



Infant Feeding Practice and Later Obesity

**Julie Lanigan
Clinical Trials Co-ordinator
Specialist Dietitian**

**MRC Childhood Nutrition Research Centre
Institute of Child Health**

Background

- Early focus
- Meeting nutritional needs
- Later focus
- *biological* effects of nutrition

Relevance

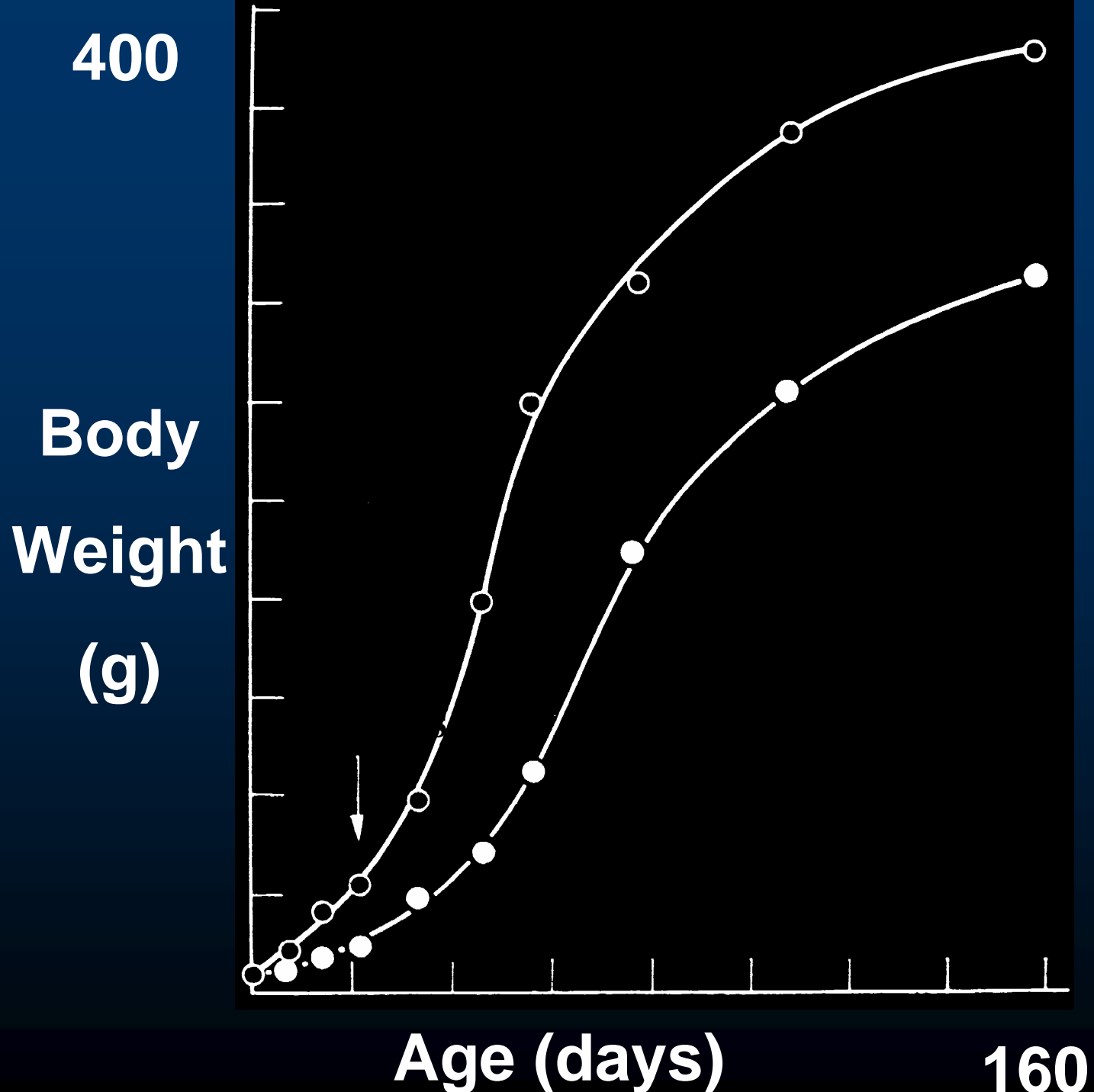
- Does early nutrition matter in terms of:
 - **response to disease**
 - long-term health outcomes

