The Northern Ireland Perspective

Prof AJ McKnight

a.j.mcknight@qub.ac.uk

𝕏 @a_j_mcknight

SPACE

SUPPORTIVE ENVIRONMENTS FOR PHYSICAL & SOCIAL ACTIVITY, HEALTHY AGEING & COGNITIVE HEALTH

This work was supported by **UK Research and Innovation** [ES/V016075/1]

UKRI Economic and Social Research Council

UKRI Healthy Ageing Challenge Social, Behavioural and Design Research

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Belfast has changed…

- Behcet's disease
  - 12x higher in NI than GB
  - higher prevalence along silk trade route
  - Linen industry?
- Inflammatory disorders
- Heart and lung diseases

Prevention by design

- Local and global challenges
- Enabling more healthy life years
- Minimising health inequalities
- Reducing burden on health systems

SPACE has broken down silos…

SPACE is starting to identify

- How environmental factors get under the skin to influence health & ill-health
- Different environmental features have more/less impact causing poor health.
- Cause or consequence of impacts? MR

Genetic Biomarkers

- Primarily inherited from our parents; small amount changes as we get older

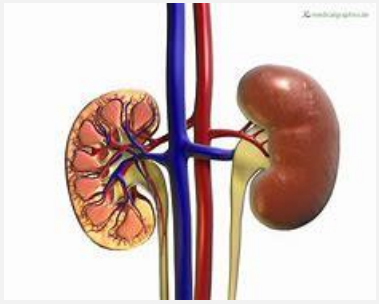
Courtesy of Visual Image Presentations/National Library of Medicine.

