Preventing Chronic Disease

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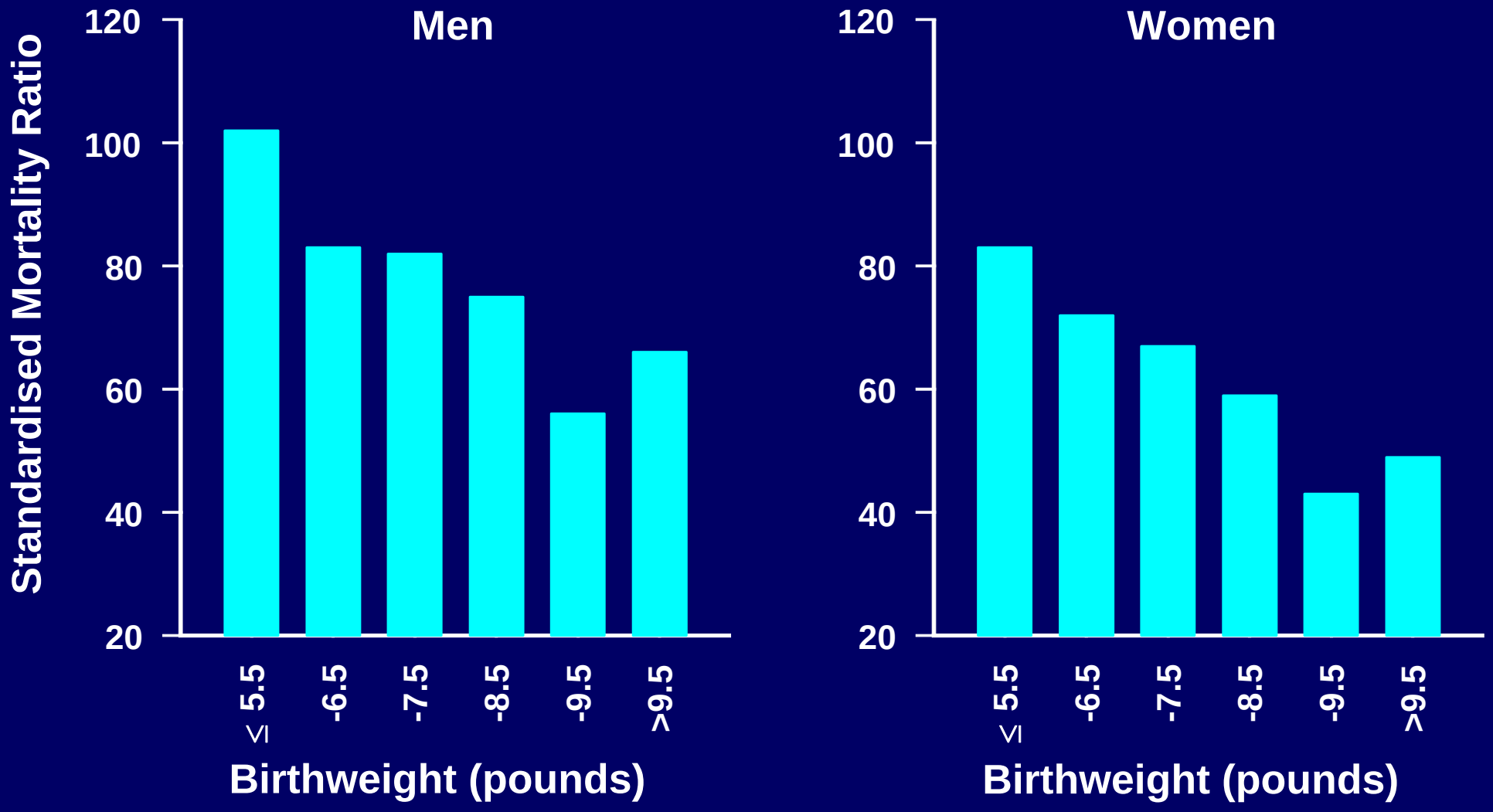
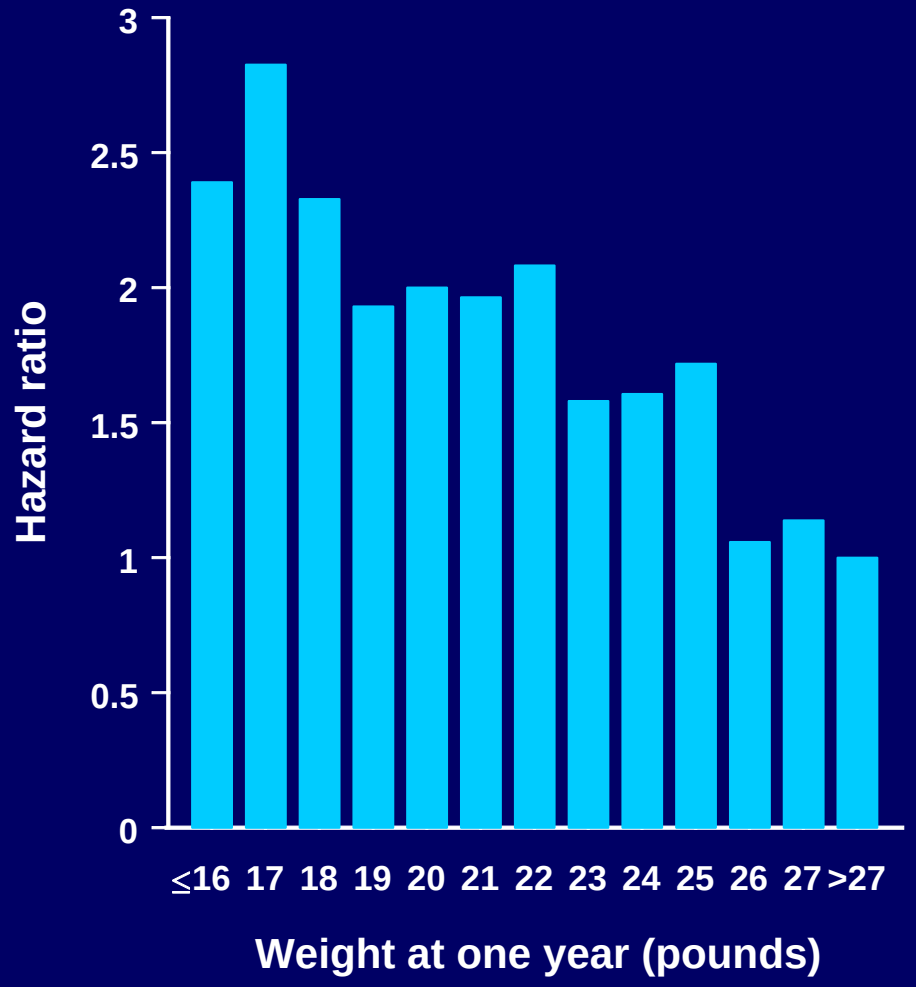
The fetal origins of chronic disease