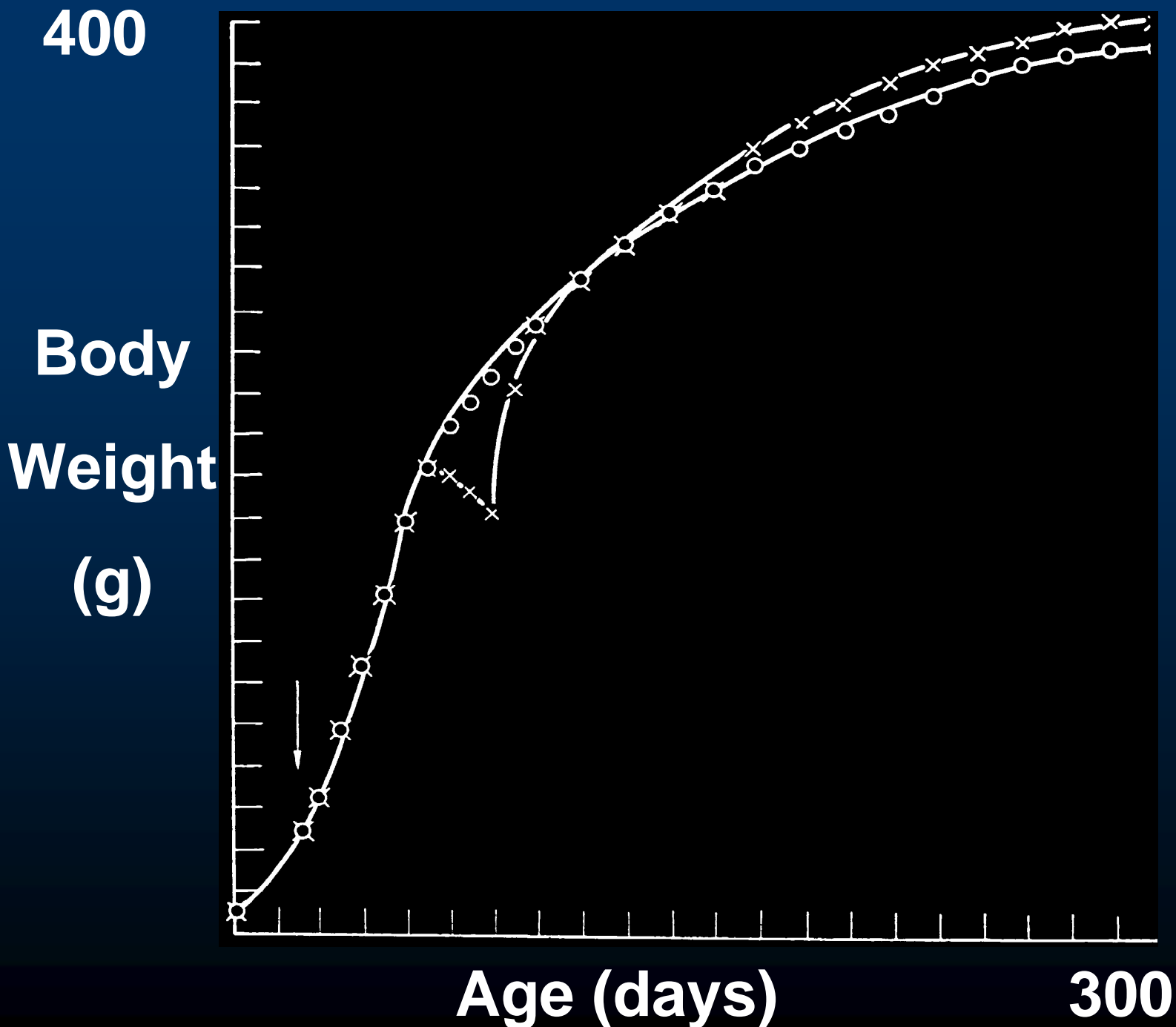
Long-term effects

- Cardiovascular
 - **obesity**
 - blood pressure
 - cholesterol
 - insulin

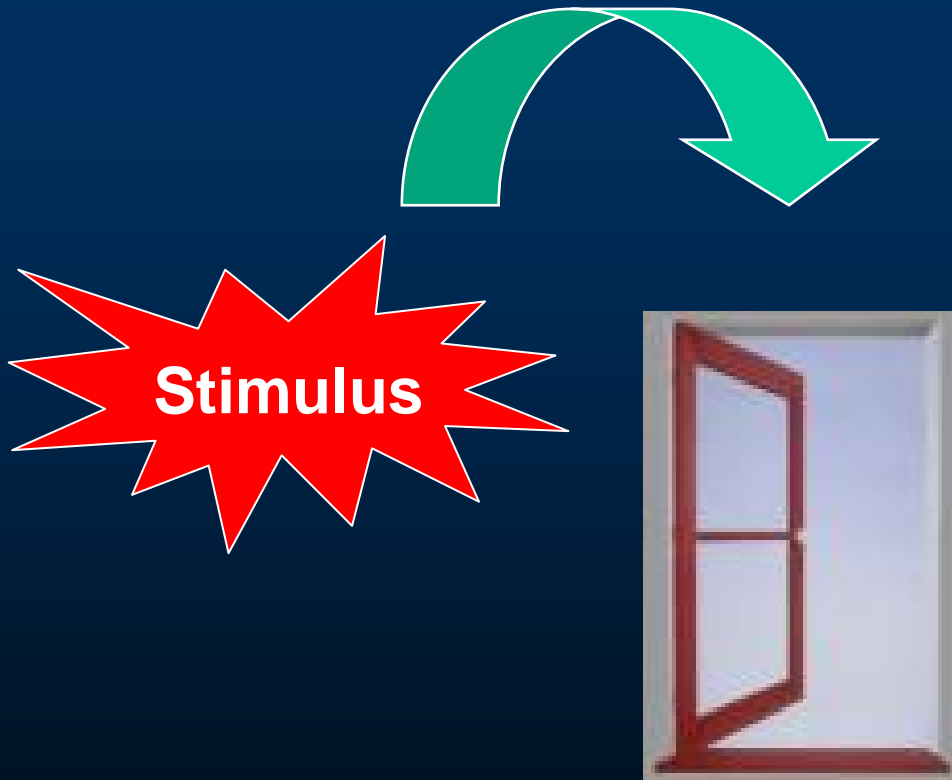
Short-term effects

- **Catch-up Growth**
- **Evolutionary conserved mechanism that favours survival**
- **Major benefits for morbidity**



