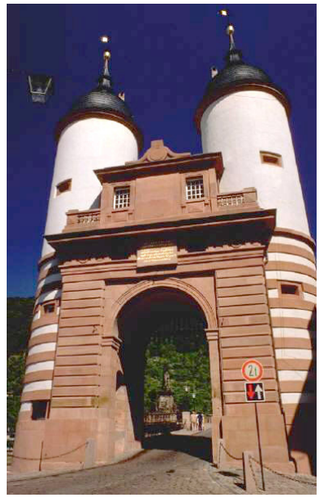


6th Congress

Place: Bäckaskog, Sweden
Date: 1998
Chairman: Bo Hagberg
Hosted by: The Lund University, Gerontology Research Center,
Swedish Centenarian Study

7th Congress

Place: Hirschhorn, Germany
Date: 1999
Chairman: Peter Martin
Hosted by: Heidelberg Centenarian Study



8th Congress

Place: Vancouver, Canada
Date: 2001
Chairman: Leonard W. Poon
Hosted by: Meeting at the International Congress of Gerontology and Geriatrics (IAGG)

9th Congress

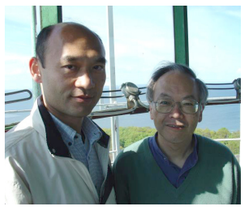
Place: Boston, USA
Date: 2002
Chairman: Leonard W. Poon
Hosted by: Meeting at the Gerontological Society of America (GSA)

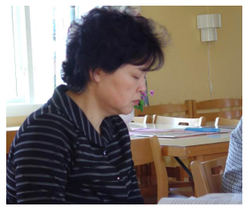
10th Congress

Place: Honolulu, USA
Date: 2003
Chairman: David Curb
Hosted by: Honolulu Asia Aging Study

11thCongress

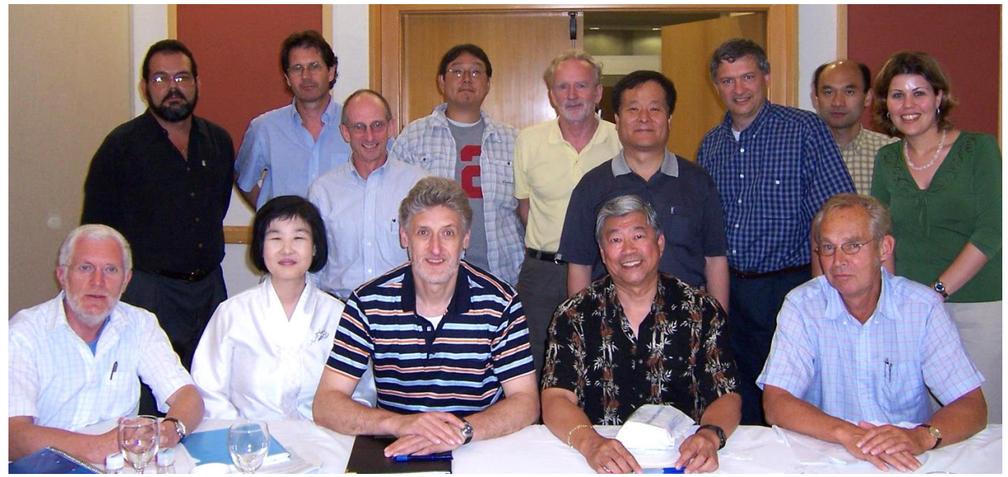
Place: Hanö, Sweden
Date: 2004
Chairman: Bo Hagberg
Hosted by: Swedish Centenarian Study

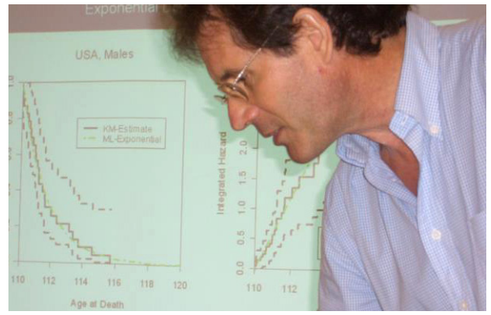


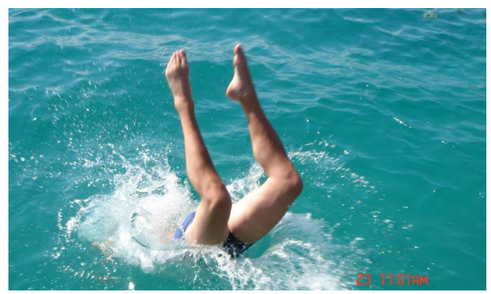


12th Congress

Place: Rio de Janeiro, Brazil
Date: 2005
Chairman: Leonard W. Poon and Grace da Rosa
Hosted by: Meeting at the International Congress of Gerontology and Geriatrics (IAGG)







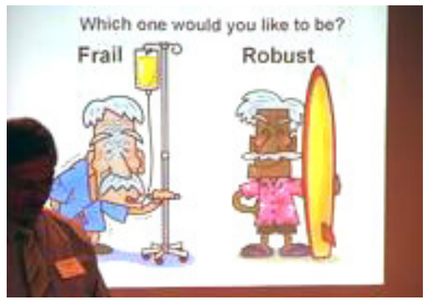
13th Congress

Place: Sunchung, Korea
Date: 2006
Chairman: Sang Chul Park
Hosted by: Korean Centenarian Study

14th Congress

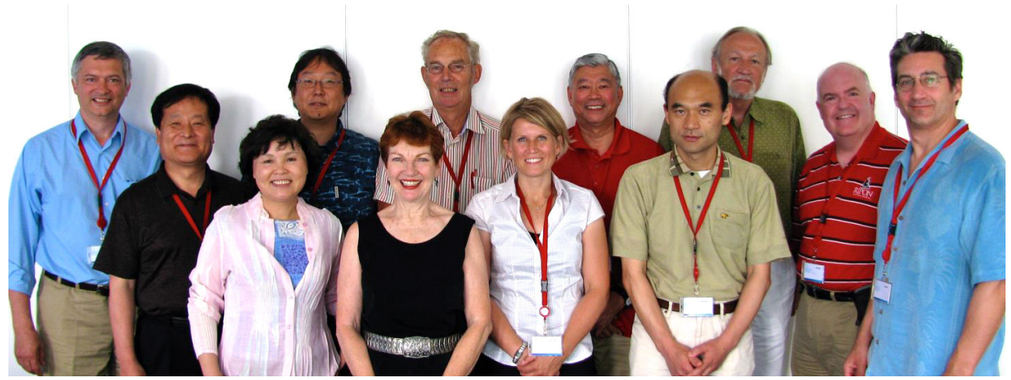
Place: Atlanta, USA
Date: 2008
Chairman: Leonard W. Poon
Hosted by: Georgia Centenarian Study

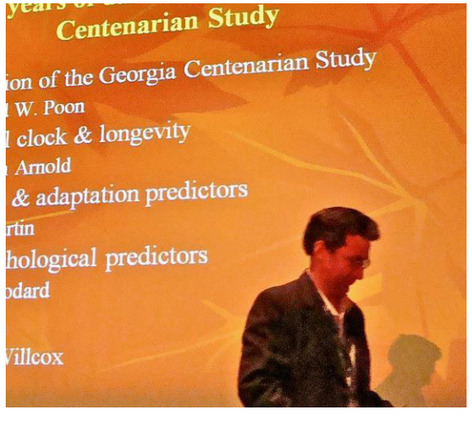
20th Georgia Centenarian Study Celebration



15th Congress

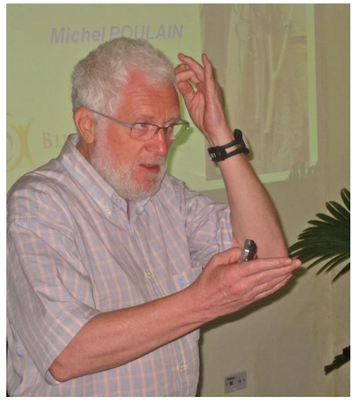
Place: Paris, France
Date: 2009
Chairman: Jean-Marie Robine
Hosted by: French Centenarian Study, 2009 International Congress of Gerontology





16th Congress

Place: Havana, Cuba
Date: 2010
Chairman: Michel Poulain
Hosted by: Cuban Centenarian Study



17th Congress

Place: Hong Kong
Date: 2011
Chairman: Karen Siu-Lan Cheung
Hosted by: Hong Kong Centenarian Study

18th Congress

Place: Hanö, Sweden
Date: 2012
Chairman: Bo Hagberg
Hosted by: Swedish Centenarian Study

19th Congress

Place: Sunchung, Korea
Date: 2013
Chairman: Sang Chul Park
Hosted by: Korean Centenarian Study

20th Congress

Place: Osaka, Japan
Date: 2014
Chairman: Yasuyuki Gondo and Nobuyoshi Hirose
Hosted by: Gerontology Consortium, Osaka University, Jointly Hosted by Graduate School of Human Sciences, Osaka University & Center for Supercentenarian Research, Keio University

21st Congress

Place: Sardinia, Italy
Date: 2015
Chairman: Michel Poulain
Hosted by: Sardinia Blue Zones Study

22nd Congress

Place: Porto, Portugal
Date: 2016
Chairman: Oscar Ribeiro and Constança Paúl
Hosted by: Portuguese Centenarian Study

23rd Congress

Place: University California, Santa Cruz, USA
Date: 2017
Chairman: Leonard W. Poon and Peter Martin
Hosted by: Georgia Centenarian Study

24th Congress

Place: Sydney, Australia
Date: 2018
Chairman: Perminder Sachdev and Henry Brodaty
Hosted by: Sydney Centenarian Study

25th Congress

Place: Lausanne, Switzerland
Date: 2019
Chairman: Daniela Jopp
Hosted by: Swiss Centenarian Study

26th Congress

Place: Tokyo via Zoom due to COVID
Date: 2021
Chairman: YasumichiArai
Hosted by: Keio University, Osaka University, Tokyo Centenarian Study

27th Congress

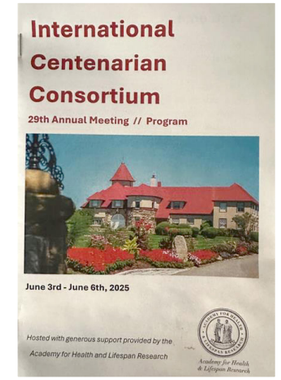
Place: Marstrand, Sweden
Date: 2023
Chairman: Ingmar Skoog
Hosted by: Swedish Centenarian Study

28th Congress

Place: Texel, Netherlands
Date: 2024
Chairman: Henne Holstege
Hosted by: 100-plus Studies

29th Congress

Place: Brewster, MA, USA
Date: 2025
Chairman: Thomas Perls
Hosted by: New England Centenarian Study, and supported by the Academy for Health and Lifespan Research




First discussion was he
the XV Internationa
Congress of Gerontol
Acapulco, Mexico, 1989
Sweden (Hagberg and Samuelsso
and the U.S. (Poon and Martin)

30th Congress

Place: Gochang, Korea
Date: 2026
Chairman: Kwangsung Park
Hosted by: Korean Centenarian Study

General Information

Venue

International Centenarian Consortium (ICC)

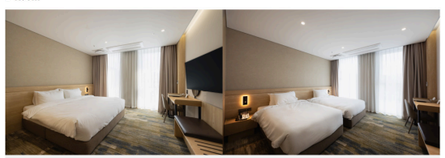
30th Annual Meeting

Date: June 9 (Tue) - 12 (Fri), 2026

Venue: Wellpark Hotel, Gochang, Republic of Korea

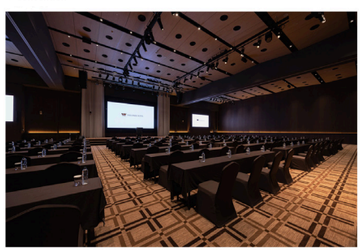
Wellpark Hotel, Gochang

Room



Single | Twin

Convention



Transportation

For your convenience, round-trip limousine bus transportation will be arranged between Incheon International Airport and the venue. The outbound bus is scheduled to depart at 12:40 pm from Terminal 2 and 1:00 PM from Terminal 1 (TBD) of Incheon International Airport on June 9. The return trip will depart from Gochang after lunch on June 12 and is expected to arrive at Incheon International Airport at approximately 5:00 PM on the same day.