- Coronary heart disease, Type 2 diabetes, hypertension, osteoporosis and asthma originate in developmental plasticity, in response to malnutrition during fetal life and infancy
- Certain cancers also originate in this way

Mortality from coronary heart disease in 15726 men and women in Hertfordshire



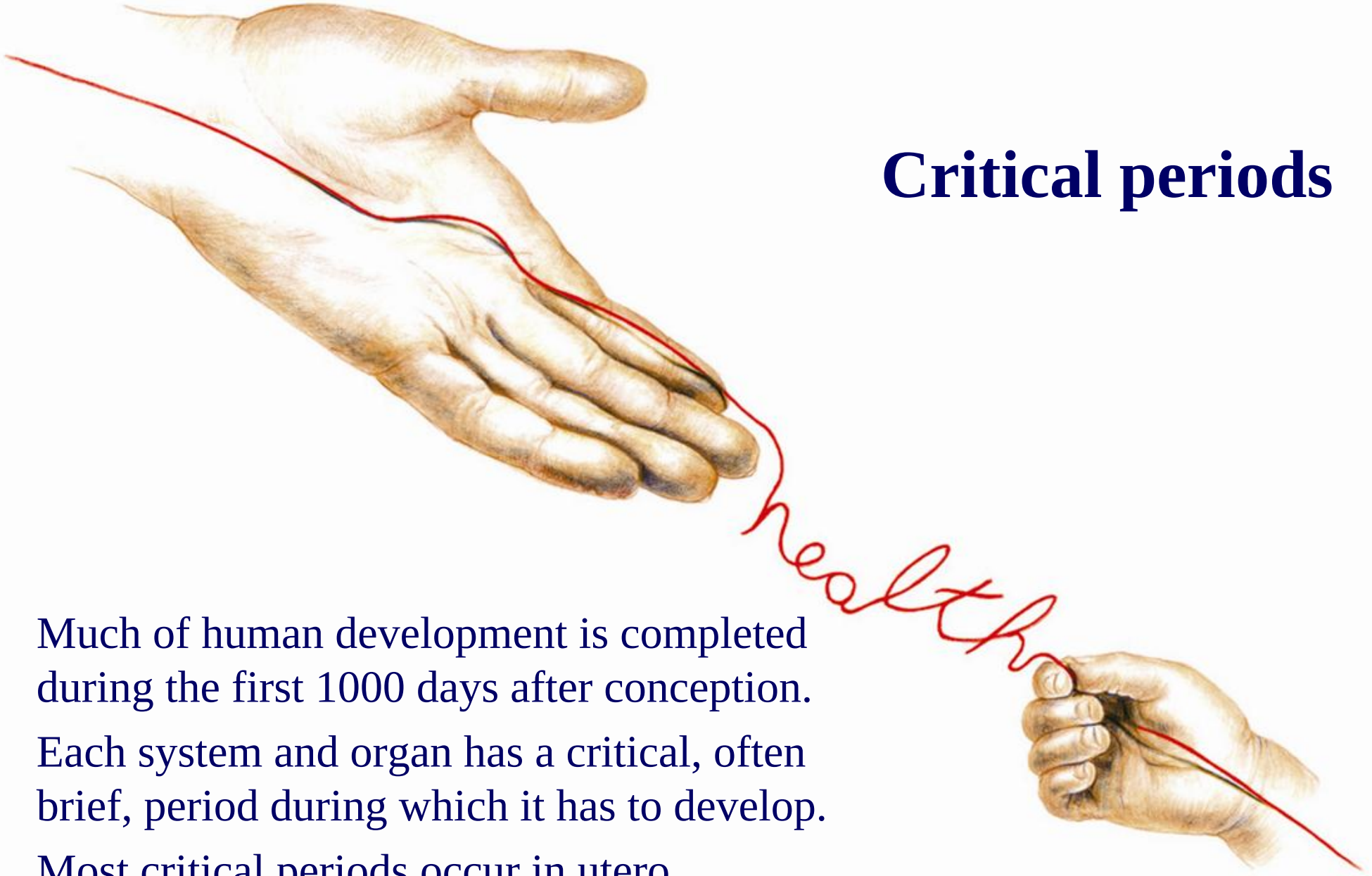
Hazard ratios for coronary heart disease in men



Programming

Malnutrition and other adverse environmental exposures during development alter gene expression and programme the body's structures and functions for life. Adverse exposures also result in slow growth and small body size.