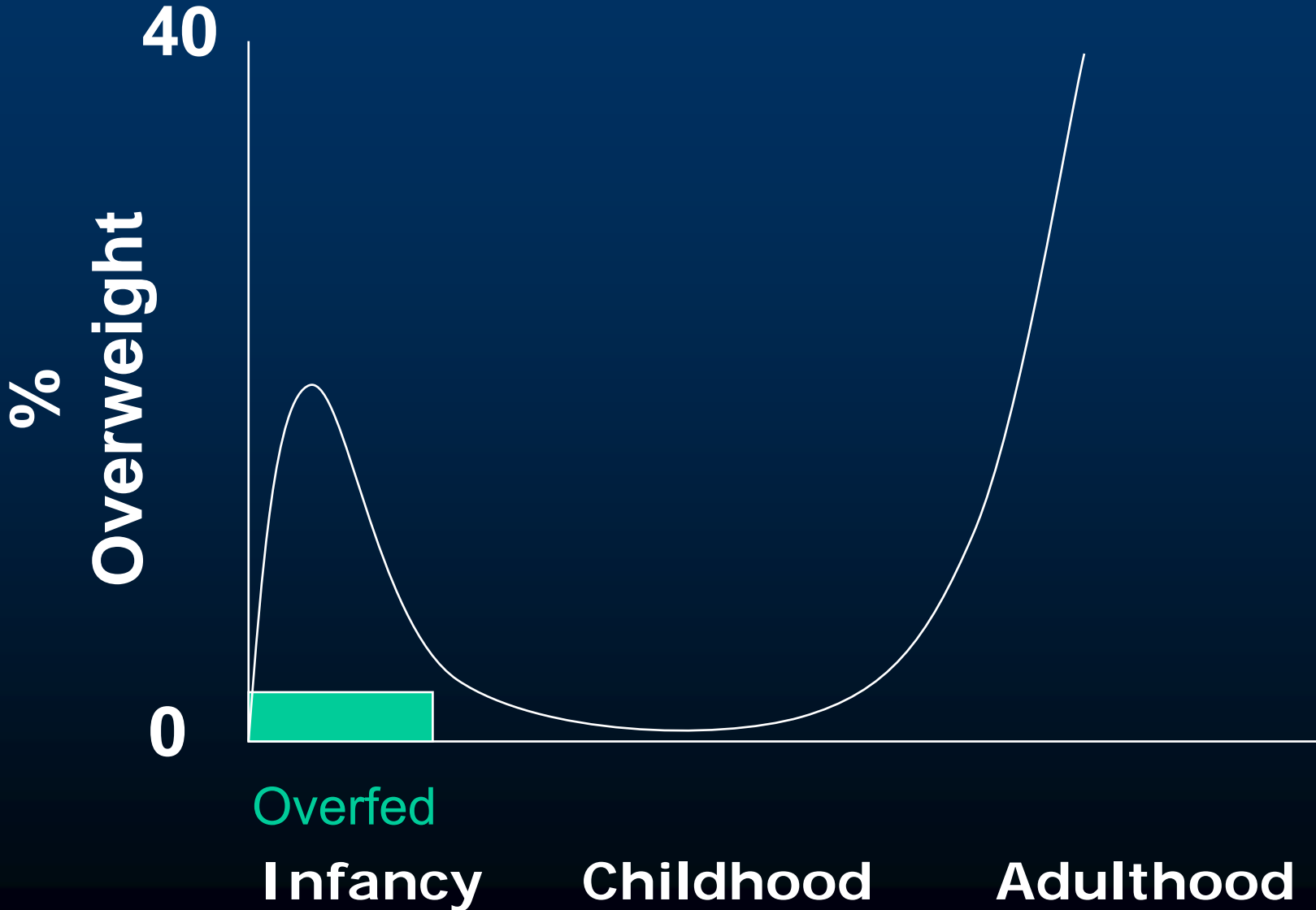


Programming



