Future Directions in Ageing Research
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Figure 4.
Female Life Expectancy in Developed Countries: 1840-2009

Biology of Ageing
Ageing Population
Ageing Independence Autonomy
Ageing and cognition
Ageing and Technology

Ageing and Mental Health
Chronic Disease and Ageing
Ageing and Health Care Costs
Ageing Productivity Economics
Ageing and Physical Activity

Ageing and the Built Environment
Ageing and Assistive Technologies
Ageing and Food and Nutrition
Ageing and Inter-generational Dependency
Ageing and Social Support

University of South Australia
Sansom Institute for Health Research
• Multitude of complex systems
• This is a superb example of interdisciplinary intersects
• Each has its own powerful research base and research directions

In regard to future research directions where would you start?

WHO intergenerational depiction
Fundamentals of Ageing

Shifts in collective life spans as a species

Biology of Ageing

Biology of Successful Ageing

What R&D?

![Graph showing functional capacity over age](image)

- Early Life
- Mid life
- Old life
Economics and Environmental Aspects of Ageing

- Shifts in collective life spans as a species
- Biology of Ageing
- Biology of Successful Ageing

Ageing and Economic Productivity
Ageing and Health Care Costs
Ageing and the Built Environments
Ageing and Intergenerational Dependency

What R&D?
Functional Capacity

Early Life: Prevention
Mid Life: Prevention
Old Life: Prevention

What R&D?
- Food/nutrition/exercise/lifestyle
- Early detection
- Information transfer
Future Directions in Ageing Research

What R&D?

- They are all important
- Issue is the R&D leverage i.e. what could make the most difference
R & D Leverage Points

Biology of Ageing

Biology of Successful Ageing

Successful R&D should provide the understanding for prolonging wellbeing/autonomy and independence

Prevention

Food/nutrition/exercise/lifestyle

Early detection

Information transfer

Successful R&D should provide the understanding for prolonging wellbeing/autonomy and independence
R & D Leverage Points

What do we see with the Biology of prevention?
Biology of Prevention

Chronic disorders

- Neurodegenerative
- Cancer
- Cardiovascular disease
- Obesity

Antibacterials

Public Hygiene

Nutrition

Florey

Fleming

Snow
Biology of Ageing

Research that leads to early detection is critical

Atherosclerosis

- Gertler et al 1950
- Plasma Cholesterol
- Gofman et al 1950
- Low Density Lipoproteins
- Albrink and Mann 1959
- Plasma Triglycerides

Cardiovascular disease

Essential Hypertension

Actuarial Society of America and Association of Life Insurance Medical Directors 1941
Alzheimer’s Disease

- Characterised by large amyloid plaques in the brains of affected individuals
- Main component of amyloid plaques is aggregated Amyloid-β peptide (Aβ)
- Soluble oligomers of Aβ are thought to be neurotoxic

*Dr Alois Alzheimer*

Human AD brain showing Amyloid plaques labelled with an anti-Aβ
Biology of Prevention
Alzheimer’s Disease

APP cleavage → sAβ → Increased sAβ production → Conformationally altered Aβ → Neuritic plaques

APP mutations → Trisomy 21 → Increased sAβ production

Presenilins mutations → Metal ions → ApoE4 and other pathological chaperons

Production of more amyloidogenic sAβ

Local factors (pH, free radicals, etc.)

APP mutations → Oxidation

Presenilins mutations → Neurofibrillary tangles

Neuronal damage

Amyloid fibrils

Dementia → Vascular amyloid
Biology of Prevention

Aβ(18-41) tetramer structure

VFFAEDVGSNKGAIIGLM35VGGVVIA42

Area (per monomer) Sc
AC(BD)=575 Å²  0.64
AD(CB)=273 Å²  0.77
AB(CD)=217 Å²  0.65
Total = 1065 Å²
Probe sphere radius=1.7Å
Biology of Prevention
Alzheimer’s Disease

Abnormal
- Amyloid-β (CSF/PET)
- Synaptic dysfunction (FDG-PET/ffMRI)
- Tau-mediated neuronal injury (CSF)
- Brain structure (volumetric MRI)
- Cognition
- Clinical function

Clinical Disease Stage
Normal → Preclinical → MCI → Dementia
Biology of Ageing

What do we see with the Biology of Ageing?

• Telomeres
• Mitochondria
• Micronucleus

Micronucleus formation

Nucleoplasmic bridge formation

Dietary reference values of individual micronutrients and nutriomes for genome damage prevention: current status and a road map to the future. American Society for Nutrition. Michael F Fenech
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