Date	Shuttle Boarding Time	Person in Charge	Emergency Contact Number
TUE	12:40	Jihyun An	+82-10-2380-0846

* To ensure an on-time departure, all passengers are kindly requested to arrive at the boarding location at least 10 minutes before the scheduled departure time.

Incheon Airport T2

- Date & Time: Tuesday, June 9, 2026
- Location: In front of Starbucks near Exit 7 on the 1st floor

Bus Boarding Area

- T2: Group Bus Stop near Gate 7

Date	Shuttle Boarding Time	Person in Charge	Emergency Contact Number
TUE	13:00	Hanna Kim	+82-10-7398-2346

* To ensure an on-time departure, all passengers are kindly requested to arrive at the boarding location at least 10 minutes before the scheduled departure time.

Incheon Airport T1

- Date & Time: Tuesday, June 9, 2026
- Location: In front of the CU convenience store between Exit 1 and Exit 2 on the 1st floor

Bus Boarding Area

- T1: Group Bus Stop near Gate 1

Bus

Pick-up Sign

Social and Tour Program

Social Program
Cultural Excursions & Farewell Programme

DAY 01 · THURSDAY, 11 JUNE

Jeonju Hanok Village Tour & Farewell Dinner
DEPARTURE 16:00, Wellpark Hotel Lobby | WALKING TOUR 17:00 – 18:00 | FAREWELL DINNER 18:30 – 20:30

Aerial view of Jeonju Hanok Village, Jeollabuk-do. Image: PxHere (CC0).

Jeonju Hanok Village is the largest traditional hanok village in South Korea, situated in the historic centre of Jeonju. Comprising more than seven hundred traditional Korean houses (hanok), the village preserves a distinctive vernacular architecture together with the culinary and ceremonial practices associated with it. At its heart stands Gyeonggijeon, the shrine enshrining the portrait of King Taejo, founder of the Joseon dynasty. The surrounding precinct - including Omokdae, Jeonju Hyanggyo and the Pungnammun Gate - affords visitors a coherent encounter with Korea's pre-modern civic and ritual landscape.

Hanjeongsik banquet service.
Image: Travie / KTO press materials.

Farewell Dinner · *Gung, Traditional Korean Fine Dining*

The farewell dinner will be held at Gung, a fine-dining establishment in Jeonju specialising in hanjeongsik - the formal multi-course banquet of the Korean royal tradition. The menu is composed of seasonal regional ingredients and offers participants a fitting conclusion to the conference programme.

DAY 02 · FRIDAY, 12 JUNE

Gochang Historic Site Tour
DEPARTURE 09:00, Wellpark Hotel Lobby | SITES Gochang Eupseong · Seonunsa Temple

Gochang Eupseong (Moyangseong) stone fortress.
Image: Korea Tourism Organization.

Gochang Eupseong · *Moyangseong Fortress*

Gochang Eupseong, also known as Moyangseong, is a stone fortress erected in 1453, during the first year of the reign of King Danjong, to defend the south-western coast. The fortification preserves the local tradition of dapseong, according to which a circumambulation of the ramparts three times, carrying a stone upon one's head, is believed to confer good health and a peaceful passage in the afterlife — a custom that continues to mark the site's civic and ritual significance.

Seonunsa Temple, Dosolsan, Gochang.
Image: Wikimedia Commons.

Seonunsa Temple · *Dosolsan, Gochang*

Seonunsa Temple is situated on Mount Dosolsan (also known as Seonunsan). Although later tradition occasionally attributes its foundation to King Jinheung of Silla, scholarly consensus identifies the monk Geomdan as its founder, dating its establishment to 577, during the Baekje dynasty. The name "Seonun" (禪雲) signifies the attainment of profound meditative absorption through sustained spiritual practice; the monastery has long served as a centre of Korean Buddhist learning and contemplative tradition.

Presenters and Moderators

In Person Presenters and Moderators

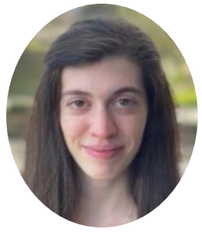
Yasumichi Arai
Keio University

Isabel Castanho
Harvard Medical School

Karen Siu-Lan Cheung
The University of Hong Kong

Kyung A Cho
Chonnam National University

Sungsoo Chun
American University in Cairo



Sara Cruces
Biogipuzkoa Health Research Institute

Zhaoli Dai-Keller
University of Sydney

Emilio Di Maria
University of Genoa

Xu Gao
Peking University, China

Jungsoo Gim
Chosun University

Yasuyuki Gondo
The University of Osaka

Jae-Young Han
Chonnam National University

In Jeong Hwang
Iowa State University

Momoho Kakuta
The University of Osaka

Jeonghwa Lee
Chonnam National University

Kun Ho Lee
Chosun University

Jean-Marc Lemaitre
INSERM and University of Montpellier

Peter Martin
Iowa State University

Daewoong Na
Chonnam National University

Gen Nakayama
Keio University

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Myung Jin Hwang	National Research Foundation of Korea
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Chulho Yang	Dongshin University (Emeritus)
Eun-Seon Yang	Hallym University
Dabin Yoon	Chosun University

Total: 30 participants (sorted alphabetically by last name).

For Moderators / Speakers

For Moderators

- Moderators are requested to ensure that all sessions start and end punctually as scheduled.
- Moderators will announce the session format and time allocation to speakers and the audience at the beginning of each session.

For Speakers

Presentation Instructions

- Presentations must be prepared in Microsoft PowerPoint in English.
- Please prepare your slides in 16:9 format (recommended).
- The 2nd slide should include your COI (Conflict of Interest) disclosure.
- Please save your data on a USB memory device or deliver it to the Preview Room at least 1 hour before your session begins.
- If other data (e.g., pictures, animations, graphs) are linked to your presentation, please store all related files in the same folder.

Presentation Time

Format	Total Time	Remarks
Plenary / Keynote	30 min	Including Q&A
General Presentation	15–20 min	Including Q&A (as assigned by session)
Pre-recorded Video	15-20 min	Including Live Q&A

- For pre-recorded video presentations: The recorded lecture will be screened, followed by a live online Q&A session with the presenter (within 5 minutes).
- The moderator of each session will communicate the exact time allocation to speakers prior to the session.

Scientific Program

The 30th International Centenarians Consortium (ICC)

Centenarians as Pioneers of the Well-Aging Era

9-12 June 2026 · Wellpark Hotel, Gochang, Korea

Time	Presentation Title	Speaker (City)
DAY 1 · Tuesday, 9 June 2026		
13:00	Shuttle Bus to Gochang	
17:00	Check-in at Wellpark Hotel	
18:00 - 21:00	**Opening Lecture** Unique Findings in Korean Centenarian Study Welcome Dinner (Wellpark Hotel)	***Sang Chul Park*** (Seoul)
DAY 2 · Wednesday, 10 June 2026		
08:00 - 09:00	Breakfast / Registration	
PLENARY KEYNOTE · Frontiers of Centenarian Science Moderator: ***Sang Chul Park***		
09:00 - 10:30	Centenarians at 100+: Decoding the Biology of Human Longevity	***Yousin Suh*** (New York)
	Celebrating One's 100th Birthday and Living a Healthy Life-what's the Connection? Celebrating One's	***Jean-Marie Robine*** (Paris)
	Who will be Age of 100?: A Prospective Centenarian Study, SONIC	***Yasuyuki Gondo*** (Osaka)
10:30 - 10:50	Coffee Break	
SESSION 1 · Multi-Omics and Systems Biology of Exceptional Longevity Moderator: ***Thomas Perls, Kyung A Cho***		
10:50 - 12:20	Association Between Multi-Organ Reserve Biomarkers and Survival in Japanese Centenarians	***Gen Nakayama and Yasumichi Arai*** (Tokyo)
	Centenarian Reference Genome–Based Structural Proteomics for Pathogenic Variant Analysis	***Sajung Yun*** (Baltimore)
	Biological Aging and Environmental Health: Insights from Aging Cohorts in China	***Xu Gao*** (Beijing)
	Cellular and Spatial Signatures of Resilience and Resistance to Alzheimer's Disease in Centenarian Brains	***Isabel Castanho*** (Boston)
12:20 - 13:30	Group Photo & Lunch	
SESSION 2 · Resilience to Age-Related Diseases and Cognitive Aging Moderator: ***Jean-Marie Robine, Kun Ho Lee***		
13:30 - 15:00	Centenarians from the Basque Country are Resilient to Age-Related Diseases	***Sara Cruces*** (San Sebastián)
	Centenarians and Oldest Olds in Liguria – COOL: A Multidisciplinary Study on the Genetics of Cognition	***Emilio Di Maria*** (Genoa)
	The GARD Cohort: Asia's Largest Longitudinal Multimodal Study on Early Detection and Prevention of Alzheimer's Disease	***Kun Ho Lee*** (Gwangju)
	Living Well at 100 and Beyond: What Qualitative Studies Tell Us About Centenarians	***Xinyu Zhang*** (Osaka)
15:00 - 15:20	Coffee Break	
SESSION 3 · Worldwide Centenarian Cohorts: Cross-Cultural Perspectives on Longevity Moderator: ***Yasumichi Arai, Kyung Chul Yoon***		
15:20 - 17:00	Blue Zones and Beyond	***Michel Poulain*** (Charleroi)
	How Have Korean Centenarians Lived Long, Healthy Lives?	***Kwangsung Park*** (Gwangju)
	Genetic Resilience to Alzheimer's Disease in Centenarians: A Global Consortium Analysis	***Niccolo Tesi*** (Amsterdam)
	Dietary Influences on Physical and Cognitive Function in Exceptional Longevity: A Cross-Cohort Analysis	***Zhaoli Dai-Keller*** (Sydney)
	A Longitudinal and Cross-Cohort Analysis of Centenarian Life in Taiwan	***Peishan Yang*** (Taipei)
17:00 - 18:00	Break Time	
18:00 - 21:00	Celebrating the 30th ICC Gala Dinner (Wellpark Hotel)	

DAY 3 · Thursday, 11 June 2026

07:30 - 08:30	Breakfast	

PLENARY KEYNOTE · Perspectives on Centenarian Science

Moderator: *Kwangsung Park*

08:30 - 10:00	Why is the Genetics of Extreme Age so Difficult?	*Thomas Perls* (Boston)
	Comorbidity Among Centenarians	*Peter Martin* (Ames, Iowa)
	The Centenarian as a Model of Successful Ageing	*Perminder Sachdev* (Sydney)
10:00 - 10:20	Coffee Break	

SESSION 4 · Biological and Social Foundations of Healthy Centenarian Life

Moderator: *Peter Martin, Clara Yongjoo Park*

10:20 - 12:00	The Longevity Blueprint Already Written: Neural and Genomic Insights from Korean Centenarians	*Jungsoo Gim* (Gwangju)
	Nutrition and Longevity: Korean Centenarian Diets	*Clara Yongjoo Park* (Gwangju)
	Changes in the Lives of Korean Centenarians: Family, Community, and Social Policy	*Jeonghwa Lee* (Gwangju)
	Research on the Immune Systems of Centenarians	*Kyung A Cho* (Gwangju)
	Genomic insights from 200 Highly Admixed Brazilian Centenarians	*Mayana Zatz* (São Paulo)
12:00- 13:00	Lunch	