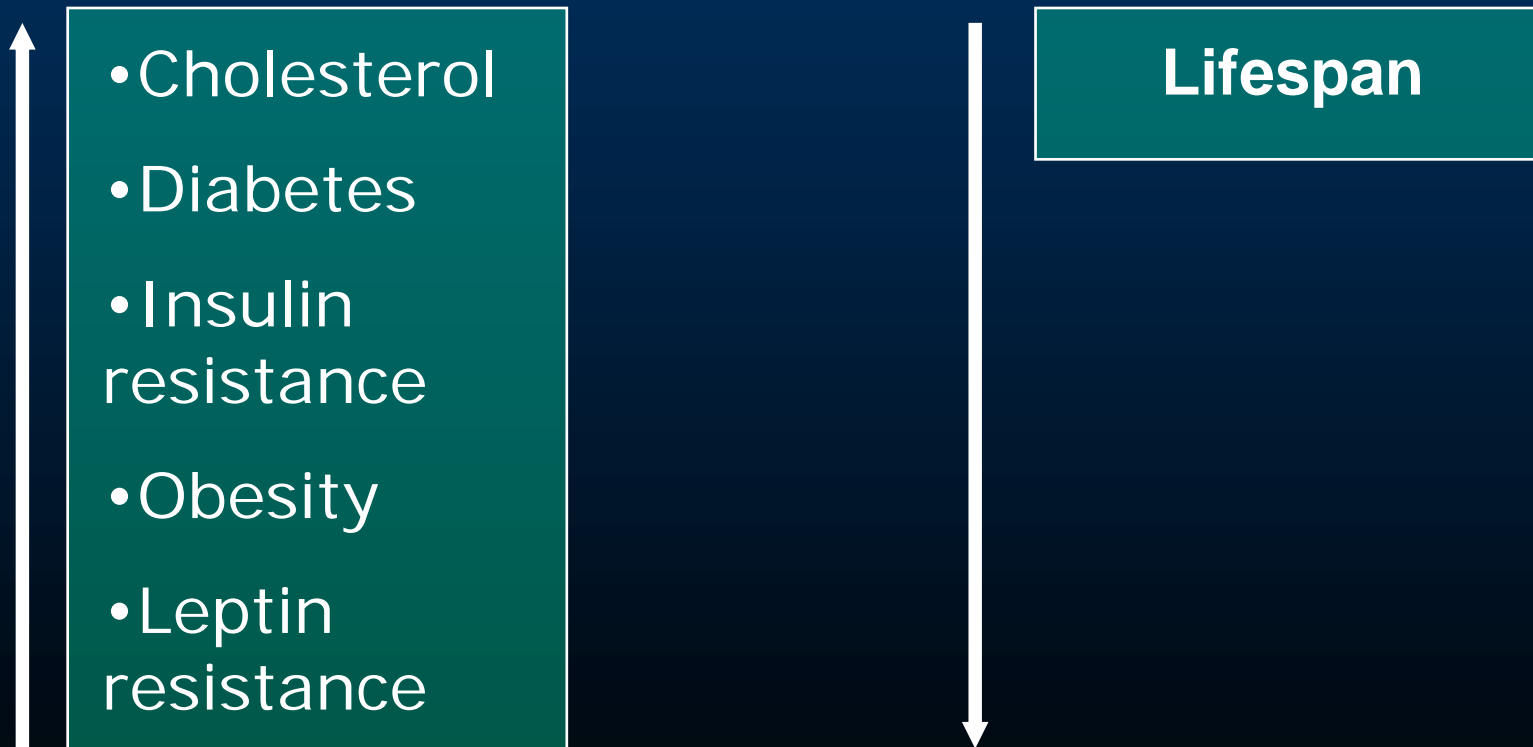
Permanent
effect on
structure
and
function