Genetic Biomarkers

- Primarily inherited from our parents; small amount changes as we get older

- **Associated with diseases and behaviours → may help prevent & treat**

Epigenetics explains more than genetics lifetime exposures



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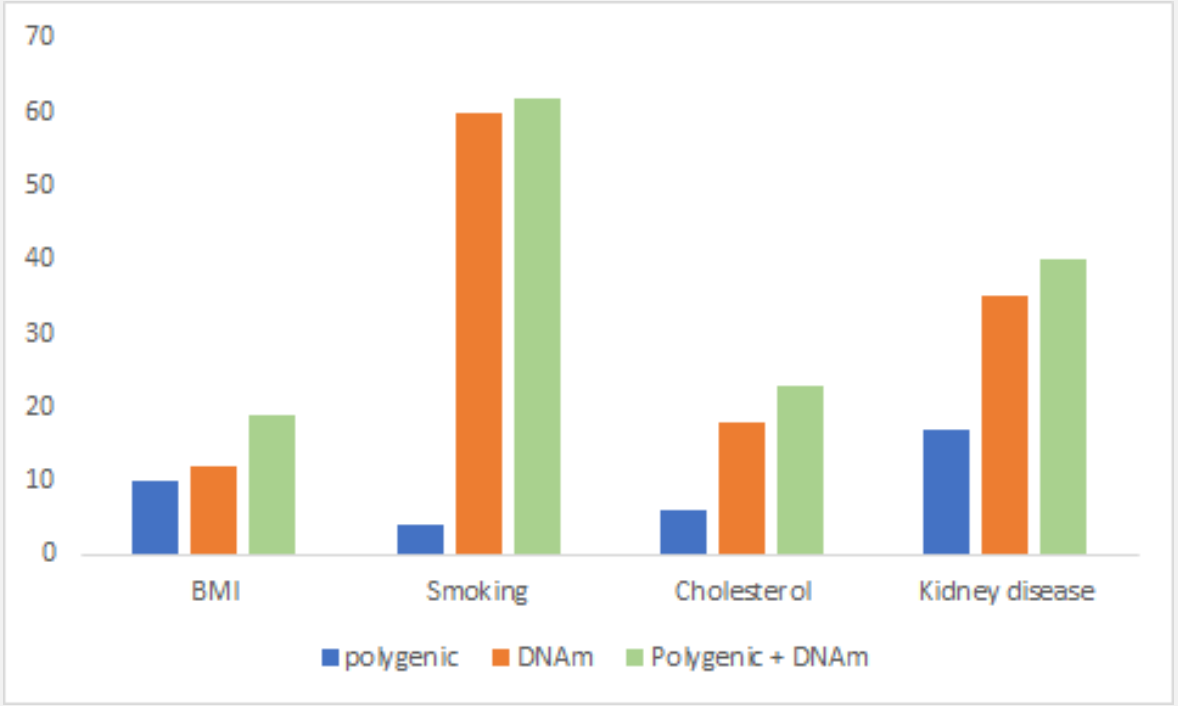
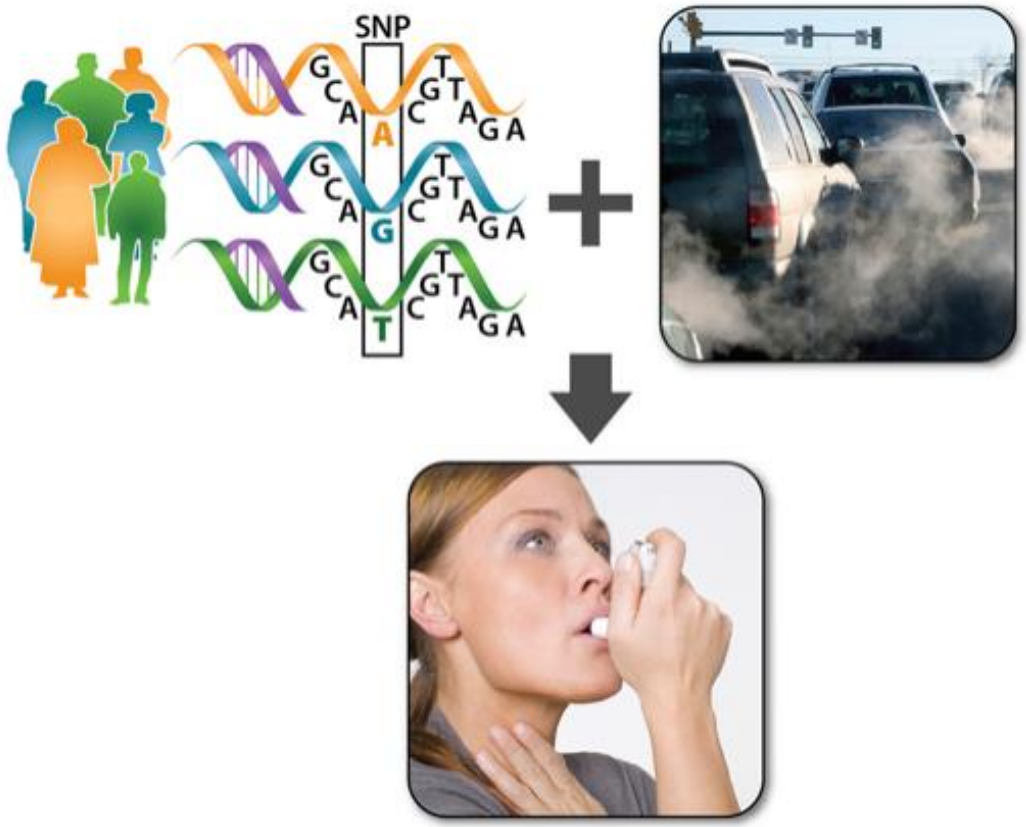


Genetic Biomarkers

- Primarily inherited from our parents; small amount changes as we get older
- Associated with diseases and behaviours → may help prevent & treat
- **Influence how we interact with our environment**

Genetic background and environmental exposure have a synergistic effect…

e.g. Asthma and air pollution



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OUR HEALTH IS LINKED TO THE ENVIRONMENT
where we are born, live, and work

How do external impacts get under our skin to influence disease?

Cognitive decline

Cognitive health

Decreased risk of disease

Increased longevity

Maintain biological processes

DNA methylation

Histone modification

Changes in chromatin structure

Increased risk of disease

Disease progression

Age acceleration

Risk Biomarker

Biological changes in response to environmental stimuli

Epigenetic changes can be risk factors or protect against disease…some damage is reversible!

Risk and time preference

DNA methylation associated with behaviours influencing health outcomes

- ✓ Cornerstones of economic analyses
- ✓ Represent important biomarkers of accumulated, complex determinants
- ✓ Surrogate markers? Link between measurable biomarkers and health behaviours?

Affect home and work environments

EPIGENETICS
2022, VOL. 17, NO. 10, 1159–1172
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RESEARCH PAPER

OPEN ACCESS Check for updates

An investigation into DNA methylation patterns associated with risk preference in older individuals

Laura J. Smyth [a], Sharon M. Cruise [a], Jianjun Tang [b], Ian Young [a], Bernadette McGuinness [a], Frank Kee [a], and Amy Jayne McKnighton behalf of the Northern Ireland COhort for the Longitudinal study of Ageing collaborative group [a]

[a]Epidemiology and Public Health Research Group, Centre for Public Health, Queen's University Belfast, Northern Ireland, UK; [b]School of Agricultural Economics and Rural Development, Renmin University of China, Beijing, China