SESSION 5 · Lifestyle and Adaptive Strategies for Successful Longevity

Moderator: *Yasuyuki Gondo, Jae-Young Han*

13:00 - 14:20	Age Differences in Developmental Adaptation	*In Jeong Hwang* (Ames, Iowa)
	Comparison of Biomarkers and Lifestyle Factors Between the Oldest-Old (80+) and Young-Old (60-79) Adults: A Machine Learning Approach Using NHANES 2021-2023	*Sungsoo Chun* (Cairo)
	Selection, Optimization, and Compensation Strategies and Survival to Age 100: Findings from the SONIC Study	*Momoho Kakuta* (Osaka)
	Transforming Longevity into Healthy Living: Effects of a Multi-Component Lifestyle and Home-Based Self-Monitoring Intervention in Older Adults—A Randomized Controlled Trial	*Karen Siu-Lan Cheung* (Hong Kong)

14:20- 14:30	Coffee Break	

SESSION 6 · Pathways to Exceptional Longevity in Centenarians

Moderator: *Karen Siu-Lan Cheung, Jeonghwa Lee*

14:30 - 15:30	The Impact of Family Structure and Living Arrangements on the Health of Centenarians in Urban and Rural China	*Miaomiao Shi* (Qingdao)
	Who Cares for Centenarians Living Alone? A Regional Comparison of Daily Living Support	*Daewoong Na* (Gwangju)
	Resilience as the Key to Longevity: How do Centenarians Cope with Changes and Critical Life Events?	*Jolanta Mackowicz* (Kraków)
	Biological Age and Immune Ageing in Sicilian Semi- and Supercentenarians.	*Anna Calabrò* (Palermo)
15:30 - 15:40	2027 ICC Meeting Announcement Closing Remarks	*Jean-Marc Lemaitre* (Paris) *Kwangsung Park* (Gwangju)
15:40 - 16:00	Break Time	
16:00	Shuttle Bus to Jeonju	
17:00 - 21:00	Walking Tour of Jeonju Hanok Village Farewell Dinner at Jeonju (Korean Traditional Dinner)	

DAY 4 · Friday, 12 June 2026

08:00 - 09:00	Breakfast
09:00 - 12:00	Gochang Historic Site Tour: Seonunsa Temple · Gochang Eupseong
12:00 - 13:00	Lunch
13:00	Shuttle Bus to the Airport

MEMO

International Centenarian Consortium (ICC)
30th Annual Meeting

Abstract Book

"Centenarians as Pioneers of the Well-Aging Era"

June 9 (Tue) - 12 (Fri), 2026

Wellpark Hotel, Gochang, Republic of Korea

International Centenarian Consortium (ICC)
30th Annual Meeting

OPENING LECTURE

Unique Findings in Korean Centenarian Study

Sang Chul Park (Seoul)

Unique Findings from Korean Centenarian Study

Sang Chul Park, M.D., Ph.D.

Seoul National University; Chonnam National University

The Korean Centenarian Study shifts the aging paradigm from "Survival" (lifespan quantity) to "Vitality" (lifespan quality, autonomy, and dignity). Through the study, several unique findings could be collected, classified as either public factors or private factors.

The geography of longevity was analyzed as for public factors. Over a 20-year tracking period (2000-2024), the longevity gap between traditional rural and modern urban municipalities closed sharply, proving that longevity maps are dynamic and time-dependent. The environmental benefit is highly visible in females but remains flat in males. As for private factors, several new and unique findings could be observed. The study identified a layered genetic architecture—including universal DNA-repair paths (MLH1, BRCA1), cardiovascular loci (ApoE, ACE), and East Asian population-specific markers (male-only ALDH2)—to build a baseline for successful genetic aging. And Korean centenarian reference genome could be built up. The most specific medical characteristics are that the cohort showed a 0% positivity rate for the Hepatitis-B surface antigen and that centenarian sera carry a unique IgG autoantibody targeting RNA polymerase II (subunit RPB1). Most interestingly, the isolated Hansen's disease community on Sorokdo Island showed unexpectedly low mortality rates at advanced ages (85+). And nutritionally very interesting findings indicate that Korean ethnic food can be classified as one of the longevity foods. The Vitamin B12 paradox that Korean centenarians are free from Vitamin B12 deficiency despite plant-based diet can be resolved by the traditional fermented foods (soybean pastes, kimchi, and edible seaweeds). Comparing the 2001 cohort (born 1890-1901) to the 2018 cohort (born 1910–1918) reveals a massive social transformation. Modern centenarians are more educated, have drastically lower smoking (3%) and drinking (2%) rates, and report significantly higher life satisfaction (50%). Independent housework capability expanded by 9-fold (from 2.8% to 25.7%).

Taken together, modern centenarians have evolved past being passive symbols of frail survival. Driven by an integrated web of genomic stability, unique immune signatures, microbial nutrition, and social autonomy, they have officially become active pioneers of a new well-aging era

International Centenarian Consortium (ICC)
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PLENARY KEYNOTE

Frontiers of Centenarian Science

Moderator: Sang Chul Park

Centenarians at 100+: Decoding the Biology of Human Longevity

Yousin Suh

Department of Obstetrics and Gynecology
Department of Genetics and Development
Columbia University Irving Medical Center, New York, NY, USA

Centenarians represent a unique model of exceptional human longevity, offering a powerful lens through which to dissect the biological mechanisms that promote extended healthspan. Human genetic studies have identified both common and rare variants associated with longevity; however, translating these associations into causal biological insights remains a central challenge. In this lecture, I will present an integrative approach that leverages human genetics to uncover the functional mechanisms underlying human longevity. Focusing on rare functional variants enriched in centenarians, particularly within pathways linked to the hallmarks of aging, we combine human genetic analyses with functional genomics approaches to define variant-to-gene relationships and elucidate the molecular mechanisms by which these variants contribute to longevity and influence cellular phenotypes. I will highlight recent work demonstrating how longevity-associated variants modulate key aging-related pathways, including stress response, genome stability, and cellular senescence. Cellular senescence, a fundamental hallmark of aging, can drive tissue dysfunction and age-related disease, yet also plays essential roles in development and tissue repair. By examining how naturally occurring longevity-associated genetic variants influence senescence programs, we gain insight into mechanisms that promote resilience to aging without detrimental trade-offs. Together, these studies illustrate how centenarian genomes can be used not only to identify genetic determinants of longevity but also to decode the underlying biological architecture of aging. This integrative approach provides a framework for understanding how human genetic variation shapes aging trajectories and for identifying key genes and pathways that influence human longevity.

Celebrating One's 100th Birthday and Living a Healthy Life-what's the Connection? Celebrating One's

Jean-Marie Robine

INSERM and University of Montpellier

For a very long time, humanity lived in environments that were not conducive to realizing its potential for longevity. In short, mortality was high at all ages of a life that rarely extended beyond 70 years. The idea that this situation was not necessarily inevitable gradually emerged during the 18th century. The pioneers of demographic science developed a whole series of indicators aimed at measuring the extent of mortality. Then, after World War II, epidemiologists and public health researchers focused their studies on risk factors for mortality, whether individual or societal. The most recent research has added genetic factors to the search for causes of premature mortality. Today, given all the progress that has been made, the issue of mortality has been replaced by the issue of longevity. How long can the human race live? How long can it remain healthy, in the sense of remaining a full-fledged member of society? Calculating life expectancies does not answer the new questions, which are not posed in the form “how long can one live from a given age” but rather in the form “up to what age can one live.” In this sense, the modal age at death (M) should be the primary indicator of human longevity and its change over time. The questions then concern the dispersion of ages at death: can it be reduced by moving toward greater equality in life spans? They do not concern risk factors for mortality but, conversely, factors that increase the chances of survival at all stages of life. Are these the same factors? Certainly not, but no one knows for sure at this point. We should distinguish between risk factors for premature mortality and factors that increase the chances of survival at all stages of life. This is the research that studies on centenarians today should focus on: what are the factors—collective and individual, biological, medical and psychological, cultural and environmental—that have enabled them to reach 100 years of age compared to those who died at the age when deaths are most common (M); what factors will enable them to continue living beyond 100? Up to what age, and what factors have allowed them to maintain good functional health? For reference, in France, where life expectancy at birth for women reached 85.9 years in 2025, the modal age at death (M) is 91 years.

Keywords: Centenarian studies, Longevity, Premature mortality, Healthy longevity, Risk factors

Who will be Age of 100?: A Prospective Centenarian Study SONIC.

Yasuyuki Gondo

Graduate School of Human Sciences, The University of Osaka, Japan

The SONIC study was launched in 2010 to address the limitations of conventional centenarian studies, which often lack concurrently collected younger control groups from the same population. This lack of controls makes it difficult to differentiate innate longevity factors from general aging-related changes or to reach generalizable conclusions. To overcome these limitations, SONIC was designed as a multi-cohort, longitudinal case-control study tracking older individuals with the potential to reach 100 years of age.

Featuring a unique "narrow age range design," the study tracks three cohorts in their 70s, 80s, and 90s, each spanning a strict 3-year birth range. This approach allows researchers to evaluate individual variations in health and aging without using chronological age as an adjusting covariate. Systematic, multi-domain follow-ups are conducted every 3 years. To ensure environmental diversity, participants are recruited via residential registries across four balanced urban and rural regions in Japan's Kanto and Kansai sectors.

SONIC stands out for its interdisciplinary collaboration, synthesizing findings from medicine, biology, dentistry, nutrition, psychology, and sociology. Investigations encompass on-site physical examinations, cognitive screenings, medical biomarker tests (including genetic variants such as the FOXO3A longevity gene), dental assessments (e.g., occlusal force and remaining teeth), and comprehensive socio-economic and psychological surveys.

Over its years of implementation, the study has generated pivotal multidimensional insights into healthy longevity. Medically, it has mapped how lifestyle diseases, daily blood pressure variability, and certain biomarkers interact across age groups to predict physical frailty and cognitive decline. Dental and nutritional analyses have underscored a profound path link: a reduction in occlusal force and posterior teeth support diminishes nutritional intake (such as vegetable and antioxidant consumption), directly accelerating BMI reduction, declines in walking speed, and early cognitive impairment. Psychosocially, the study developed a Japan-specific Gerotranscendence Scale, demonstrating that positive psychological shifts help the oldest-old preserve emotional stability and subjective well-being despite physical and cognitive decline.

Regarding the primary aim, the oldest cohort (2012-90 cohort; aged 89–91 in 2012) turned 100 between 2021 and 2023. We sampled the addresses of all 89- to 91-year-old residents in the research area from the residential registry (n=3,746). We sent invitation letters for mail and invitation surveys to non-institutionalized individuals (n=3,322); 1,935 replied to the mail survey, and 272 participated in the invitation survey. Among the 3,746 individuals, 1,935 were community-dwelling, 813 were institutionalized, and 998 did not respond (classified as unknown). Government official death certificate microdata confirmed that 217

(12.0%) of the community-dwelling, 23 (2.9%) of the institutionalized, and 71 (7.4%) of the unknown group reached 100 years of age. The living status of 192 individuals was not confirmed. We have begun analyzing mortality data alongside previously collected data and launched a visiting survey of centenarians in May 2026.

International Centenarian Consortium (ICC)
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SESSION 1

Multi-Omics and Systems Biology of Exceptional Longevity

Moderator :Thomas Perls, Kyung A Cho

Association Between Multi-Organ Reserve Biomarkers and Survival in Japanese Centenarians

Gen Nakayama, Ryo Shikimoto, Takashi Sasaki, Yukiko Abe, Nobuyoshi Hirose, Yasumichi Arai

Center for Supercentenarian Medical Research, Keio University School of Medicine

Background: Clarifying the process that leads to mortality in centenarians is key to understanding which system's failure (such as the immune, metabolic, or cardiovascular system) acts as the decisive trigger when the human body approaches its limits. However, few studies have simultaneously examined biomarkers spanning multiple organ systems.