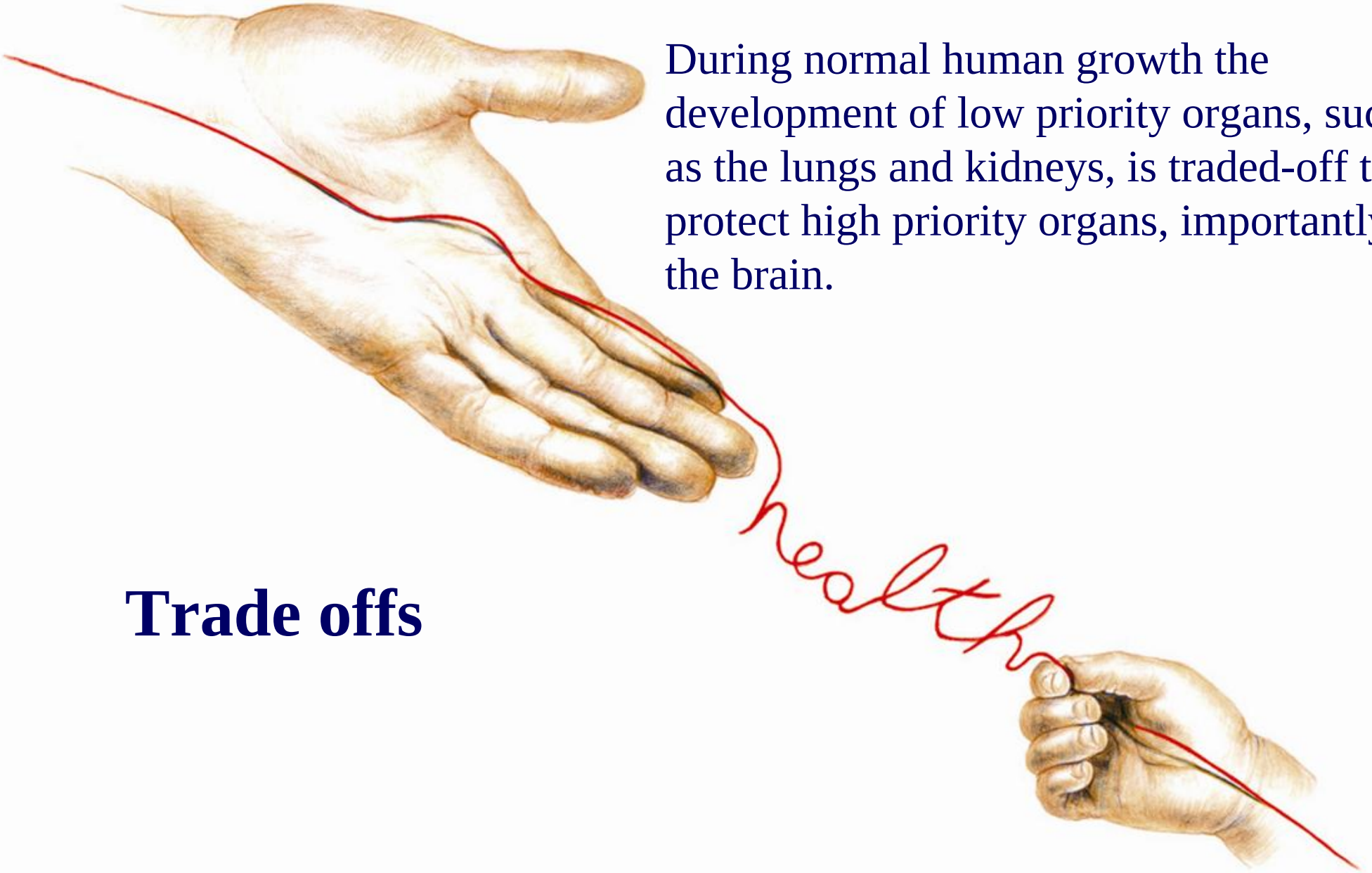
Critical periods



- Much of human development is completed during the first 1000 days after conception.
- Each system and organ has a critical, often brief, period during which it has to develop.
- Most critical periods occur in utero

Trade offs

During normal human growth the development of low priority organs, such as the lungs and kidneys, is traded-off to protect high priority organs, importantly the brain.



