Canadian Longitudinal Study on Aging: Advancing the Science of Aging through Interdisciplinary Research

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The Aging Revolution

- The rapid and continuing increase in human survival.
- New scientific understanding of the ageing process.
- The changing nature of old age and its determinants.
- Expectations, adjustments and policy.

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Demographic Futures

- Upward trend in life expectancy continue, cease, or reverse?
  - + Effective interventions against age-related diseases
  - + Improved environment for ageing
  - + Life-cycle deceleration (delayed reproduction)

  - - Adverse effects of excess nutrition
  - - Adverse effects of alcohol and drug abuse
  - - Adverse effects of increasingly sedentary lifestyles
  - - Life-cycle acceleration (early maturation)

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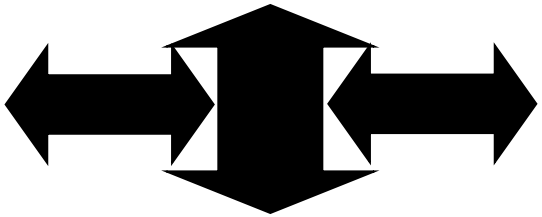
Why ageing occurs

Intrinsic



Extrinsic

How ageing is caused

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What Accounts for the Individuality of Human Ageing?

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Genetic Heritability of Human Lifespan

Cournil & Kirkwood *Trends in Genetics* 2001

Twin Studies

▪ McGue et al (1993)	0.22
▪ Herskind et al (1996)	0.25
▪ Ljungquist et al (1998)	<0.33

Traditional Family Studies

▪ Philippe (1978)	0-0.24
▪ Bocquet-Appel & Jakobi (1990)	0.10-0.30
▪ Mayer (1990)	0.10-0.33
▪ Gavrilova et al (1998)	0.18-0.58
▪ Cournil et al (2000)	0.27

Genes account for 25% of what determines longevity

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Extrinsic Factors Beyond Biology

- Nutrition
- Lifestyle
- Social
- Psychological
- Physical Environment
- Chance

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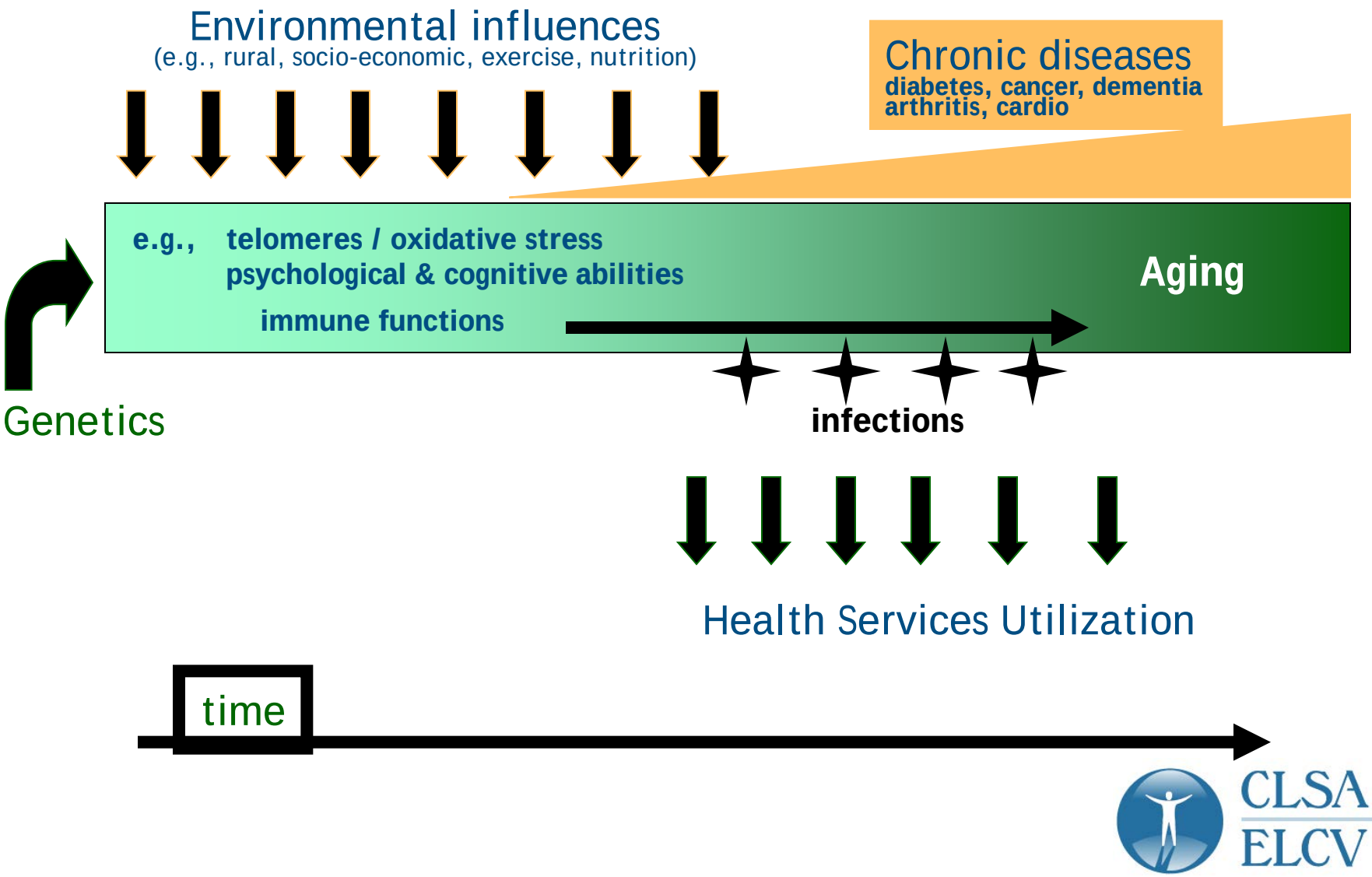
Need for Integration to Understand Aging and Health