Adult Obesity in Female Baboons Overfed in Infancy

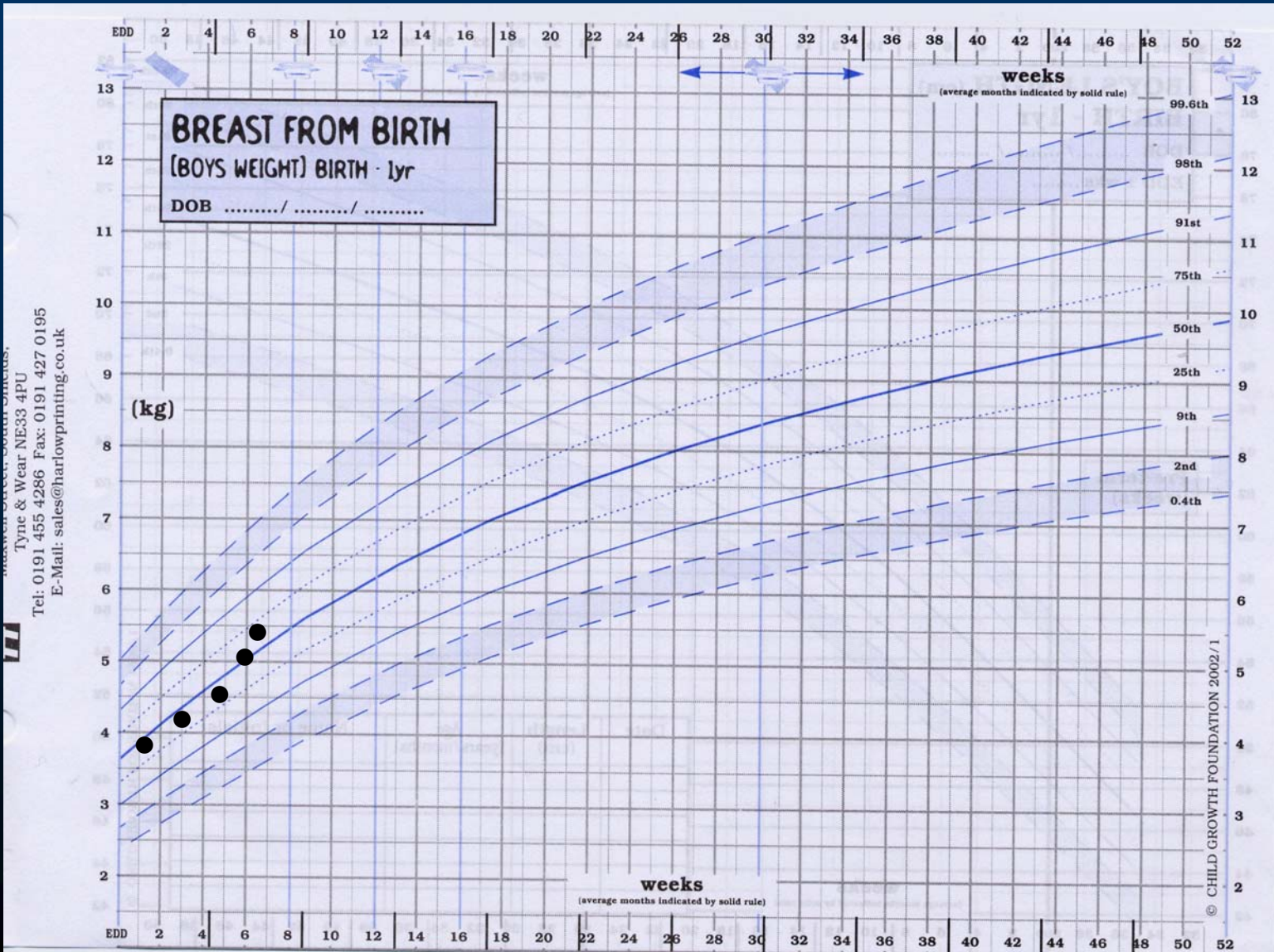


Long-term effects

• Catch-up Growth in rats