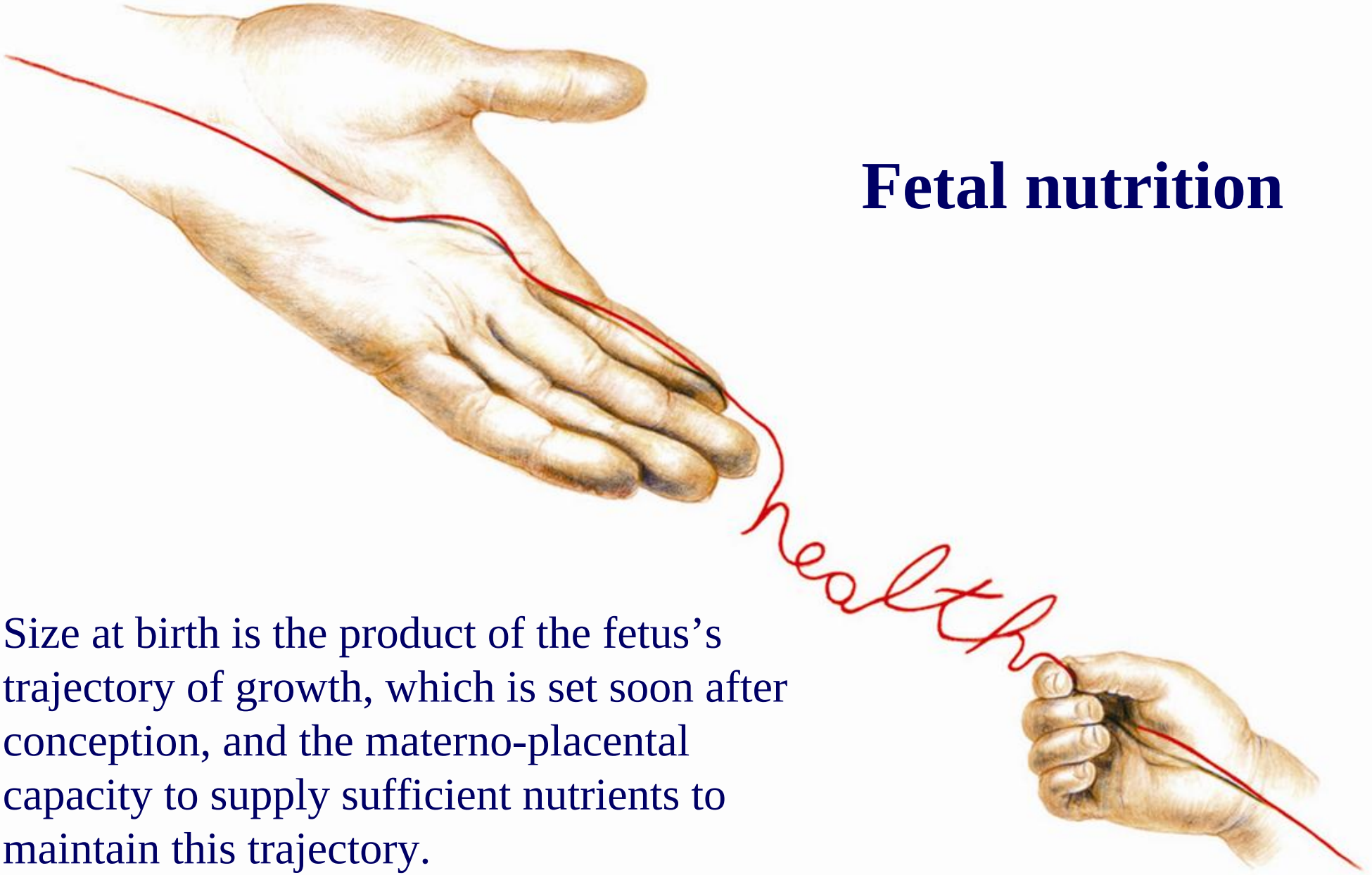
Small body size at birth

People who were small at birth are biologically different:

- Reduced functional capacity e.g. fewer nephrons, less muscle
- Altered metabolic settings e.g. insulin resistance
- Altered hormonal production e.g. stress responses, sex hormones

Associations between early growth and later disease extend across the range of fetal and infant growth. This implies that what are regarded as normal variations in the supply of nutrients to the baby have important long–term effects.

Fetal nutrition



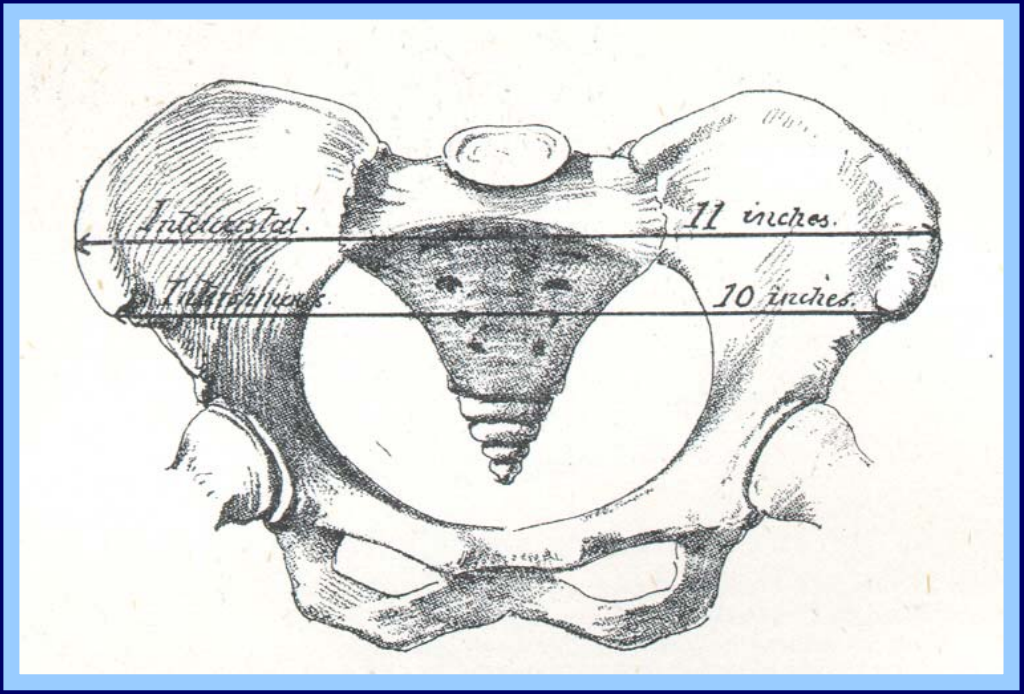
Size at birth is the product of the fetus's trajectory of growth, which is set soon after conception, and the materno-placental capacity to supply sufficient nutrients to maintain this trajectory.