ABSTRACT

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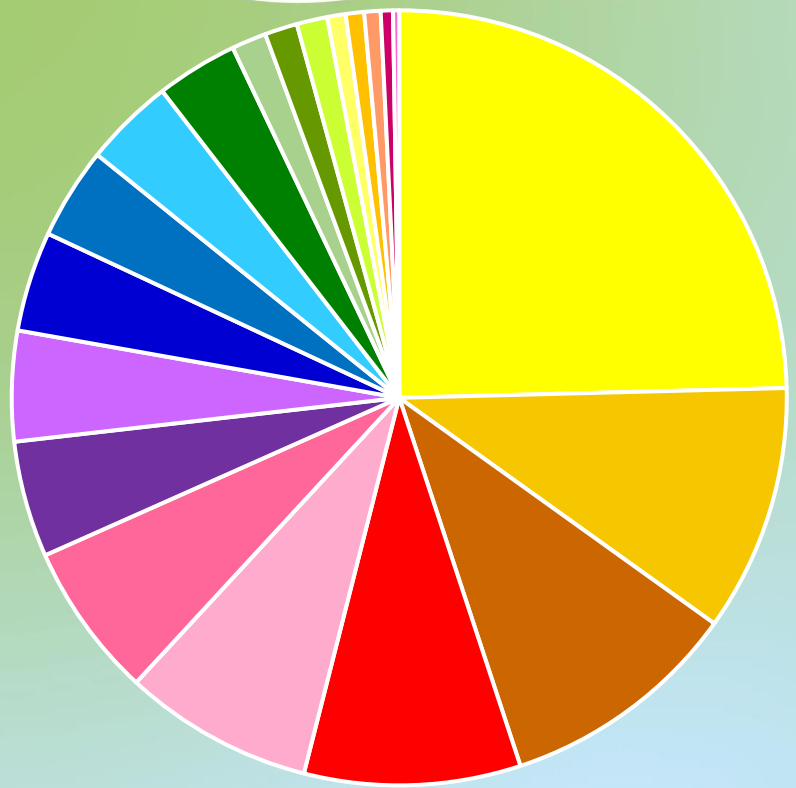
Differential methylation in *CD44* and *SEC23A* is associated with time preference in older individuals

Laura J. Smyth [a,1], Sharon M. Cruise [a,2], Jianjun Tang [b,*,3], Ian Young [a], Bernadette McGuinness [a], Frank Kee [a,4], Amy Jayne McKnight [a,4,5], on behalf of the Northern Ireland COhort for the Longitudinal study of Ageing collaborative group

[a] *Epidemiology and Public Health Research Group, Centre for Public Health, Queen's University Belfast, BT12 6BJ Northern Ireland, United Kingdom*
[b] *School of Agricultural Economics and Rural Development, Renmin University of China, Beijing, China*

