SOCIOECONOMIC STATUS AND HEALTH:
exploring biological pathways

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This thesis describes The Biomarkers of Social Disadvantage study. The initial concept was developed in collaboration with researchers from the National Centre for Epidemiology and Population Health and the Centre for Mental Health Research. Design of fieldwork protocols, data collection, entry and analysis and writing up are my original work.

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Robyn Lucas, BSc MB ChB MPH&TM
A Dedication

To my beloved father,

Jim Lucas,

who died September 24, 2003,
during the final stages of thesis preparation.
Acknowledgements

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Abstract

The cross-sectional Biomarkers Study was undertaken in Canberra, Australia (2000-2002) to examine the role of psychosocial factors in the socioeconomic health gradient, via physiological changes consequent upon activation of the neuroendocrine stress response.

The study population was derived from healthy 40-44 year old men and women already participating in a longitudinal cohort study. Using data from the cohort study, four groups with similar occupational status were formed. The study sample was randomly selected within these groups, thus representing the socioeconomic spectrum.

A pilot study involved 60 participants with blood and saliva samples measured on two occasions. A further 302 people had blood and saliva samples taken on one occasion. Socioeconomic status was measured by occupational code and status, personal and household income, education and perceived position in the community and in Australia. Psychosocial and behavioural factors, including job strain, job security, coping style, anxiety, depression, optimism, self-esteem, sense of belonging and trust, social support, smoking, exercise and alcohol intake were assessed by self-report. Five biological parameters: plasma fibrinogen, glycated haemoglobin, waist-hip ratio, serum neopterin and salivary IgA were measured as outcome variables. Three hypotheses were tested:
1. There is a socioeconomic gradient in measures of psychosocial stress, and of psychological resilience.

2. There is a socioeconomic gradient in biological measures that have a plausible association with future disease.

3. Psychosocial factors mediate the demonstrated association between socioeconomic status and the biological measures.

Data analysis confirmed a socioeconomic gradient in some psychosocial and behavioural variables: economic strain (r=-0.44, p<0.001), job demands (r=0.45, p<0.001), job control (r=0.26, p<0.001), active coping style (r=0.28, p<0.001), sense of optimism (r=0.24, p<0.001), social capital (r=0.26, p<0.001), job security (r=0.17, p=0.002), job marketability (r=-0.16, p=0.005), sense of belonging (r=0.22, p<0.001), number of adverse life events (r=-0.13, p=0.01) and positive interaction with family and friends (r=0.20, p<0.001), vigorous physical activity (r=-0.16, p=0.002), alcohol consumption (r=0.30, p<0.001) and smoking status (r=-0.25, p<0.001). There was no socioeconomic gradient in anxiety, depression, neuroticism, hostility, locus of control, self-esteem, perceived stress or mental health (SF-12). Four of the five biological markers varied with socioeconomic status: plasma fibrinogen (female (F): r=-0.26, p=0.002, male (M) r=-0.08, p=0.30), glycated haemoglobin (F: r=-0.23, p=0.01, M: r=-0.11, p=0.17), waist-hip ratio (F: r=-0.19, p=0.03, M: r=-0.27, p<0.001), serum neopterin (F: r=-0.21, p=0.009, M: r=-0.04, p=0.56), salivary IgA (F: r=-0.07, p=0.38, M: r=0.004, p=0.97). A more adverse biological profile was associated with lower socioeconomic status. Work characteristics, coping style, smoking and exercise were particularly important mediators of the association between the biological markers and socioeconomic status. Particular psychosocial
factors were consistent mediators of the association between specific biomarkers and socioeconomic status (with little variation for different measures of socioeconomic status). However, the particular psychosocial factors providing significant mediation varied for the different markers.

In this sample of healthy 40-44 year olds, four out of five biological markers showed moderate socioeconomic variation with a more favourable profile associated with higher SES. The data provide limited support for the importance of psychosocial factors in the socioeconomic health gradient.
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Glossary

**Acrophase**: The time of the day when an individual is typically at his/her highest level of the characteristic of interest.

**Acute phase response**: a physiological response to injury (and probably stressor exposure), mediated by cytokines and glucocorticoids, which results in the hepatic release of acute phase proteins (including fibrinogen, haptoglobin and C-reactive protein), as well as mediators of pain, leukocyte trafficking and vessel permeability.

**Adrenocorticotrophin hormone** (ACTH): a hormone released from the anterior pituitary gland under control of CRH and negative feedback control from cortisol levels. ACTH stimulates the adrenal cortex to produce glucocorticoids, of which cortisol is of primary importance in human physiology.

**Autonomic nervous system** (ANS): A subdivision of the motor nervous system of vertebrates that regulates the internal environment. It consists of parasympathetic and sympathetic divisions.

**Corticotrophin releasing hormone** (CRH): produced primarily by the parvocellular neurons in the paraventricular nuclei of the hypothalamus and stimulating the anterior pituitary release of ACTH. There are also CRH-producing neurons in the paragigantocellular and parabranchial nuclei of the medulla and the locus coeruleus allowing communication between the fast and slow stress responses.
**Cortisol**: a steroid hormone released from the adrenal cortex. Cortisol has multiple effects on the metabolic system resulting in increased blood glucose and may suppress the immune system.

**Cytokines**: protein factors secreted by macrophages and helper T cells as regulators of neighbouring cells, e.g. tumour necrosis factor alpha (TNF-α), interleukin 6 (IL-6).

**Gini coefficient**: A quantitative measure of inequality, based on the Lorenz curve. The higher the Gini coefficient, the greater the level of inequality.

**Glucocorticoid receptor** (GCR): the cytoplasmic receptor to which glucocorticoids attach to exert their intranuclear action on target genes.

**Hypothalamic pituitary axis** (HPA): Incorporates the hypothalamus, hormone releasing factors, the anterior and posterior pituitary and the hormones released from these regions.

**Interleukins**: specific cytokines released by different T cells of the immune system. Currently interleukins are labelled 1-15, i.e. IL-1, IL-2 etc.

**Lymphocytes**: A family of white blood cells. Lymphocytes that complete their development in the bone marrow are called B cells, and those that mature in the
thymus are called T cells. T cells are further differentiated based on a cluster of differentiation (CD) number, e.g. CD 4.

**Parasympathetic nervous system** (PNS): A division of the autonomic nervous system, that enhances body activities that gain and conserve energy, such as digestion and reduced heart rate.

**Sympathetic adrenal medullary** (SAM) system: The combination of the pathways of the sympathetic nervous system and the adrenal medulla, activation of which results in the release of adrenaline.

**Sympathetic nervous system** (SNS): A division of the autonomic nervous system that generally increases energy expenditure and prepares the body for action.