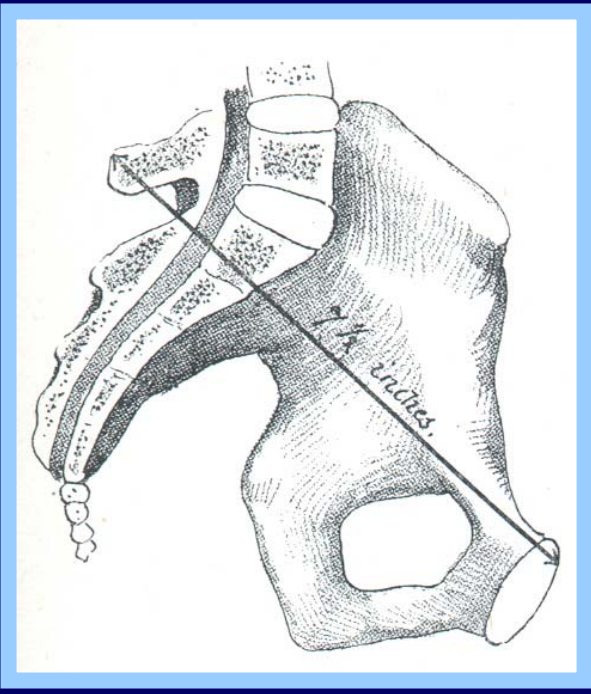
Fetal Nutrition

The fetus is nourished by

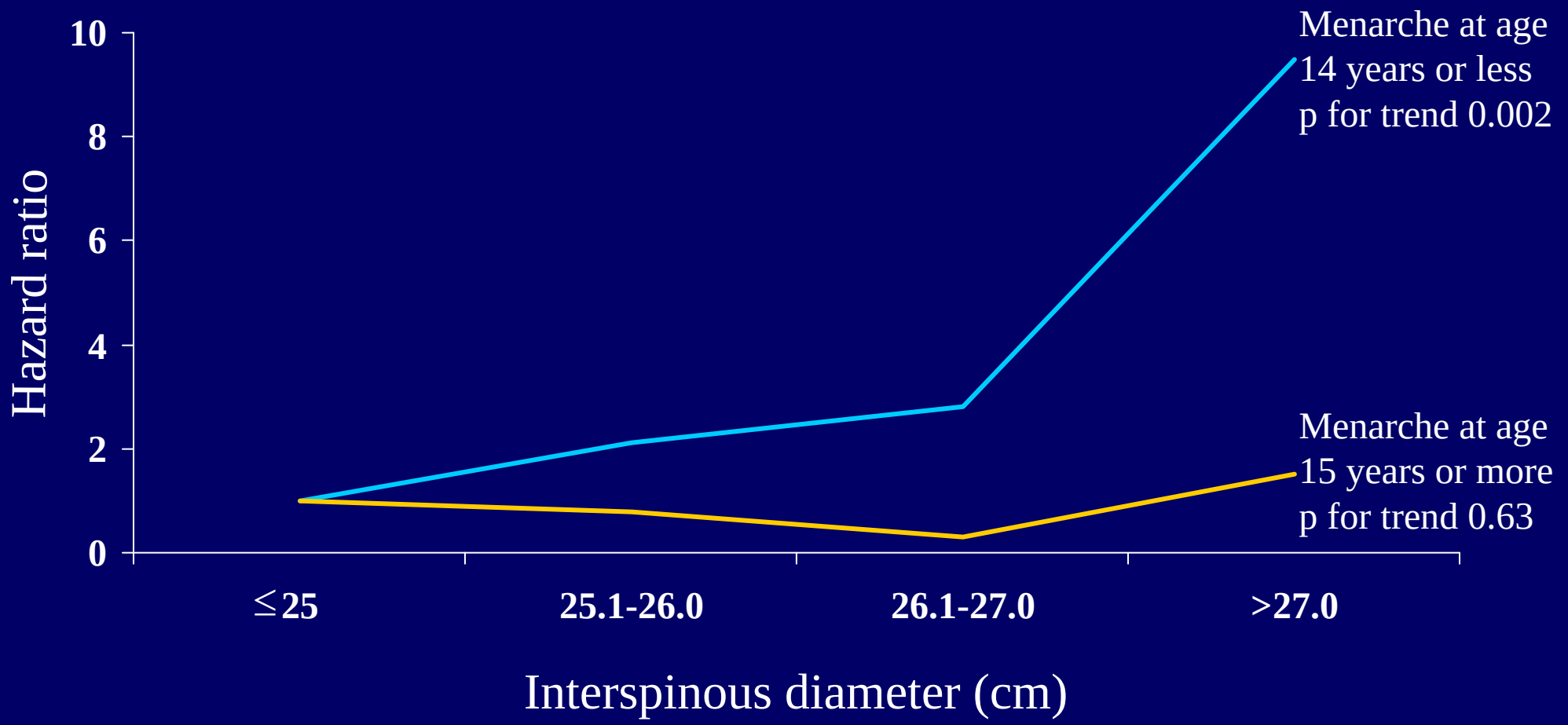
- the mother’s diet
- the nutrients stored in her body
- her metabolism
- the placenta’s ability to transport nutrients from mother to baby