Molecular biomarkers of risk and resilience in health



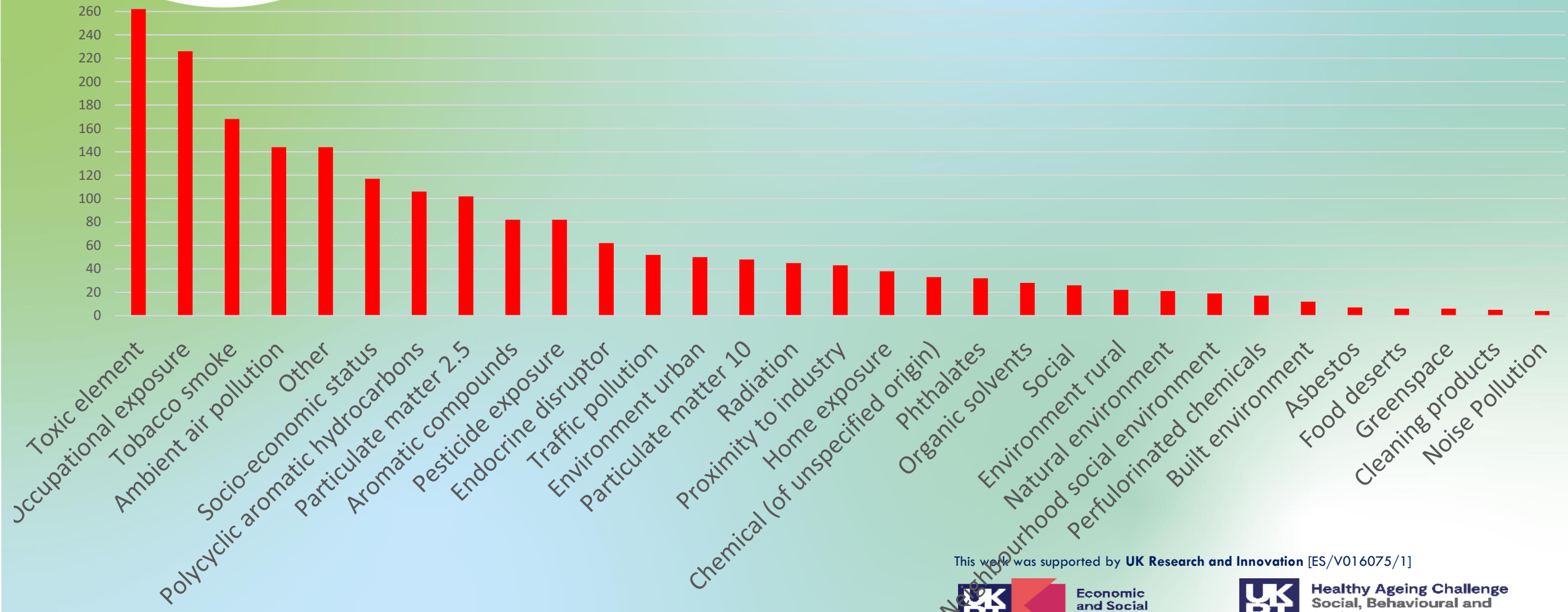
- **Cancer**
- Pulmonary
- Accelerated biological ageing
- **Cardiovascular**
- Other
- Birth outcomes
- Immune
- Neurodevelopmental disorders
- Infertility
- Metabolic
- Inflammation
- Cognitive decline
- Sensory impairment
- Skin
- **Kidney**
- **Premature Death**
- Genotoxicity
- Parkinson's disease
- Musculoskeletal
- Frailty

DNA methylation: epigenetics is the top-ranked molecular biomarker associated with environmental features

Cancer: most frequent health outcome associated with exposures

Molecular biomarkers of risk and resilience in health

Frequencies of reported exposure in systematic review



This work was supported by **UK Research and Innovation** [ES/V016075/1]

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Epigenetic clocks are helping us understand environmental influences on our DNA

Discrepancies between epigenetic and chronological ages indicate accelerated biological ageing

Assess impact of environmental exposures over time

Identification of high-risk individuals susceptible to adverse effects of environmental exposures

Epigenetic Clock Analysis

Identify links between molecular biology, environmental exposures and overall health

Suggest which environmental features have the most health impacts that may be reversed!

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WE ARE IDENTIFYING:

- ✓ Biomarkers associated with environmental stressors.
- ✓ Urban-rural features that have the most impact on health outcomes.
- ✓ Subset of the population susceptible to / resilient from environmental 'toxins'.

Risk biomarkers: improve prevention and optimize management
e.g. lifestyle / behaviour modification, biologically impactful environmental designs.

Resilience biomarkers: the most impactful environmental designs promoting health.

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It represents a collaboration between Queen's University Belfast and partnering organisations from across health, government, third sector, private and public organisations, the NICOLA Advisory Research Group and the SPACE Project Team, without whom the research would not have been possible. Full details are available on our website: qub.ac.uk/sites/space

THE SPACE TEAM

𝕏 @spacequb


Professor Ruth Hunter
Principle Investigator


Professor Bernadette McGuinness
Principle Investigator


Dr Leandro Garcia
Co-Investigator


Professor Jennifer McKinley
Co-Investigator


Dr Ione Avila-Palencia
Research Fellow


Professor Amy Jayne McKnight
Co-Investigator


Professor Trung Q Duong
Co-Investigator


Dr Sean O'Neill
Research Fellow


Dr Shay Mullineaux
Research Assistant


Professor Geraint Ellis
Co-Investigator


Dr Claire Cleland
Research Fellow/
Co-Investigator


Ms Sophie Glover
PhD Student


Ms Katie Quinn
Technician


Professor Frank Kee
Co-Investigator


Selin Akaraci
Research Fellow


Dr Mike Trott
Research Assistant


Professor
Dermot O'Reilly
Co-Investigator


Ms Roisin Corr
Project Administrator


Dr Joanna McHugh
Power
Co-Investigator


Ms Gemma McNickle
Embedded Researcher
(OSNI)


Ms Fareena Naz
PhD Student


Yogesh Gupta
Research Fellow


Ruoyu Wang
Research Fellow


Niamh O'Kane
Research Fellow /
Science
Communication and
Research Impact
Officer


Hüseyin Küçükali
Research Fellow


Michael Donnelly
Involve


Rebekah McCabe
Involve

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