Objective: We have previously reported that markers of inflammation and organ reserve—such as those for the heart, kidneys, and liver—are significantly associated with all-cause mortality in centenarians. Furthermore, we recently reported that neurofilament light chain (NfL), which reflects axonal damage in neurons, is more strongly associated with the prognosis of centenarians than phosphorylated tau 181 (pTau181). The aim of the present study is to determine which biological factors are most critical for survival in extreme old age by simultaneously incorporating these various markers of organ function into a model predicting all-cause mortality.

Methods: Japanese centenarians were recruited from 2000 to 2021 across two prospective cohort studies: the Tokyo Centenarian Study (TCS) and the Japanese Semi-supercentenarian Study (JSS). This study included 285 centenarians (mean age: 103.6 y, male-to-female ratio: 1:3.8) who underwent measurement of blood biomarkers reflecting organ reserve, such as NfL and NT-proBNP, out of an initial cohort of 638 centenarians whose cognitive function was assessed using the mini-mental state examination (MMSE). The survival status of the centenarians was surveyed annually via home visits or telephone interviews. All-cause mortality was the outcome used in the survival analysis. NfL and pTau181 were measured using the Simoa (Single Molecule Array) platform, while NT-pro BNP, cystatin C, and cholinesterase were centrally analyzed at a commercial laboratory using standard methods. Each biomarker was converted to a Z-score, and its association with prognosis was examined using a Cox proportional hazards model.

Results: In unadjusted models, each biomarker was significantly associated with all-cause mortality. However, in the model incorporating all biomarkers simultaneously, only NfL and NT-pro BNP showed a significant association with all-cause mortality.

Conclusion: These findings indicate that age-related changes in the central nervous system and the heart are the two major factors affecting the survival prognosis of centenarians.

Keywords: Centenarians, Biomarkers, Cognitive function, Neurofilament light chain (NfL), Survival

Centenarian Reference Genome-Based Structural Proteomics for Pathogenic Variant Analysis

Sajung Yun

Department of Bioinformatics. Center for Biotechnology Education. Kreiger School of Arts and Sciences, Johns Hopkins University, USA

This presentation examines how centenarian reference genomes, when integrated with structural proteomics and modern computational tools, reframe the interpretation of pathogenic genetic variants. Using the Central Dogma of Biology as a conceptual scaffold, we trace how single nucleotide polymorphisms, insertions, deletions, and frameshift mutations alter protein structure and function. We introduce a four-case analytical model for comparing patient genomic data against both the standard Hg38 reference and a centenarian cohort reference, demonstrating how this dual-comparison substantially reduces false positives and false negatives in clinical variant calling. Detailed case studies of BRCA1 Exon 11 and the ORAI1 calcium channel gene illustrate these principles in practice. In BRCA1, remarkable evolutionary conservation across centenarian genomes reinforces the critical importance of genomic stability at this locus. In ORAI1, a prevalent frameshift deletion—present in 99.74% of sampled centenarians—produces a dramatically truncated protein with paradoxically favorable structural and functional properties, potentially conferring protection against inflammaging. These findings collectively support the development of longevity-informed, population-specific reference genomes as a cornerstone of next-generation precision medicine.

Biological Aging and Environmental Health: Insights from Aging Cohorts in China

Xu Gao

Peking University, China

China is stepping into an era of rapid aging. Biological aging is the foundation of aging-related diseases and mortality. It provides a new sight into handling the aging-related health burden. We initiated a cohort of longevity and aging in Southern China and collaborated with multiple aging cohorts in China to understand the roles of biological aging and related environmental exposures in promoting healthy aging in China. We first developed DNA methylation clocks using whole-blood samples from 5,636 individuals aged 3–118 years, comprising a 26-CpG Lifespan clock and 8 organ-specific clocks (adipose, artery, brain, heart, immune, kidney, liver, muscle) validated in two independent cohorts. We identified two critical aging transition points at ages 22 and 70 years. Centenarians exhibited an Adipose–Kidney–Muscle rejuvenation pattern, associated with reduced mortality (HR = 0.70) and better functional outcomes. We then used DNA methylation to figure out whether the control of air pollution in China could mitigate the burden of frailty in China. We first conducted a multistate modeling analysis in a nationwide cohort with 21,654 older adults. An interquartile range reduction in PM2.5 exposure increased the likelihood of improvement for frail/prefrail individuals by more than 50% while lowering their risks of worsening frailty or mortality. A quasi-experimental study of 1816 adults, leveraging the implementation of China's Clean Air Act, further validated these findings. Additionally, in our prospective cohort of aging, we included 235 older adults with follow-up data and identified three frailty-related CpG sites that were associated with PM2.5 exposure. The DNA methylation profiles were robustly associated with the change in frailty. Our study demonstrates that incorporating DNA methylation based measurement of biological aging could help reduce the burden from environmental exposures to promote longevity.

Cellular and Spatial Signatures of Resilience and Resistance to Alzheimer's Disease in Centenarian Brains

Isabel Castanho[1,2], Pourya Naderi Yeganeh[1,2], Anupama Rai[1,2], Quadri Adewale[1,2], Alice Rodrigues[1,2], Jane Banahan[1,2], Susan Bookheimer[3], Sofiya Milman[4], Vonetta Dotson[5], Bonnie Wong[2,6], Ariana Anderson[3], Mirella Diaz-Santos[3], Harry Vinters[3], Christopher Kazu Williams[3], Shino Magaki[3], George Murphy[7], Dmitry Prokopenko[2,6], Maria Mavrikaki[1,2], Stacy L. Andersen[7], Thomas T. Perls[7], Doo Y. Kim[2,6], Rudolph E. Tanzi[2,6], Winston Hide[1,2]

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[2]Harvard Medical School, Boston, MA, USA

[3]University of California, Los Angeles, USA

[4]Albert Einstein College of Medicine

[5]Georgia State University, USA, [6]Massachusetts General Hospital, Charlestown, MA, USA

[7]Boston University School of Medicine, USA

Background: Some individuals retain cognition despite Alzheimer's disease (AD) neuropathology (resilience), while others escape pathology at extreme age (resistance). With aging as the strongest risk factor for AD, healthy centenarians are a natural model of neuroprotection. We previously identified excitatory-inhibitory (E/I) balance as a key resilience feature, and that specific inhibitory neuronal subtypes may play a primary role in resistance. However, the spatial context of these protective mechanisms remains undefined.

Objective: To delineate spatially resolved cellular and molecular signatures underlying cognitive resilience and resistance to AD in centenarian brains and identify transcriptional programs that maintain neuronal protection against neurodegeneration.

Method: We integrated multimodal transcriptomic profiles (bulk RNA-seq, single-nucleus RNA-seq, and spatial transcriptomics) from centenarian dorsolateral prefrontal cortex tissue, obtained from two cohorts: the Boston University Alzheimer's Disease Research Center (BU; n = 20) and the Resilience/Resistance to AD in Centenarians and Offspring (RADCO) study (n = 16). Brains were stratified by pathology and cognitive status: BU brains were classified as "healthy" or "AD", and RADCO brains from cognitively healthy centenarians were classified as "resilient" or resistant". Systems-level analyses resolved cell-type-specific and spatially organized transcriptional programs associated with resilience versus resistance and with cognitive outcomes.

Result: AD brains indicated disrupted cortical E/I balance driven by selective vulnerability of neuronal subpopulations previously linked to hyperexcitability and cognitive decline. Resilient and resistant brains preserved inhibitory systems and specific neuronal populations. Spatial analyses revealed protective signatures within defined cortical architectures, highlighting coordinated cellular programs that distinguish resilience from resistance at the tissue level.

Conclusion: Our study defines key molecular, cellular, and spatial features that differentiate resilience from resistance to AD in centenarians. These findings suggest distinct yet convergent protective processes and identify cell-specific pathways as therapeutic targets to maintain cognitive health.

Keywords: Genomics, Transcriptomics, Single-cell transcriptomics, Spatial transcriptomics, Resilience, Resistance, Alzheimer's disease, Neuroprotection

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International Centenarian Consortium (ICC)
30th Annual Meeting

SESSION 2

Resilience to Age-Related Diseases and Cognitive Aging

Moderator: Jean-Marie Robine, Kun Ho Lee

Centenarians from the Basque Country are Resilient to Age-Related Diseases

Sara Cruces-Salguero[1], Igor Larrañaga[2], Javier Mar[2,3], Ander Matheu[1,4,5]

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[5]Centro de Investigación Biomedica en Red de Fragilidad y Envejecimiento (CIBERfes), Carlos III Institute, Madrid, Spain.

Background: The Basque Country is one of the regions with highest average age in the world, but multimorbidity rates are increasing. Previous studies from our group showed that Basque centenarians had fewer diseases and overall better biological profiles than non-centenarians, but the impact of age-related diseases on centenarians remains unknown.

Objective: We aim to analyze the specific response of centenarians against age-related diseases, including cancer, neurodegenerative diseases (NDDs), and cardiovascular diseases (CVDs).

Methods: We analyzed Electronic Health Records (EHRs) to assess the incidence and effect of age-related diseases in centenarians and non-centenarians in the Basque Country. Descriptive statistics were applied to discern differences between the two population groups in terms of prevalence, number of diagnoses, and treatments. Survival analysis was performed through Kaplan-Meier estimator. Trajectories of laboratory parameters were explored through non-linear mixed models (NLMMs).

Results: Centenarians showed reduced prevalence of cancer, particularly of the most aggressive tumor types. They also had fewer diagnoses and treatments, and no records of metastasis, and demonstrated extended survival both since the first and last diagnosis of cancer. Trajectories of biological data revealed that centenarians exhibited favorable blood profiles. Similarly, they had fewer diagnoses of NDDs, increased survival, and displayed protective biological profiles. Regarding CVDs, they had fewer acute diagnoses, despite overall prevalence being similar between both groups, longersurvival, and healthier biological trajectories.

Conclusions: Centenarians experience reduced severity of age-related diseases and more favorable biological recovery compared to non-centenarians. These findings indicate potential resilience mechanisms that may contribute to healthy ageing.

Centenarians and Oldest Olds in Liguria - COOL: A Multidisciplinary Study on the Genetics of Cognition

Emilio Di Maria[1,2], Carlotta Gualco[1], Erika Muscolino[1], Nicoletta Reale[3], Claudio Marcello Solaro[3], Laura Camia[4], Umberto Tortorolo[4], Claudio Ivaldi[5], Luca Mazzella[6], Fabio Bandini[6], Massimo Del Sette[7], The COOL study Investigators[8]

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Background: Despite the body of literature on genetic risk factors for dementia, little is known on protective genetic factors associated with favourable cognitive ageing in the oldest population. In Europe, Italy has a leading position with a swelling aged population, and the urban area of Genoa has one of the highest prevalence of centenarians. We conducted a systematic review that provides an updated set of norms for the neuropsychological test that are frequently used to assess the cognitive profile in individuals aged >90 years (Gualco C et al. 2025). Here, we report the rationale of the COOL study, the development of the study protocol and the preliminary results from the cohort profile (Di Maria E et al., under review).

Objectives: The COOL study is a not-for-profit, multicentric study involving a cohort of centenarians (aged >99) living in the Genoa area, located in the Liguria region, Italy. The primary endpoint is the identification of genomic biomarkers associated with cognitive status, using the cognitive profile as primary outcome measure.

Methods: The study protocol was developed as a multi- and inter-disciplinary effort, based on the current good clinical practice and the local health care practices determined by the national and regional health care regulations and procedures. The section on the clinical and neuropsychological assessment was designed in conjunction with "Centenari a Trieste" (Tettamanti M and Marcon G, 2018). Eligible participants are identified by family doctors or home care specialists. Centenarians underwent a semi-structured interview on personal, disease and family history, and a neuropsychological assessment of the main cognitive domains. Venous blood was taken during routine clinical evaluation, if planned.