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Policy Needs

- Changing demographics #1 priority of Canadian Federal and Provincial Governments
- Healthy aging is important to the Canadian public and policy makers
- Canada differs from other countries in its:
  - health and social policy
  - health care delivery systems
  - climate, environment, geography, and
  - retirement policy and pension programs
- Seniors of tomorrow have different needs and expectations
  - major implications & challenges for the health care system and for social programs

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Scientific Evidence

More than 70 longitudinal studies worldwide

- Most studied people over age of 65
- Many collected lot of information on social factors or retirement but lack detailed information on health, especially clinical and biological measures or vice versa
- Few looked at the aging process from a mid-life to old age perspective
- Few were population-based studies able to capture the changing individual within a changing context and incorporate multiple levels of inquiry, the cell, the individual and society
- Few studies focused on how individuals cope or adapt to changing circumstances and how it impacts their well-being

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Principal Investigators

Lead PI: Parminder Raina - McMaster University

Co-PI: Christina Wolfson - McGill University

Co- PI: Susan Kirkland - Dalhousie University

Birth and Aging of the CLSA

- Aylmer meeting - 2001
- Protocol development - 2002-2003
- International Peer Review - 2004
- Pilot Phase 1 - 2005
- Pilot Phase 2 - 2006
- Launch - 2008

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The Canadian Longitudinal Study on Aging (CLSA)

- A key strategic initiative of CIHR
  - The Canadian Longitudinal Study on Aging
- More than 160 researchers - 26 institutions
- Multidisciplinary - biology, genetics, medicine, psychology, sociology, demography, economics, epidemiology, nursing, nutrition, health services, biostatistics, population health

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Design Considerations

- Cross-Sectional versus Longitudinal?
- Breadth versus Depth?
- National versus Regional?
- Integrating scientific and policy agenda?

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Overall Aims of the CLSA

- To examine aging as a dynamic process.
- To investigate the inter-relationship among intrinsic and extrinsic factors from mid life to older age.
- To capture the transitions, trajectories and profiles of aging: successful aging.
- To provide infrastructure and build capacity for sustained high quality research on aging in Canada.