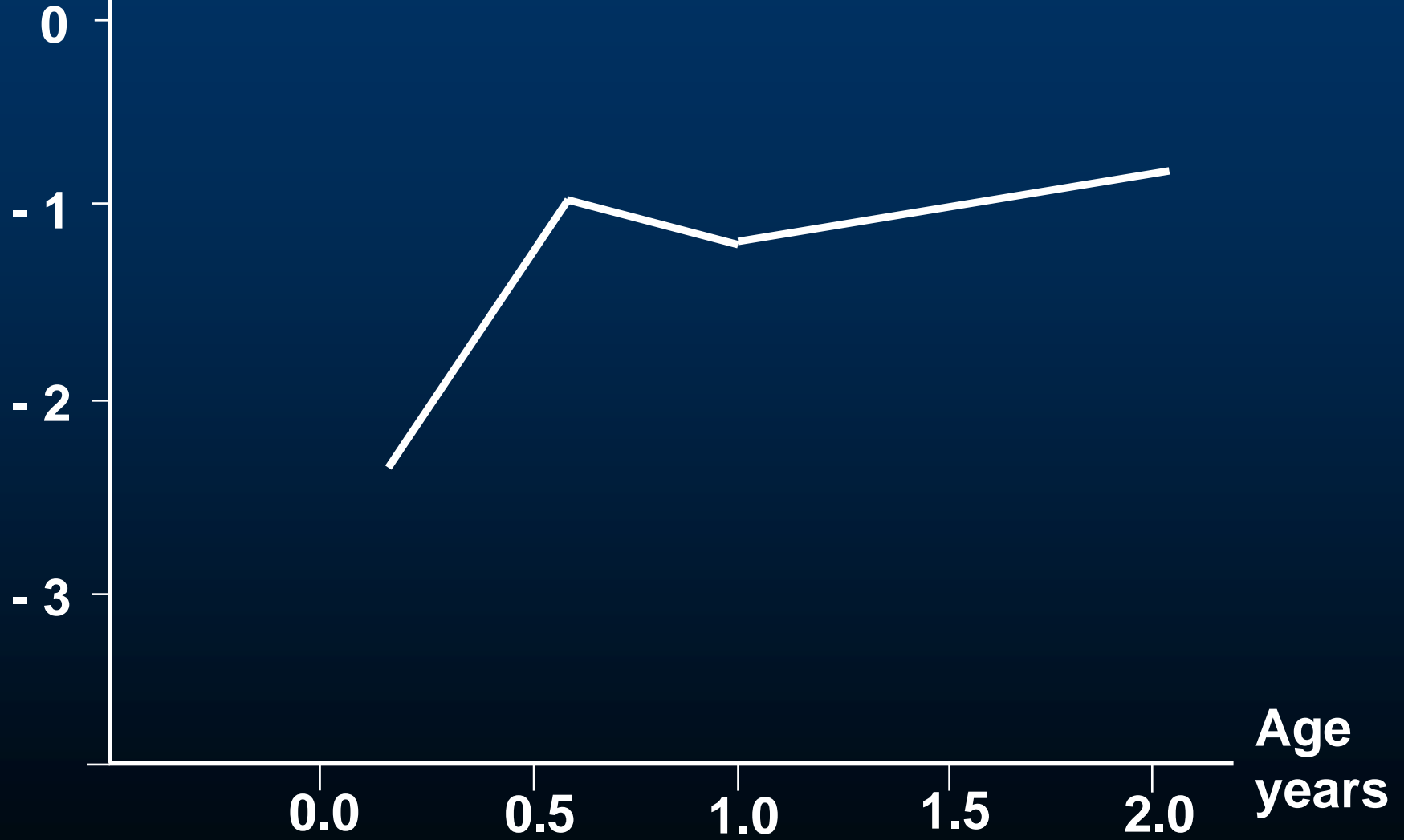
Growth Acceleration



Tyne & Wear NE33 4PU
 Tel: 0191 455 4286 Fax: 0191 427 0195
 E-Mail: sales@harlowprinting.co.uk