Results: As of July 2025, we enrolled 88 centenarians (age range: 99-108, median 100.56) with and without cognitive impairment; 32 subjects were followed up. All participants were of European ancestry, 81% were female. The cognitive profile in assessed subjects showed a wide range of cognitive health measures (CDR 0-5; MMSE 3-30, median 24). We collected 67 biological samples, on which APOE gene variants were genotyped.

Conclusions: We demonstrated that the protocol is feasible, and acceptable by participants and their families. A comprehensive phenotype dataset was established, and DNA samples were stored. Centenarians exhibited a broad spectrum of cognitive profiles, from preserved cognition to severe dementia. These findings will eventually allow to interpret the profiles of genomic variants as associated with variability of cognitive performance in centenarians. The molecular underpinnings of healthy cognitive ageing could inform health policy strategies in the general population.

Key words: Dementia, Cognition, Ageing, Centenarians, Cognitive health, Protocol, Genetic risk factors.

The GARD Cohort: Asia's Largest Longitudinal Multimodal Study on Early Detection and Prevention of Alzheimer's Disease

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Background: Alzheimer's disease (AD) poses an escalating public health crisis in South Korea, where the elderly population is projected to exceed 19 million by 2050. The Gwangju Alzheimer's & Related Dementias (GARD) cohort was established in 2013 as Asia's largest community-based, longitudinal, multimodal study, aimed at mapping biomarker trajectories, identifying Korean-specific risk factors, and enabling precision prevention of AD.

Methods: Community-dwelling individuals aged ≥60 years underwent a three-stage screening process comprising cognitive assessments, multimodal neuroimaging (MRI, amyloid PET, FDG-PET), biospecimen collection, and multi-omics profiling (genomics, transcriptomics, proteomics, and metagenomics of gut, saliva, and dental plaque). Plasma p-tau217, GFAP, and NfL were quantified using ultra-sensitive Simoa immunoassays. A two-step screening strategy — plasma p-tau217 prescreening followed by confirmatory amyloid PET — was applied to identify preclinical AD. Longitudinal follow-up was risk-stratified by amyloid PET status with annual assessments for high-risk individuals.

Results: From over 17,000 screened individuals, 12,877 were enrolled (mean age 72.17 ± 6.5 years; 62.98% female), including 5,123 cognitively unimpaired (CU), 3,250 MCI, and 2,125 AD dementia cases. The cohort accumulated over 10,843 MRI scans, 5,810 amyloid PET scans, and 7,060 EEG/ERP recordings. Over the decade-long follow-up, 450 participants converted from CU to MCI and 106 from MCI to AD. Plasma p-tau217 achieved an AUC of 0.93 for detecting amyloid pathology in cognitively unimpaired individuals, enabling preclinical AD identification with greater than 90% accuracy. Longitudinal analyses further revealed that elevated fasting plasma glucose and total cholesterol were significantly associated with accelerated progression to dementia and faster neurodegeneration, as evidenced by progressive cortical atrophy and hippocampal volume loss on longitudinal structural MRI.

Conclusions: Plasma p-tau217 prescreening (AUC = 0.93) combined with targeted amyloid PET confirmation provides a clinically feasible and cost-effective strategy for early AD detection even in asymptomatic individuals. Elevated cholesterol and plasma glucose further accelerate neurodegeneration in preclinical stages, defining a critical window for vascular and metabolic risk factor modification. These findings establish GARD as a pivotal platform for advancing precision dementia prevention and early intervention strategies.

Living Well at 100 and Beyond: What Qualitative Studies Tell Us about Centenarians

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This study synthesized qualitative studies on centenarians to examine the psychological, social, and existential processes that support well-being, adaptation to aging, and meaning in life in the centenarian years. Seventeen qualitative studies published between 2000 and 2024, involving adults aged 95 years and older, were included. Literature searches were conducted using PubMed, CINAHL, PsycINFO, Scopus, CiNii Articles, and Google Scholar. The quality of the included studies was assessed using the CASP Qualitative Checklist. The mean CASP score was 8.5 out of 10, indicating that the included studies were generally of high quality. Data were analyzed using Thomas and Harden's thematic synthesis approach, which involved line-by-line coding, the development of descriptive themes, and the generation of higher-order analytical themes. The analysis generated 118 initial codes, which were synthesized into 11 final integrated themes. These themes were further organized into three conceptual dimensions. The first dimension, the individual dimension (D1), reflected self-regulation, growth, and agency, and included (T1) early-life foundations and moral development, (T2) work ethic and purposeful roles, (T5) autonomy, adaptation, and independence, and (T7) intellectual curiosity and lifelong learning. The second dimension, the relational dimension (D2), represented connectedness, mutual support, and generativity, and included (T3) family bonds and reciprocity, (T6) active and purposeful living, and (T8) optimism, humor, and emotional stability. The third dimension, the existential dimension (D3), captured faith, meaning-making, and transcendence, and included (T4) faith, spirituality, and meaning-making, (T9) acceptance of adversity and resilience, (T10) simplicity, frugality, and harmony in daily life, and (T11) acceptance of death and life completion. Taken together, these dimensions suggest that well-being in the centenarian years is shaped through the interaction of personal resources, supportive relationships, and existential acceptance. These findings suggest that Successful Aging in extreme old age cannot be fully understood through conventional models that emphasize health, independence, and activity. Instead, a broader framework is needed—one that includes acceptance, relationality, and meaning-making. In this context, "quiet agency," or the capacity to adjust one's attitudes and ways of thinking rather than attempting to control the external environment, may be an important mechanism underlying psychological adaptation among centenarians.

Key words: Centenarians, Successful aging, Qualitative research, Thematic synthesis, Well-being

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SESSION 3

Worldwide Centenarian Cohorts: Cross-Cultural Perspectives on Longevity

Moderator: Yasumichi Arai, Kyung Chul Yoon

From the Demographic Concept of Blue Zone to Living Blue Zone

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Twenty-five years after its initial formulation, the concept of the Longevity Blue Zone remains highly relevant to the study of exceptional longevity. Its main specificity lies in shifting the focus from individual centenarians to the longevity profile of an entire population.

This population-based approach requires robust demographic indicators and rigorous age validation. By introducing the Extreme Longevity Index, centenarians are grouped according to their place of birth rather than their place of residence. This birth-based perspective is essential for better identifying the early-life, environmental, social, cultural, and possibly genetic factors that may favour extreme longevity.

However, the debate remains intense with researchers who continue to assess longevity mainly according to place of residence. A Blue Zone should not be confused with a longevity hotspot. The latter often reflects selective migration, attracting older adults who settle in desirable places where they can pursue a comfortable and health-conscious lifestyle. In contrast, a Longevity Blue Zone identifies a population whose exceptional longevity is rooted in its place of origin and long-term demographic history.

The recent creation of an international non-profit association named LIVING BLUE ZONE aims to promote the seven lifestyle principles observed in the Blue Zones in order to improve quality of life in our post-modern societies. This initiative has attracted considerable interest from different sectors of society and represents an effort to help people live not only longer, but also better and healthier lives, while supporting the policy implications of demographic and gerontological research.

How have Korean Centenarians Lived Long, Healthy Lives?

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Background: Korea is among the most rapidly aging societies in the world. Over 25 years, the Korean Centenarian Study Group has conducted systematic multidisciplinary investigations of community-dwelling centenarians across urban and rural cohorts.

Methods: Cross-sectional and longitudinal assessments were conducted in three regional cohorts comprising urban Gwangju and rural Gokseong-Gurye-Damyang (GuKokSumDam) and Hwasun, encompassing genomics, immunology, functional status, sensory function, nutrition, lifestyle, and social ecology.

Results: Korean centenarians demonstrate a multilayered genetic architecture, preserved immune resilience, and compression of morbidity with sustained functional independence. Lifestyle characteristics include lifelong tobacco and alcohol abstinence (>80%), time-restricted early eating aligned with circadian biology, habitual low-intensity physical activity, and a fermented soy-based diet. Rural centenarian density was 2.9-fold higher than urban despite inferior medical infrastructure, implicating social ecology as a primary longevity determinant.

Conclusion: Korean centenarians exemplify a biologically resilient and behaviorally coherent model of healthy aging, in which genetic and immune advantages are sustained by lifelong lifestyle habits and social ecological factors rather than medical intervention alone.

Genetic Resilience to Alzheimer's Disease in Centenarians: A Global Consortium Analysis

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Background: Alzheimer's Disease (AD) is the most common form of dementia and one of the most prevalent diseases at old age. While aging is the strongest risk factor, genetic factors also play an important role, with heritability estimated at 60-80%. Genome-Wide Association Studies (GWAS) have identified ~120 common genetic variants associated with AD and related dementia. Despite the high prevalence of AD at older ages, some individuals reach ages over 100 years while maintaining good cognitive and physical function. This raises the question to what extent such individuals harbor protective genetic factors. We have previously shown that cognitively healthy centenarians from the 100-plus Study are genetically protected against AD, being depleted for risk-increasing AD alleles and enriched for protective alleles. A polygenic risk score (PRS) based on these variants was ~5-fold lower than in AD patients, and 2-fold lower than in healthy older adults.

Objective: It remains unclear whether these findings generalize to other centenarian cohorts worldwide with different genetic background, selection criteria, and environment exposures. Including multiple cohorts will increase power to detect both shared and population-specific genetic factors underlying resilience to AD. However, international data sharing is limited by privacy regulations, requiring alternative approaches for large-scale analyses.

Methods: We developed an analysis pipeline enabling genetic analyses without sharing raw genotype data. We will evaluate the association at the single variant level and through PRS. Centenarians will be compared to ancestry-matched healthy older adults (age <85) and AD patients where available. Within centenarians, we will assess associations of the PRS with survival and cognitive performances (MMSE, clock drawing test). The pipeline is currently being applied to >5,000 centenarians across multiple cohorts and countries (The Netherlands, Germany, Denmark, Sweden, Australia, United States, Japan, and Brazil), with additional cohorts under evaluation. The results will be combined through meta-analysis.

Results: While the analyses are ongoing, preliminary results are consistent with previous findings, showing that centenarians have a lower AD PRS compared to healthy older adults from the same population. Within centenarians, a higher AD PRS is associated with reduced survival. Conclusion:

Preliminary findings support the hypothesis that centenarians carry genetic factors contributing to resilience to AD and dementia. Importantly, this study shows the feasibility of a collaborative, distributed analysis framework that enables large-scale genetic studies without sharing genotyping data, facilitating international efforts to uncover genetic factors underlying healthy cognitive aging.

Key words: Centenarians, Resilience, Dementia, Cognitively healthy aging, Genetics, Common variants

Dietary Influences on Physical and Cognitive Function in Exceptional Longevity: A Cross-Cohort Analysis

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Background: Dietary influences on cognitive and physical function in advanced age, particularly among those with exceptional longevity, remain unclear. We compared dietary, cognitive, and functional characteristics of adults aged 80–90 years from the Sydney Memory and Ageing Study (MAS) with adults aged ≥95 years from the Sydney Centenarian Study (SCS), and examined whether dietary factors were associated with activities of daily living (ADL) impairment, low cognitive performance, and dementia diagnosis longitudinally.

Methods: Harmonised data from 614 participants (MAS n=381; SCS n=233) were analysed. To improve comparability, analyses were restricted to MAS participants aged ≥80 years (original cohort aged 70–90), as the SCS dietary data used in this study reflected participants' most recent dietary habits from age 80 years onward. Other baseline information included body mass index (BMI), education level, language background, Activities of Daily Living (ADL; higher scores indicate greater impairment), and Mini-Mental State Examination (MMSE; lower scores indicate poorer cognitive performance). Longitudinal analysis using multivariable logistic regression models examined associations of dietary factors with ADL dependence (score >7), low MMSE (score <24), and dementia clinical diagnosis assessed at the third follow-up in pooled and cohort-specific analyses, adjusting for age, sex, BMI, education, language background, baseline ADL and MMSE, cohort indicator (pooled models), and other specific cohort covariates.