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Future of Research on Aging in Post-Genomic Era

- Age-related changes---"complexity"
  - INDIVIDUAL LEVEL
  - SOCIETAL AND CONTEXTUAL LEVEL
- Innovative study design that advance science of aging and health as well as inform health and social policy
- Need for interdisciplinary long-term longitudinal studies

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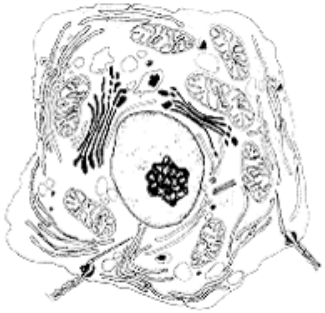
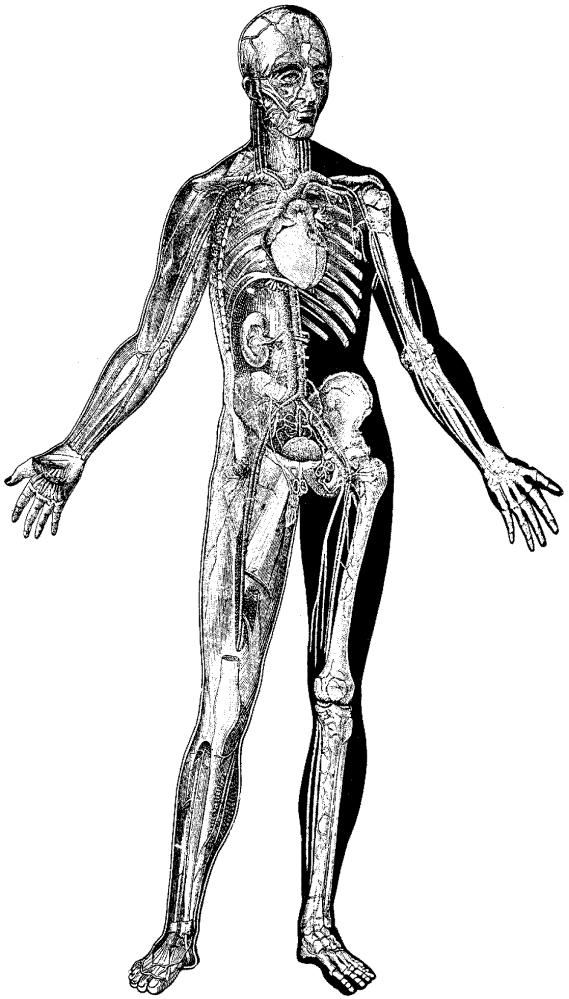


Innovation - Cell to Society



- Mid life to old age
- Quantitative traits
  - Physical
  - Social
  - Psychological
- Gene-environment interactions
- Disease, disability, psychosocial consequences
- Adaptation

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CLSA Program of Research

- Biological Function
  - Genetics/epigenetics
- Physical Function
  - Mobility/Chronic diseases/Injury
- Psychological Function
  - Cognition/Mental Health/Coping
- Social Function
  - Work and retirement/Social Participation/Housing/Economics