Timing of Catch-Up Growth

Mean Height SDS



(Karlberg, et al 1995)

Adverse effects of growth acceleration in humans

- Exposure
 - Weight gain in infancy
- Outcome
 - Overweight/obesity

(Stettler et al, Obesity reviews, 2005)

Does size matter?

- **Exposures**
 - Infant size or growth rate
- **Outcome**
 - Obesity beyond infancy

(Baird et al, BMJ online, 2005)

Effect of breast-feeding

- **Exposures**
 - Breast-feeding
- **Outcome**
 - Childhood Obesity

(Arenz et al, International Journal of Obesity, 2004)

Adverse effects of growth acceleration in humans

- **Obesity**
- **Blood pressure**
- **Insulin resistance & diabetes**
- **IGF-I concentrations**
- **Cardiovascular mortality**

926 recruits

Trial 1

502
randomised

Trial 2

424
randomised

BBM

PTF

TF

PTF

A

B

A

B

A

B

A

B

Banked Breast Milk

Pre-term Formula

Term Formula

Effects in pre-term infants

Breast Milk

Pre-Term Formula

- **Blood pressure measured Age 15-16 years**
 - **Breast Milk Feeding**
 - Reduced weight gain
 - reduced blood pressure
 - Large effect size
 - Dose dependent

(Singhal et al, **Lancet** 2001)

Effects in pre-term infants

Breast Milk

Pre-Term Formula

- **Other risk factors for cardiovascular disease Age 15-16 years**
 - **Breast Milk Feeding**
 - Reduced weight gain
 - Reduced LDL:HDL cholesterol
 - Dose dependent

**Are Preterm
Infants a Special
Case ?**

Benefits of breastfeeding

• Term infants

Observational:
Blood Pressure
Cholesterol
Obesity
Insulin resistance

• Pre-term infants

Observational
Obesity
Experimental
& dose dependent
Blood Pressure
Cholesterol
Insulin resistance

Early nutrition in **Term** SGA Infants

- **Conclusions**
- **Term infants sensitive**
- **BP effect size large**
- **Growth acceleration detrimental**

Growth acceleration and later obesity

**'The attributable risk
is 30%'**

(Stettler et al, 2005)

Cholesterol reduction effect

- 10% lowering with breast-feeding
- Reduces cardiovascular disease
 - incidence by 25%
 - mortality by 13-14%

Pre-natal Growth and later obesity

- **Low birth-weight associated with**
 - **Increased central fat**
 - **Changes in hormonal axes**
 - **Changes in insulin sensitivity**

Early Growth and later obesity

- Possible mechanisms
- Hormonal
 - YYY3-36
 - IGF-1
 - Adipokines (e.g. Leptin)

Nutritional influences during infancy

- Possible candidates
 - Carbohydrate
 - Fruit juice
 - Protein
 - Fat
 - Calcium/dairy

Nutritional influences during infancy

- **Possible candidates**
 - **Sucking behaviour**
 - **Complementary feeding**

Other influences during infancy on later obesity

- Possible candidates
 - Genetics
 - Parental weight/obesity
 - Socioeconomic status
 - Smoking
 - Physical activity

Effect of early nutrition on later blood pressure

Breast-feeding / growth reduce diastolic blood pressure by -3.2 mm Hg

Compared with:

- Weight loss -2.8
- Alcohol reduction -2.1
- Salt restriction -1.3
- Exercise -0.2

(Ebrahim & Smith, 1998)

Influence of blood pressure on cardiovascular risk

Framingham Study: effect of 2mm Hg reduction in diastolic blood pressure:

- Hypertension 16%
- Coronary artery disease 6%
- Stroke 15%
- Prevents
 - 67,000 MI and 34,000 strokes per year in the US

Early Growth and Nutrition

- Major factor for later health
- All infants
 - not just small ones
- Larger effect than birth weight