Results: Compared with MAS participants, SCS participants were older (mean age 97.0 vs 83.3 years), more likely to be female (62.6% vs 55.5%), more likely to have normal weight (52.5% vs 31.1%), and reported higher fruit and vegetable intake (mean 5.7 vs 3.7 servings/day). They also had poorer ADL function (mean 12.4 vs 7.2) and lower MMSE (mean 23.3 vs 28.0) (all $p<0.001$). In pooled analyses, higher vegetable intake was associated with lower odds of ADL dependence (OR=0.57, 95% CI: 0.38–0.85; p=0.007), but not with low MMSE. Higher fruit intake was associated with lower odds of low MMSE (OR=0.88, 95% CI: 0.78–1.00; p=0.05), but not with ADL dependence. No dietary factors were associated with dementia diagnosis. Cohort-specific estimates were directionally consistent but imprecise and not statistically significant.

Conclusions: Adults with exceptional longevity aged 95 or older reported higher fruit and vegetable intake than those aged 80-90 years, yet had poorer cognitive and functional profiles, likely reflecting advanced age. Higher vegetable and fruit intake were associated with lower odds of ADL dependence

and low MMSE, respectively, but not with dementia. These findings suggest dietary factors may contribute to maintaining functional and cognitive independence in later life, although larger studies are needed to confirm these associations in populations with exceptional longevity.

Key words: Extreme longevity, Activities of daily living, Cognitive function, Dementia, Dietary intake

A Longitudinal and Cross-Cohort Analysis of Centenarian Life in Taiwan

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This report analyzes the socio-behavioral trajectories and health profiles of centenarians in Taiwan through longitudinal observations and cross-cohort comparisons spanning from 2008 to 2024. The analysis further integrates empirical data regarding specialized centenarian services provided by non-governmental organizations. Findings indicate that while females exhibit longer life expectancy, male centenarians demonstrate significantly superior performance in the Activities of Daily Living (ADL) scale, highlighting a gender-based health paradox at the stage of extreme longevity. Regarding residential arrangements, Taiwanese centenarians show a high preference for aging in place. Notably, over 70% of primary caregivers are children aged 70 or older, underscoring a distinct demographic phenomenon of "elders caring for the oldest-old". Financial security for this population relies primarily on filial support and government subsidies. Practical service experience reveals that both centenarians and their caregivers possess unique needs and characteristics. Consequently, this report recommends that policy formulation incorporate gender sensitivity and establish precise resource allocation mechanisms specifically tailored for the "oldest-old".

Key words: Centenarians, Social support for the oldest-old

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PLENARY KEYNOTE

Perspectives on Centenarian Science

Moderator: Kwangsung Park

Why is the Genetics of Extreme Age so Difficult?

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Centenarians, their siblings and offspring markedly delay disability and have prolonged health spans. A recent independent study of New England Centenarian Study centenarians and their siblings survival data indicates 60% of the variation in those who live to 100 yrs is genetically determined (Shenhar, et al. Science 2026;391). Other studies suggest an even stronger genetic influence upon survival to older ages such as 105+ yrs (Sebastiani, et al. PloS One 2012;e29848). Recent work suggests that genetic profiles of exceptional longevity are typified by a reduced burden of loss-of-function variants, a greater frequency of protective variants, and greater genomic integrity.

Despite strong evidence that genetics plays an important role in exceptional longevity (EL), little is known so far about how this genetic influence translates into slower aging and expanded health span. Challenges to progress in this area include that hundreds of small-effect variants are involved (that nonetheless lead to high polygenic risk scores), gene-environment interactions lead to a substantial interindividual variability and heterogeneity of the EL phenotype, the rarity of people who live to these extreme ages, and the lack of whole genome sequence data of centenarians and their offspring with longitudinal phenotypic data and multi-omics profiles all have challenged progress in this area. There is cause for hope however. Polygenic risk scores and other studies are perhaps implicating a relatively few key biological pathways in extreme longevity, interindividual variability may decrease with increasing age beyond 100 years, the ICC is an opportunity to improve phenotypic precision across studies and for fostering ancestry-underrepresented studies, omics data generation is becoming more accurate and less expensive and data sharing portals such as the ELITE portal provide opportunities for meta- and mega-analyses.

Comorbidity Among Centenarians

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Background: A central challenge in aging research is closing the gap between life span and health span — the number of years lived in good health. While many people now reach extreme old age, little is known about how morbidity accumulates as future centenarians move through their nineties. Understanding these late-life trajectories is essential for promoting healthier longevity. Objective This study examined the prevalence and longitudinal changes in comorbidity burden from age 90 to 100 among future centenarians and identified key predictors of morbidity trajectories during the tenth decade of life.

Method: Using longitudinal data from the Health and Retirement Study (HRS), we identified 307 participants who survived to at least age 98. Seven Elixhauser Comorbidity Index conditions with direct mappings in HRS self-reports were selected: congestive heart failure, hypertension, chronic lung disease, diabetes, cancer, arthritis, and psychiatric problems. Unweighted and weighted comorbidity scores were constructed. Repeated-measures ANOVAS and latent growth curve modeling was used to examine changes in comorbidity and to test predictors of initial levels and rates of change.

Results: At age 90, arthritis (68%) and hypertension (61%) were the most prevalent conditions, while heart failure, diabetes, cancer, lung disease, and psychiatric problems were less common. The repeated ANOVA showed that the unweighted comorbidity index did not significantly change over time after Greenhouse–Geisser correction, $F(2.64, 377.70) = 2.27$, $p = .088$, indicating no reliable longitudinal change. In contrast, the weighted comorbidity index showed a significant change across time, $F(5, 400) = 8.98$, $p < .001$, indicating that overall comorbidity scores changed over time when conditions were weighted according to clinical importance. The weighted growth curve model showed excellent fit, χ^2 (N=393) = 18.79, $p = .04$, CFI = .99, RMSEA = 0.047 and revealed a significant increase in comorbidity burden from a mean weighted score of 1.24 at age 90 to 1.91 at age 100 (slope = 0.37, $p = .01$). Higher cognitive function at age 90 predicted lower initial comorbidity ($\beta = –0.315$, $p < .01$), whereas female sex ($\beta = 0.30$, $p < .05$) and higher BMI at age 90 ($\beta = 0.63$, $p = .001$) were associated with steeper increases in comorbidity over time.

Conclusion: In a representative sample of older adults, comorbidity burden rises substantially during the nineties, even among those who reach age 100. Cognitive reserve appears protective, while female sex and higher BMI accelerate morbidity accumulation. These findings highlight the importance of interventions in mid-to-late life to narrow the gap between life span and health span and support healthier exceptional longevity.

Key words: Comorbidity, Centenarians, Trajectories

The Centenarian as a Model of Successful Ageing

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Background: Centenarians are exceptional in their longevity, deviating more than 3 SD from the average lifespan of their cohort. They are generally able to delay the development of both musculoskeletal and cognitive frailty until a very late age. Can they justifiably be considered to be models of healthy ageing, both to understand the processes of healthy ageing and to develop strategies to reduce the healthspan-lifespan gap?

Method: A narrative review of the field of longevity, with a focus on studies of centenarians, in particular.

Results: Centenarians can bridge the gap between lifespan and healthspan to a significant degree, consistent with Fries' model of compression of morbidity. Centenarians with preserved vision and hearing (about 40%) are models of preserved senses. About 40-50% of centenarians escape dementia until death and can serve as a model of healthy brain ageing. They are therefore good models of 'successful' ageing and may provide insights into reducing the healthspan gap. The study of centenarians may also provide insights into mechanisms of ageing, as extreme phenotypes have been used to provide biologically relevant associations. The expectation is that the processes of ageing will be slowed or attenuated in centenarians when compared to those who live to a normative age. This approach has been used to some extent to examine genetic, metabolic and proteostatic mechanisms of ageing, and special aspects of the centenarian gut microbiome have been described. The centenarians have also informed personality factors that influence longevity as well as attitudes toward ageing. There are, however, several limitations to this research, especially as research into centenarians in the past has been in small, select populations and is often opportunistic, and ecological factors appear to be important that are difficult to replicate.

Conclusion: The study of centenarians holds promise for insights into ageing. Since centenarians are small in number in most jurisdictions, and involving them in research is challenging, an international collaborative effort is needed to fully avail of the opportunities for novel insights that they can offer.

Key words: Centenarian, Ageing, Lifepsan, Healthspan, Model, Frailty, Compression of morbidity

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SESSION 4

Biological and Social Foundations of Healthy Centenarian Life

Moderator: Peter Martin, Clara Yongjoo Park

The Longevity Blueprint Already Written: Neural and Genomic Insights from Korean Centenarians

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Exceptional longevity is a polygenic trait shaped by the coordinated action of multiple biological pathways. Despite 15 years of genome-wide association studies (GWAS), individual variants explain only a modest fraction of heritability, highlighting the need for a systems-level perspective. Through integrative analysis of 45 longevity-related GWAS datasets, we identified five core functional axes, including neural homeostasis, immune regulation, and lipid metabolism, onto which genetically heterogeneous findings consistently converge. Analysis of pleiotropic disease hubs further revealed that centenarians exhibit selective genetic risk avoidance in cardiopulmonary, gastrointestinal, and renal systems. To investigate the functional genomics of healthy aging, we performed a GWAS of physical mobility (Functional Ambulation Category) in a Korean centenarian cohort. Among 42 candidate genes identified, brain-enriched genes, particularly those expressed in the cerebellum and cortex, substantially outnumbered muscle-expressed genes, suggesting that neural regulatory mechanisms are central to preserved mobility in the oldest-old. Cross-ancestry comparison with non-Hispanic white oldest-old individuals further revealed both shared and Korean-specific genomic signatures of exceptional longevity. These findings support a paradigm shift from single-gene to systems biology, and from muscle-centered to brain-integrated models of healthy aging. The genomic potential for longevity appears broadly encoded in the human genome, and Korean centenarians offer a unique window into how that blueprint is realized.

Keywords: Centenarian genomics; Longevity genetics; Preserved mobility; Neural regulatory network; Pleiotropic disease hub

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Nutrition and Longevity: Korean Centenarian Diets

Clara Y. Park

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Korean cuisine is centered on rice as the staple, served with soup, kimchi, and multiple side dishes (banchan) in a single-table communal setting. Its nutritional profile has long been characterized by high grain and vegetable intake, substantial consumption of fermented vegetables and soybeans (kimchi, doenjang, and gochujang), and historically very high sodium intake.Over the past two decades, Korean diets have shifted from post-war undernutrition toward contemporary imbalance, with rising diet-related chronic disease. Dietary quality has improved among older adults in the decade preceding the COVID-19 pandemic but remains systematically higher in urban than in rural areas, with the largest urban–rural gap observed among 1950s–1960s birth cohorts.

The centenarians studied since 2000—primarily rural, with urban participants from Seoul and Gwangju—represent the only long-running data of this kind in Korea. Most centenarians studied can eat independently and enjoy eating. Caregiving structures for meal preparation have shifted dramatically: the near-exclusive role of daughters-in-law in the early 2000s has given way to approximately equal participation by daughters-in-law, sons, and daughters, together with growing involvement of care workers and facility-based meal services. Meal timing has become less regular (100% regular in 2001 vs. 65% in the 2020s), and dietary supplement use among centenarians has risen from 16.7% to over 60%, similar to the rates in the general older population. Centenarian diets remain traditional and rice-centered, but Korean centenarians consistently consume less energy and a lower proportion of carbohydrate energy (~68%) than the general older population, with correspondingly higher protein and fat shares—a profile closer to that of centenarians in other countries than to that of other Korean older adults. Urban–rural differences persist in food variety and micronutrient intake (notably iron and omega 3). The specific dietary factors that contribute to Korean centenarians' longevity remain to be fully characterized; continued methodological development and longitudinal linkage to functional outcomes are necessary.