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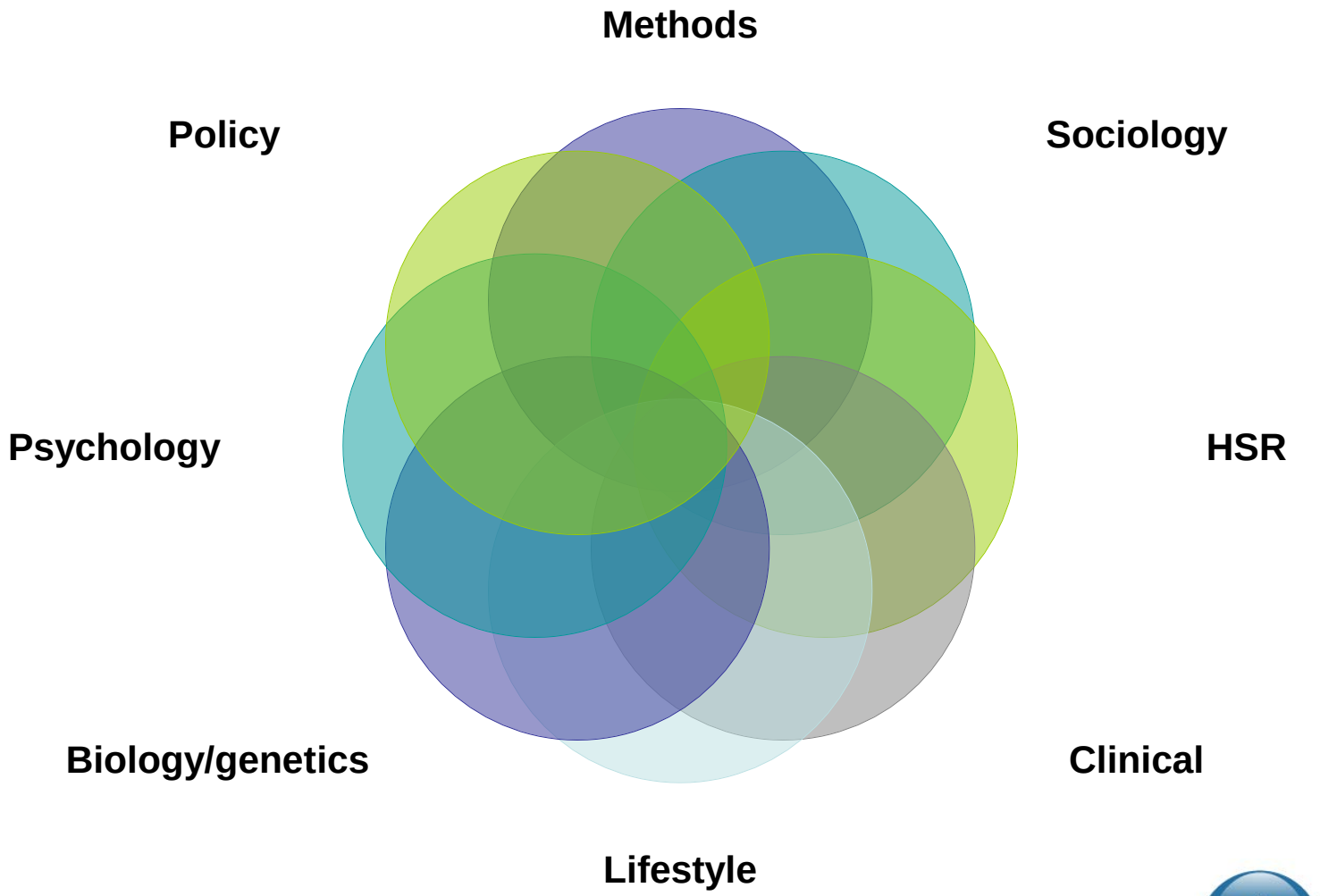
Interdisciplinary Research Agenda



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Focus of Measurement

Biomedical

- Activities of daily living/disability/injuries
- Frailty/co-morbidities
- Chronic diseases
- Cognitive function
- Mental Health
- Oral health
- Vision, hearing
- Medications
- Health Care Use
- Institutional care
- Genetics/Biology
  - Disease susceptibility/longevity genes
  - DNA repair
  - Antioxidant defence
  - Apoptosis, programmed cell death
  - Immunosenescence
  - Telomere loss
- Nutrition

Psychosocial

- Lifestyle/behaviours
- Social networks and social support
- Care giving/Care receiving
- Social care
- Everyday competence, adaptive functioning, coping
- Personality, emotion, psychopathology
- Work to retirement transitions
- Structural inequalities
- Built environments/physical environment/Housing
- Economics/Wealth
- Demograhics
- Healthy aging and well being
- Linkage to secondary data bases
  - Health care use
  - Disease registries e.g. Cancer
  - Drugs
  - Environmental

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Biological Samples

- **Blood based Sample Types**
  - Serum
  - Plasma, heparin
  - Plasma, EDTA
  - Plasma, citrate
  - Whole blood, EDTA
  - Buffy coat
  - Buffy Coat with Trizol
  - Whole Blood, Acid Citrate Dextrose + Dimethyl Sulfoxide
  - Peripheral Blood Mononuclear Cells
- Urine (no preservative)

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Passive Data Collection

- Data linkage at the individual level to existing databases:
  - Administrative databases: physician services, hospitalizations, medications
  - Homecare, community services, mental health
  - Vital statistics: mortality
  - Disease registries: cancer, diabetes surveillance, notifiable diseases, trauma, agricultural injuries
  - Motor vehicle registration and accidents

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Data Linkage

- Data linkage at the macro level to existing databases:
  - By geographical region (postal code)
    - Pollution: air, water
    - Climate: temperature, precipitation
    - Motor vehicle density

