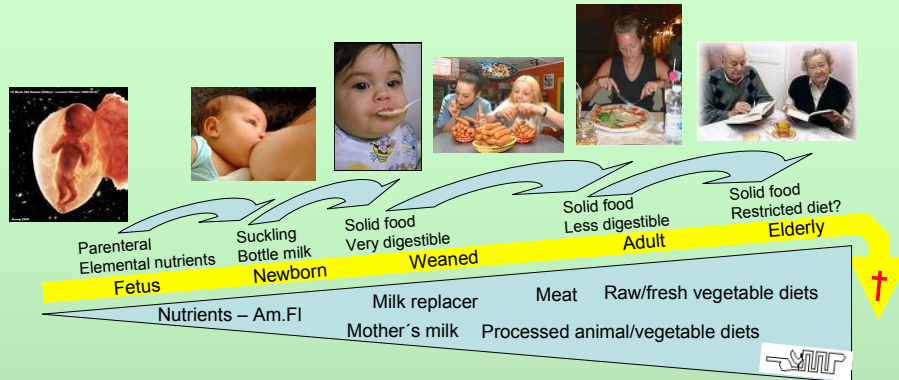


## Dietary changes during development?

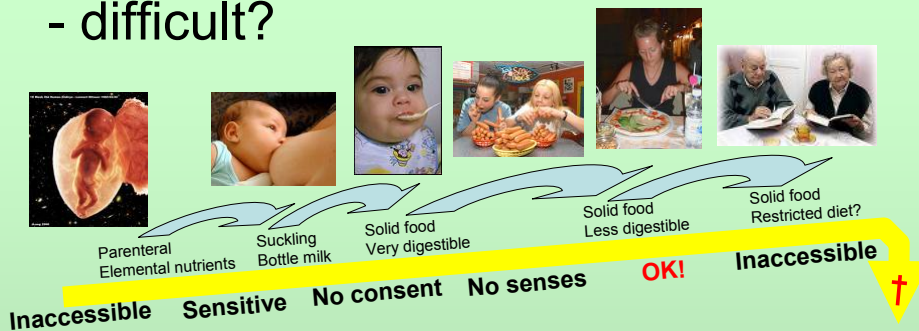


### Why?

- Changes in organ anatomy/physiology (e.g. GIT, liver, pancreas)
- Altered growth of tissues/organs
- Altered function of tissues/organs
- Altered disease sensitivity of tissues/organs

## Developmental nutrition research

- difficult?



### LONG TERM STUDIES:

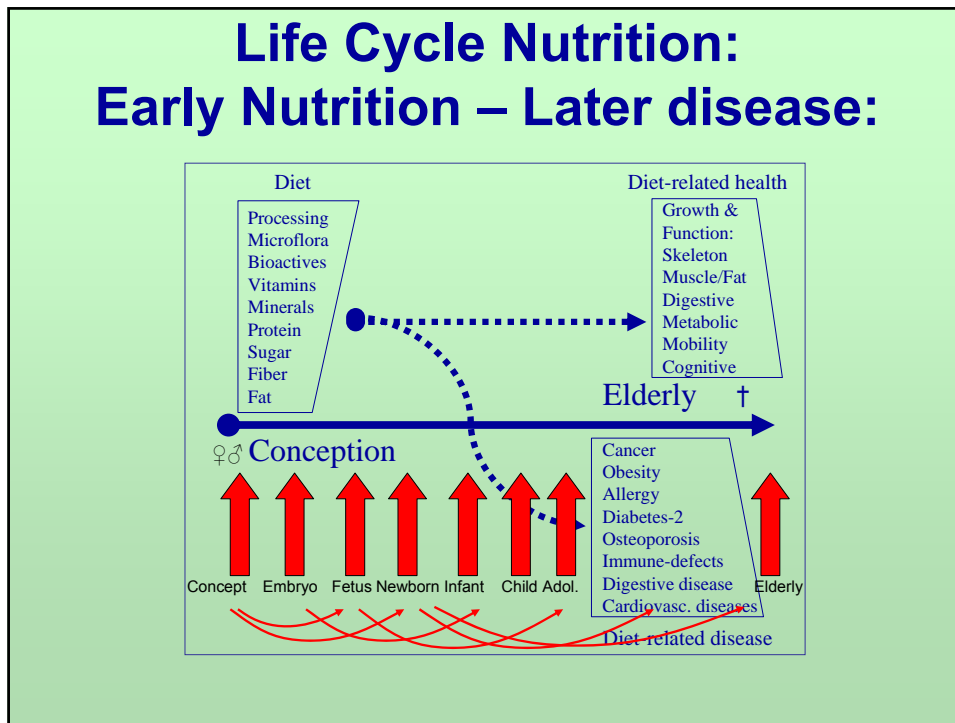
- It takes too long to investigate (PhD programs are 3 years!)
- The long time factor makes experiment uncontrollable
- Cell function changes over the course of an experiment