Changes in the Lives of Korean Centenarians: Family, Community, and Social Policy

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South Korea transitioned into an aging society in 2000 (7% of the population aged 65+) and became a super-aged society by 2025 (20%). Concurrently, the population of centenarians has grown dramatically. Marking the 25th anniversary of research on Korean centenarians, this study examines longitudinal changes in their lives, focusing on family dynamics, community environments, and the efficacy of social welfare policies. While early research primarily focused on family-based caregiving, current scholarship emphasizes the capacity for independent living and the integrated roles of families, local communities, and social welfare policies. This study aims to analyze the evolution of Korean centenarians' lives over the past 25 years and discuss the underlying social implications. The research employs comparative data from 49 community-dwelling centenarians surveyed in 2001 and 169 individuals aged 95+ surveyed between 2023 and 2025. By analyzing socio-demographic characteristics, family structure (e.g., marital status, living arrangements, number of surviving children), primary care providers, and utilization of welfare services, we identify the key drivers of these life-course changes. Findings reveal significant shifts: the proportion of centenarians living with a spouse increased from 8% to 14%, while the rate of living alone surged from 12.2% to 51%. The significant difference in the number of surviving children reflects a fundamental transformation in family-based support structures, serving as a critical indicator of how caregiving dynamics have evolved. This study evaluates the transformation of the Korean care system—from reliance on traditional familial norms to the institutionalization of the Basic Pension, Long-Term Care Insurance, and customized elderly care services—analyzing how these policies now supplement or substitute for traditional family roles. Ultimately, this research provides insights into the future of super-aged populations and suggests strategic policy directions for a rapidly aging society.

Key words: Korean centenarians, Family support, Community, Social welfare policy, Long-term care, Independent living

Research on the Immune Systems of Centenarians

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Centenarians do not simply possess an aged or weakened immune system; rather, they exhibit a profoundly reorganized one. Earlier views held that their longevity stemmed from an inherently low-inflammatory state. However, accumulating evidence now indicates that centenarian immunity is not characterized by reduced inflammation per se, but by a deliberately reorganized inflammatory landscape—one in which inflammatory and counter-regulatory signals are simultaneously recalibrated to enhance responsiveness to infection and disease resistance, rather than to suppress immune activity. This reconfiguration, now recognized as immune remodeling, represents a durable adaptation shaped by decades of cumulative exposure, adaptation, and recovery, prioritizing biological resilience over the preservation of youth. At the cellular level, selective reshaping of lymphocyte composition and clonal reorganization of cytotoxic populations further reinforce this network, supporting enhanced surveillance, infection control, and recovery capacity—as exemplified by centenarians' resilience during COVID-19. Together, these features form a resilient immune system underlying their remarkable resistance to multimorbidity and frailty.

So, can we reprogram the aged immune system to resemble that of centenarians? Can immune remodeling be deliberately induced to confer resistance against aging and age-related diseases? In this presentation, I will introduce an emerging technology that makes this possibility tangible—TLR5-based modulation of innate immunity. Through ongoing collaborations with global teams, we are demonstrating that TLR5 modulation not only strengthens infection resistance but also confers resilience against aging and a broad spectrum of age-related diseases, supporting its potential as an immune remodeling-inducing technology that recapitulates key features of centenarian immunity. Such an approach is expected to provide a translational foundation for extending healthspan and overcoming multimorbidity by reprogramming the aged immune system toward a resilient, centenarian-like state.

Genomic Insights from 200 Highly Admixed Brazilian Centenarians

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Background: Brazil offers a unique opportunity to investigate genomic and other biological factors associated with longevity in a highly admixed and heterogeneous population exposed to diverse socioeconomic and environmental conditions. Among centenarians, supercentenarians (individuals aged 110 years or older) constitute an even rarer subgroup with extraordinary resistance to aging-related decline. Aim: To establish and characterize a Brazilian cohort of centenarians, including supercentenarians, for genomic, immunological, functional and multi-omics investigations focused on healthy aging and biological resilience.

Methods: We conducted nationwide recruitment and longitudinal follow-up of 206 Brazilian centenarians from multiple regions, including 18 certified supercentenarians. Until April 2025, Brazil held a remarkable position in global longevity records, with the world's longest-lived woman, I.C.L (deceased at 116 years-old), and the two longest-lived men, including J.M.N, who is currently the world's oldest living man at 113 years-old. Clinical, family history and lifestyle data were collected, including information regarding diet, sleep, medications use, smoking, alcohol consumption, and functional independence. Genomic DNA, total RNA, peripheral blood mononuclear cells (PBMCs), plasma and serum were obtained for downstream whole-genome sequencing (WGS), transcriptome, proteome, immunological analyses, and iPS derived cell lines for functional assays.

Results: The cohort demonstrated remarkable heterogeneity in health trajectories and lifestyle habits. While some centenarians reported smoking or regular alcohol consumption throughout life, others exhibited highly restrictive lifestyles and limited medication use, supporting that extreme longevity depends on multiple biological and environmental pathways. Physical activity patterns were similarly diverse. Some individuals maintained regular exercise habits, whereas others reported sedentary lifestyles. Women (n = 151) represented 73% of the cohort, while men (n = 55) accounted for 27%. Interestingly, female centenarians displayed short stature, with an average height of 1.53 ± 0.07 m, while males averaged 1.67 ± 0.09 m. Despite the expected heterogeneity, most individuals exhibited body mass indices within the healthy range. Some supercentenarians remained lucid and partially independent in activities of daily living beyond age 110. Familial clustering including families with multiple centenarians supports potential inherited protective factors. Ongoing genomic studies aim to identify rare and novel variants associated with resilience regarding, age-related diseases, and immune adaptation in this highly admixed population.

Conclusion: Brazilian centenarians, particularly supercentenarians, constitute an exceptional and underrepresented model for studying healthy aging and resilience. The integration of genomic, immunological, and longitudinal clinical data from this cohort may help identify novel protective mechanisms associated with extended health span and contribute to precision medicine approaches for aging populations.

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SESSION 5

Lifestyle and Adaptive Strategies for Successful Longevity

Moderator: Yasuyuki Gondo, Jae-Young Han

Age Differences in Developmental Adaptation

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Background: Loneliness among older adults in the United States is an escalating public health concern driven by the unique life circumstances of this growing population. Nearly 30% of adults aged 65 and older experience loneliness at least some of the time, with rates rising substantially among the oldest-old population. Adverse childhood events and early relationships with parents can have lasting effects on later development and well-being, whereas life events experienced during the adult years, personality traits, as well as socioeconomic conditions can acutely alter feelings of loneliness. Despite these findings and the rapidly growing body of research examining loneliness in later life, far fewer studies adopt a comprehensive framework that considers both early-life experiences and current resources and stressors.

Objective: Guided by the developmental adaptation model (Martin & Martin, 2002), this study examines distal and proximal predictors of loneliness in later life and whether pathways vary by age (60–79 vs. 80+).

Method: Using the Health and Retirement Study (HRS), we tested structural equation models in which adverse childhood experiences (ACEs) and relationships with mother were associated with loneliness directly and indirectly through neuroticism, events during the adult years, and economic resources.

Results: Model comparisons indicated that the fully constrained model fit was significantly different from the unconstrained model, $\Delta\chi^2(13)=23.47$, $p<.05$. The semi-constrained model showed good fit, $\chi^2(11)=50.31$, $p<.001$, RMSEA=.02, CFI=.99, and was not significantly different from the unconstrained model, supporting partial age differences in pathways. Among adults aged 60–79, ACEs predicted greater loneliness directly ($\beta=.037$, $p<.01$) and indirectly through neuroticism ($\beta=.021$, $p<.001$) and economic resources ($\beta=.020$, $p<.001$), including sequential pathways via recent adversity ($\beta=.003$, $p<.001$). Relationship with mother was directly ($\beta=-.079$, $p<.001$) and indirectly through neuroticism ($\beta=-.032$, $p<.001$) protective. Among adults aged 80+, ACEs did not influence loneliness directly. However, there were significant specific indirect effects of ACEs on loneliness through economic resources and events during the adult years ($\beta=.008$, $p<.001$). Higher relationships with mother in the 80+ age group was associated with lower loneliness ($\beta=-0.072$, $p<.001$), whereas higher neuroticism ($\beta=.307$, $p<.001$) and poorer economic resources ($\beta=0.261$, $p<.001$) were associated with greater loneliness.

Conclusion: These findings suggest that early-life adversity is more directly linked to loneliness among adults aged 60–79, whereas in advanced age (80+), loneliness is shaped primarily by psychosocial and economic factors. Results underscore the importance of life-span interventions addressing both early adversity and modifiable adult risks.

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Key words: Loneliness, United states, Developmental adaptation model

Comparison of Biomarkers and Lifestyle Factors Between the Oldest-Old (80+) and Young-Old (60-79) Adults: A Machine Learning Approach Using NHANES 2021-2023

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Background: The young-old (60-79 years) and oldest-old (80+ years) exhibit distinct physiological, nutritional, and psychosocial profiles, yet few studies have compared these groups using machine learning (ML) across multiple health domains. This study identified key clinical and lifestyle factors distinguishing the oldest-old from the young-old using three ML approaches in a nationally representative U.S. sample.

Methods: Data were from NHANES August 2021-August 2023. The analytic sample included adults aged 60 and older (N = 3,504): young-old 60–79 years (n = 2,979, 85.0%) and oldest-old 80+ (n = 525, 15.0%). The NHANES age variable is top-coded at 80 for confidentiality, providing a methodologically justified binary threshold. Fifty-three predictors spanning five domains were examined: demographics (sex, race/ethnicity, education, marital status, income-to-poverty ratio), dietary intake (energy, macronutrients, fiber), laboratory biomarkers (complete blood count), physical examination (blood pressure, BMI), and health questionnaire data (depression, alcohol, physical activity, diabetes). Preprocessing included special-code recoding, median/mode imputation, one-hot encoding, and standardization. The dataset was split 80/20 using stratified sampling with SMOTE applied to the training set. Three ML models were compared: Logistic Regression (LR), Random Forest (RF), and Neural Network (NN; MLPClassifier, 128->64->32 architecture), each tuned via 5-fold stratified cross-validation. Performance was assessed using AUC-ROC, sensitivity, specificity, F1-score, PPV, and NPV.

Results: All three models showed satisfactory performance. LR achieved AUC-ROC = 0.8068 with the highest sensitivity (0.6095), best identifying the oldest-old, though with lower specificity (0.8462) and accuracy (83.1%). RF yielded the highest AUC-ROC (0.8473) and accuracy (92.1%) with strong specificity (0.9758) but lower sensitivity (0.1429). NN produced intermediate performance (AUC-ROC = 0.7778; sensitivity = 0.3619; specificity = 0.9369). Cross-validation AUC-ROC was higher for RF (0.9952 ± 0.0011) and NN (0.9834 ± 0.0012) than LR (0.9396 ± 0.0028), suggesting overfitting in complex models. Key discriminating factors included lymphocyte percent, neutrophil percent, mean corpuscular volume, hematocrit, household size, income-to-poverty ratio, physical activity, and marital status.

Conclusions: ML models effectively distinguish the oldest-old (80+) from the young-old (60–79) using NHANES data. LR demonstrated superior clinical utility due to highest sensitivity, while RF achieved the highest overall discrimination. The gap between cross-validation and test performance highlights the importance of held-out validation. Hematological indices and socioeconomic factors were the most discriminating variables, with implications for targeted interventions for the rapidly growing oldest-old population.