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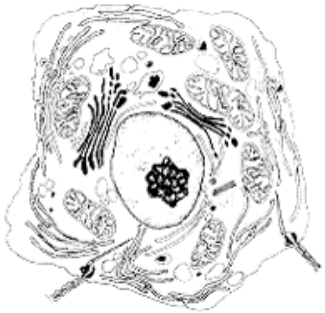

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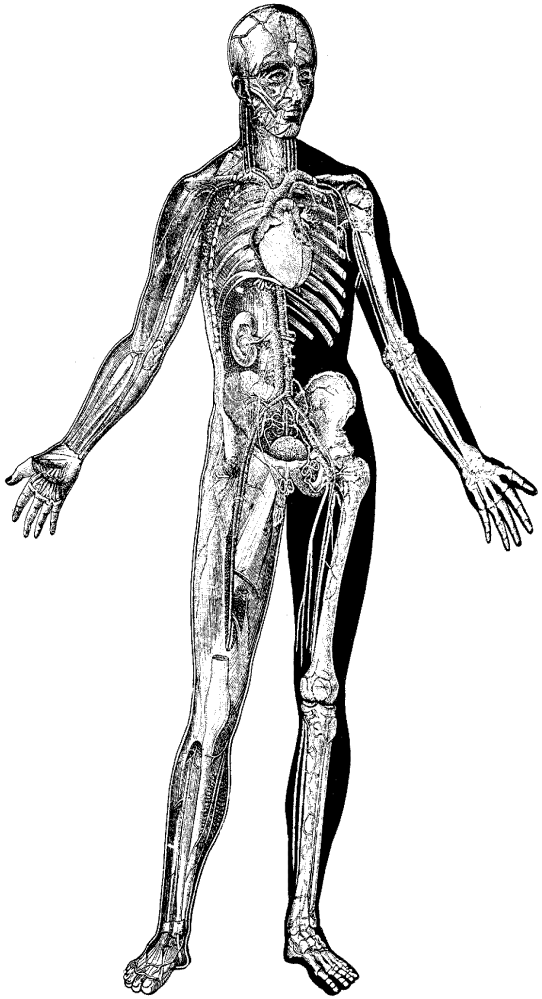

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Example Research Questions: Cognition as a Quantitative Trait

Cognition as a precursor:

- Is decline in cognition (memory, executive function and psychomotor speed) in mid and later life associated with changes in health outcomes?

<u>Cognition as a mediator</u>

- How do cognitive functions mediate or moderate relations between biological/physical status and adaptive functioning and/or social participation?

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Example Research Questions: Cognition as a Quantitative Trait

Cognition as an outcome

- Are epigenetic changes over time associated cognition?

Adaptation

- How do individuals with cognitive change adapt to maintain performance in everyday functioning?