Pelvic diameters

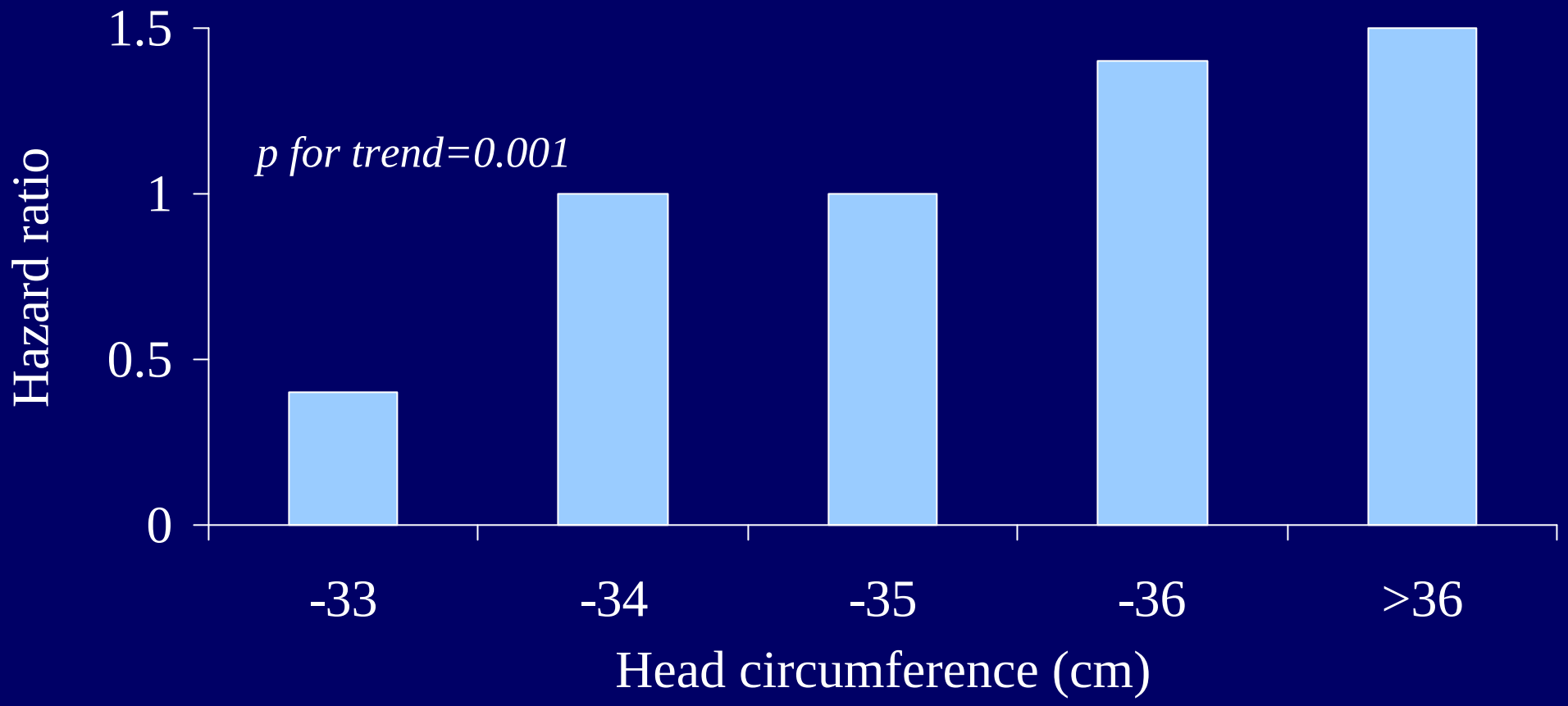




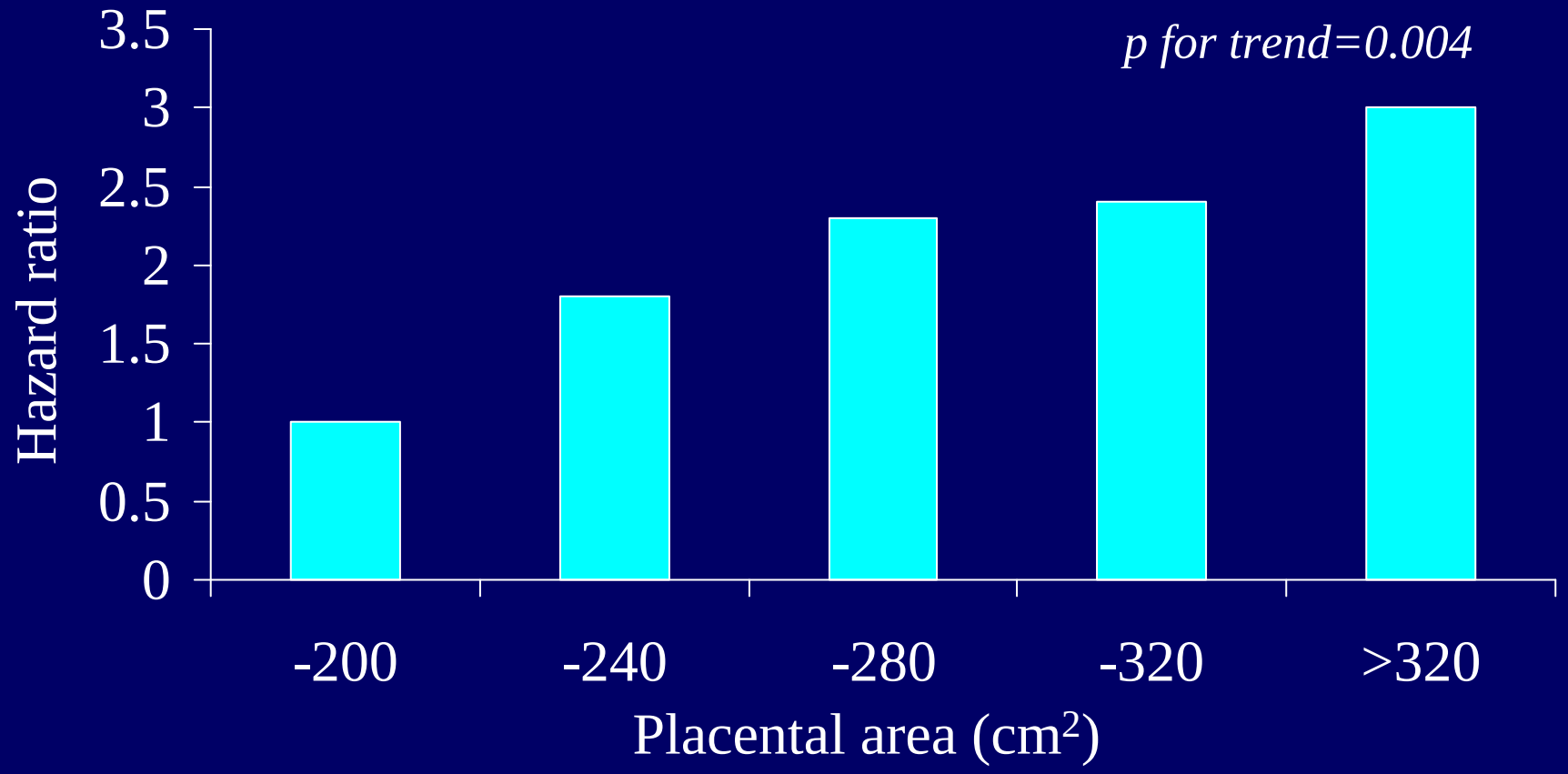
Hazard ratios for ovarian cancer according to mothers' interspinous diameter and age at menarche



Lung cancer according to head circumference at birth



Lung cancer according to placental area



Chronic disease

The causes of chronic disease are linked to variations in the normal processes of development that programme a few key systems - the immune system, anti-oxidant defences, inflammatory responses and the number and quality of stem cells.