Key words: Oldest-old, Young-old, Aging, Machine learning, NHANES, Logistic regression, Random forest, Neural network, Hematological biomarkers, Gerontology

Selection, Optimization, and Compensation Strategies and Survival to Age 100: Findings from the SONIC Study

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Background: Selection, Optimization, and Compensation (SOC) strategies are life-management strategies that help individuals maintain well-being against functional decline. SOC strategies consist of selecting goals, optimizing resources, and compensating for losses. Previous studies have shown associations between physical, cognitive, and social resources and SOC use among the young-old and old-old (Jopp & Smith, 2006; Wang & Tsai, 2021). Centenarians also use compensation strategies to maintain daily lifestyles, as suggested by interview studies (Milevsky, 2021), but whether SOC contributes to longevity remains unclear.

Objective: This study examined whether the frequency of SOC use predicts survival to age 100 and explored the association between SOC use and resources. Method: Participants were 209 community-dwelling Japanese people (47.4% male; mean age =89.94, range=88-92, SD=0.92) from the longitudinal cohort study of Septuagenarians, Octogenarians, and Nonagenarians Investigation with Centenarians (SONIC) in Japan. The mean follow-up was 7.27 years (SD=3.56), during which 75.1% of participants died. Participants were classified into four groups based on gender and centenarian status: male non-centenarians (39.71%, N=83), male centenarians (7.66%, N=16), female non-centenarians (35.41%, N=74), female centenarians (17.22%, N=36). SOC strategies, physical function, cognitive function, and social relationships were assessed. SOC was measured using a 12-item, 2-point scale comprising elective selection, loss-based selection, optimization, and compensation. Analyses included Mann-Whitney U tests, correlations, and restricted mean survival time analysis.

Result: SOC score did not differ by centenarian status. In males, SOC, physical function, cognitive function, social relationships, and centenarian status were not correlated with one another. In females, only physical function correlated with centenarian status (r =.20), and optimization strategy correlated with physical function (r =.34). The slope in the correlation between SOC and physical function differed by centenarian status in males. In the Cox regression analyses, SOC did not predict survival and showed neither mediating nor moderating effects on the association between physical function and survival.

Conclusion: SOC did not predict survival due to the dominant influence of physical function in the oldest-old. However, the steeper slope between SOC and physical function among male centenarians suggests SOC may relate to resources differently for those who eventually reach age 100. To clarify when such patterns emerge, future studies should examine the 70s and 80s, when biological constraints are less severe, and SOC effects can be more clearly observed.

Key words: Selection optimization compensation strategies, Survival time analysis, Longitudinal cohort study

Transforming Longevity into Healthy Living: Effects of a Multi-Component Lifestyle and Home-Based Self-Monitoring Intervention in Older Adults—A Randomized Controlled Trial

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Background: Global life expectancy has increased substantially; however, longer lifespan does not necessarily translate into healthy ageing. Metabolic syndrome (MetS) remains a major public health concern, with an estimated global prevalence of approximately 28% in 2023, affecting nearly 1.54 billion adults worldwide. Evidence from centenarian studies suggests that exceptional longevity is strongly associated with modifiable lifestyle factors—including predominantly plant-based dietary patterns, regular physical activity, stress regulation, and social connectedness—underscoring the need for integrated strategies that extend healthspan alongside lifespan.

Aim: To evaluate the effectiveness of a multi-component lifestyle intervention integrated with a home-based digital self-monitoring health system in improving MetS and psychosomatic symptoms among older adults.

Methods: In this randomized controlled trial, 107 older adults with central obesity and at least two additional MetS components, along with concurrent psychosomatic symptoms, were assigned to either an intervention group or a waitlist control group. The intervention included structured multidisciplinary training with ongoing support and access to an eHealth system for daily tracking of physical activity, dietary intake, mindfulness practice, perceived stress, and physiologic parameters. Outcomes were assessed at baseline (T0) and post-intervention (T3) using blood biochemistry, anthropometric measures, WHO Integrated Care for Older People (ICOPE) assessments, validated health questionnaires, and focus group–based process evaluations. Ninety participants (84%) completed the study.

Results: Generalized estimating equation analyses demonstrated significant improvements in blood pressure, lipid profiles, and prediabetes risk in the intervention group compared with controls. Participants also reported improved sleep quality, reduced chronic pain, enhanced social engagement, and greater perceived social support. Clinically meaningful changes were observed, with 26% and 47% of intervention

participants achieving ≥5% reductions in body weight and visceral fat, respectively.

Conclusion: A digitally supported, multi-component lifestyle intervention significantly improved cardiometabolic and psychosocial outcomes among older adults with MetS. Integrating centenarian-informed lifestyle principles with home-based self-monitoring may offer a scalable strategy to promote healthy ageing and extend healthspan.

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SESSION 6

Pathways to Exceptional Longevity in Centenarians

Moderator: Karen Siu-Lan Cheung, Jeonghwa Lee

The Impact of Family Structure and Living Arrangements on the Health of Centenarians in Urban and Rural China

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Against China's profound population aging and shrinking family size, the changing family structures and living arrangements of Chinese centenarians reflect the transformation of traditional family-based eldercare and urban-rural bifurcation. Drawing on CLHLS data from 2008 and 2018, this study analyzes decade-long trends in living arrangements and family structures of centenarians and their health impact mechanisms from the urban-rural dual structure perspective. Findings reveal that under filial piety norms, intergenerational co-residence remains dominant in both urban and rural areas, yet its proportion declined over the decade, while living alone remained stable and institutionalization, though still low, showed an upward trend. Average co-residing household size shrank from 3.03 to 2.65 persons. Family structure exhibited nuclearization: three-generation co-residence declined while spouse-only and two-generation arrangements rose, mirroring the waning of the traditional extended family model. Significant urban-rural disparities persisted: rural areas had higher proportions living alone, while the upward trend in institutionalization was more pronounced in urban areas; nevertheless, family-based eldercare remained the absolute mainstream in both settings. Binary logistic regression revealed a dual mechanism of health selection and care adaptation: centenarians living alone or with spouse only exhibited significantly better physical self-maintenance capacity and cognitive function, indicating that only those in relatively good health could maintain independent living, a selective effect more pronounced in rural areas. Conversely, institutionalization and transition to two-generation co-residence were adaptive strategies responding to functional decline when family care resources were strained, reflecting pragmatic adjustments under eldercare pressure. Policy recommendations include: accelerating rural elder care service development to support rural centenarians living alone; addressing growing urban institutional care demand by improving inclusiveness and accessibility; and sustaining intergenerational co-residence benefits through family support and respite care policies, thereby preserving the cultural resilience of Chinese family eldercare while constructing an integrated social old-age security system for the longevity society.

Key words: Chinese centenarians, Living arrangement, Family structure, Health, Urban-rural dual structure

Who Cares for Centenarians Living Alone?: A Regional Comparison of Daily Living Support

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Background/Objective: This study explored the daily living support systems of community-dwelling centenarians living alone, amid rapid population aging and the rise of single-person elderly households. Centenarians were operationally defined to include semi-centenarians aged 95–99, and the study examined primary caregivers across daily living domains and differences by residential type, considering regional variation based on distance from metropolitan areas.

Methods: Data were collected through in-person visits (2023-2026) with 114 community-dwelling centenarians living alone (metropolitan Gwangju: n=33, peri-urban rural Hwasun: n=28, typical rural Goheung·Boseong·Gochang: n=53). Seven daily living domains were assessed: basic living skills, housework, administrative tasks, shopping/medical visits, social activities, household repairs, and financial management. Caregivers were classified as self, family, formal care resources (care workers, living support workers, social workers), and friends/neighbors. Descriptive statistics and cross-tabulation analyses were conducted using SPSS 25.

Results: Metropolitan centenarians relied primarily on family, self, and formal care resources, with no assistance from friends/neighbors. Peri-urban rural centenarians reported self as the most common, followed by family, formal care resources, and friends/neighbors, while typical rural centenarians showed a similar pattern. Formal care resource utilization was lower in peri-urban rural and typical rural areas compared to metropolitan areas, while informal support from friends/neighbors — absent in metropolitan areas — was observed in rural settings. Domain-specific analyses revealed significant differences in housework and household repairs. In housework, family involvement was markedly low across all regions, with formal care resources filling this gap in metropolitan areas, while peri-urban rural and typical rural centenarians predominantly managed independently. In household repairs, family was the primary source across all regions, yet friends/neighbors played a notable role in typical rural areas.

Conclusion: Metropolitan areas showed a prominent role of formal care resources, while rural areas demonstrated relatively higher self-management rates, with a small but notable presence of non-familial informal support networks, such as friends and neighbors, confirmed in rural settings. This study recommends: strengthening formal care resource expertise and service quality for metropolitan centenarians; expanding outreach services and transportation support in rural areas; fostering mutual aid networks utilizing non-familial informal support such as friends and neighbors in rural communities; and building community-based care systems to compensate for the weakening caregiving role of families across all regions.

Keywords: Centenarian, Living alone, Daily living support, Primary caregiver, Urban-rural comparison

Resilience as the Key to Longevity: How Do Centenarians Cope with Changes and Critical Life Events?

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In Poland during last two decades, the group of people who have reached the symbolic age of 100 has increased more than 13-fold, and in the last year alone (2024-2025) there were almost 1,600 new additions. Data indicates an increase in the number of centenarians from approximately 800 in the early 2000s to over 10,400 in 2025 – this is one of the clearest signals of the strong demographic change in Poland.

Methodology: The main goal of this presentation is to analyze the role of resilience (mental resilience) as a key adaptive mechanism that enables centenarians to maintain of psychological well-being in the face of the permanent crisis of losses/grief. A collective case study (multcase study) was employed in the research (Stake, 2009), with an in-depth interview (IDI) and The Brief Resilience Coping Scale (BRCS). The study encompassed seven cases (between 98- and 106 years) living in the area of Krakow. The respondents were in a good intellectual condition.

Results: Each participant cited the loss of a loved one, parent, partner, or child as a critical life event. The resources that helped them recover from such events included religion (faith) and a flexible approach to life, accepting changes beyond their control. This attitude indicates that despite the occurrence of difficulties or critical life events, these individuals were able to function adaptively. Individual psychological testing confirmed a high level of resilience in the subjects. The conclusions from the analyses may indicate that resilience in centenarians is a dynamic, adaptive process that evolves throughout life.

Biological Age and Immune Ageing in Sicilian Semi- and Supercentenarians

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Sicilian semi-supercentenarians (aged ≥105 years) and supercentenarians (≥110 years) represent a unique model of successful ageing, having survived exceptional environmental and infectious challenges, including the Spanish influenza and COVID-19 pandemics. This study investigates their immuno-inflammatory profile to better understand the mechanisms underlying their extraordinary longevity.

In our studies, a Sicilian cohort (n = 249; age range 19–111 years) was analysed and stratified into age groups ranging from young adults to supercentenarians. Composite inflammatory indices (INFLA-score and SIRI), T-cell subsets (αβ and γδ), B cells, and Natural Killer (NK) cells were assessed by flow cytometry. Biological age was evaluated through age-correlation analyses based on inflammatory and senescence-like related parameters.

Systemic inflammatory markers (e.g., INFLA-score and SIRI) significantly increased with chronological age in the overall cohort. However, semi- and supercentenarians displayed values not significantly different from those observed in young adults, suggesting an efficient control of inflamm-ageing. Age-correlation analyses further revealed a marked dissociation between chronological and biological age in extreme longevity. While most individuals followed the expected age-related increase in biological ageing markers, a substantial proportion of ultra-centenarians present a biologically younger phenotype despite their advanced chronological age. From an immunological perspective, ageing was associated with a decline in naïve T cells accompanied by an expansion of NK cells and terminally differentiated effector memory T cells (TEMRA), particularly within CD8+ and Vδ1 subsets, which reached their highest levels in the oldest centenarians.

These findings support the concept that immune ageing in supercentenarians is not characterised by a uniform decline, but rather by a process of differential adaptation. The coexistence of controlled inflamm-ageing preserved biological age, and compensatory immune remodelling may allow these individuals to effectively cope with lifelong antigenic and inflammatory stress, ultimately contributing to exceptional human longevity and healthier ageing trajectories.

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