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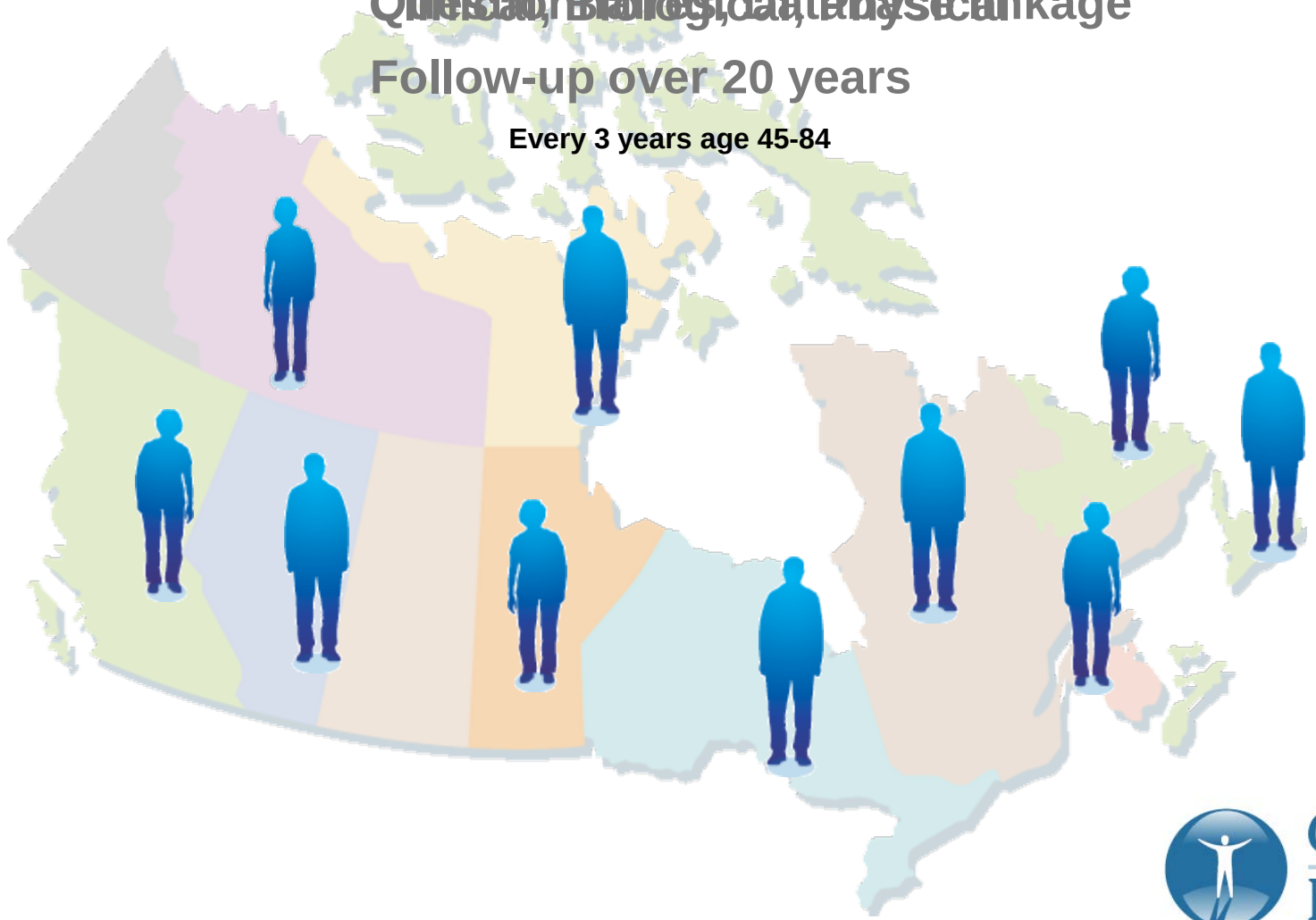
CLSA Architecture

- Participant recruited, 50,000 30,000 (at 10 sites)
- Interview, Biological, Physical
- Questionnaire, Data, Physician linkage
- Follow-up over 20 years
  - Every 3 years age 45-84



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EQUIPMENT AND INFRASTRUCTURE SUPPORTING RESEARCH ON AGING

National Network of Facilities

- ***Biological Processing Centre***
  Bio-banking, biomarker discovery & analysis (located in Hamilton).
- ***Computer-Assisted Telephone Interview Centers***
  Collect health and psychosocial data (located in Halifax and Sherbrooke).
- ***Data Collection Centers***:
  collection of nutrition, physical, clinical data, & biological specimens (*see below).
- ***National Coordinating Center***:
  Oversight, project management, communication for overall initiative (located in Hamilton).
- ***Genetics and Epigenetics Centre***
  Genotyping, epigenetic analysis,& bioinformatics, (located in Vancouver).
- ***Data Management and Statistics***
  assimilation, distribution and analysis of of all CLSA data (located in Montreal).

BIOLOGICAL FUNCTION

PHYSICAL FUNCTION

PSYCHOLOGICAL FUNCTION

SOCIAL FUNCTION

INFRASTRUCTURE — **CLSA AREAS OF RESEARCH**

* Located in St. John's, Halifax, Sherbrooke, Montreal, Ottawa, Hamilton, Winnipeg, Calgary, Vancouver & Victoria.

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Collaboration with Statistics Canada

- CCHS 4.2: Healthy Aging and CLSA
  - CLSA expertise for content development
  - Recruitment for CLSA
  - Cross-sectional versus Longitudinal

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Launch

- First selection of 20,000 started in late 2008 in collaboration with Statistics Canada CCHS Healthy Aging module

- Remaining 30,000 will be recruited in 2010

- CFI application for national infrastructure in October 2008

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Sources of Funding

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  - CIHR, CIHR-IA
- Other Funding Partners
  - FRSQ- Réseau Québecois de Recherche sur le Vieillissment
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