**RESULT:** Nutritional advice based on epidemiology and tradition

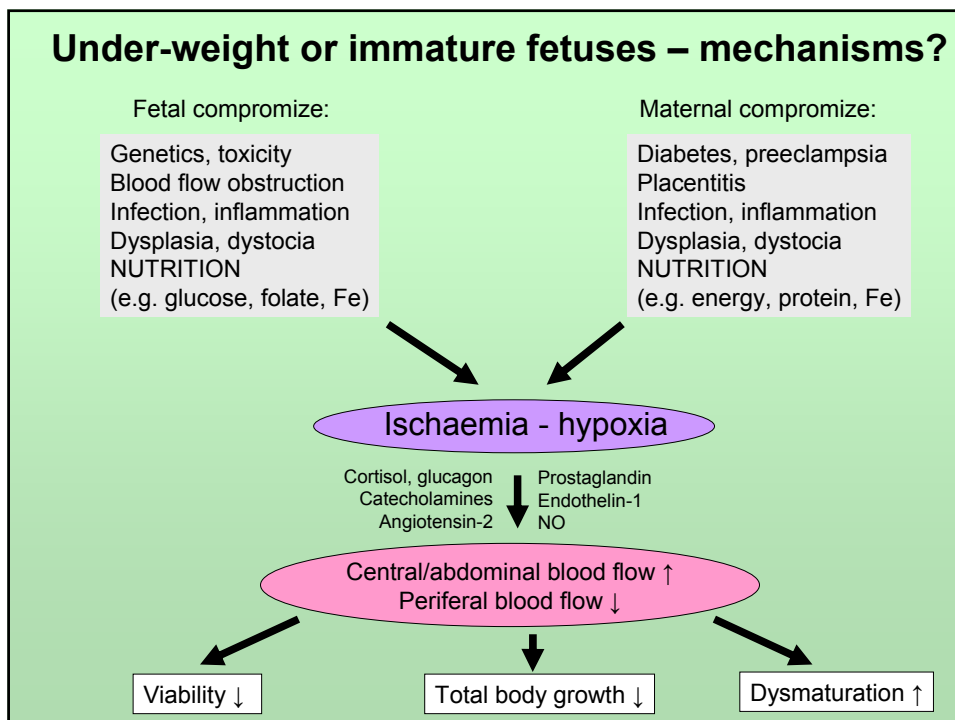
**Supplement:** Animal/cell model studies



## Life Cycle Nutrition: Early Nutrition – Later disease:



## Under-weight or immature fetuses – mechanisms?



## Under-weight or immature fetuses – how to help?

↓

Early delivery  
– postnatal catch-up

In utero intra-  
amniotic feeding?

Prenatal  
growth hormones?

Nutrient-enriched  
milk formulas

Postnatal  
growth hormones?

↓

Delivery delay  
- maturation

Ex utero feeding  
of "fetal" diets?

Prenatal  
maturation hormones?

Parenteral or  
elemental diets

Postnatal  
maturation hormones?

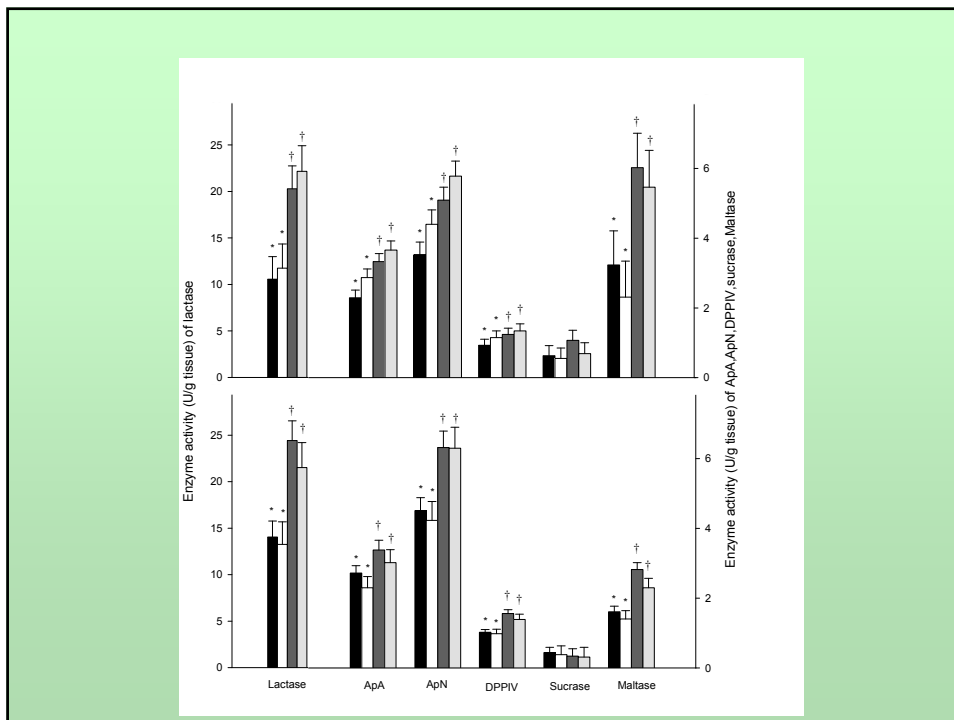
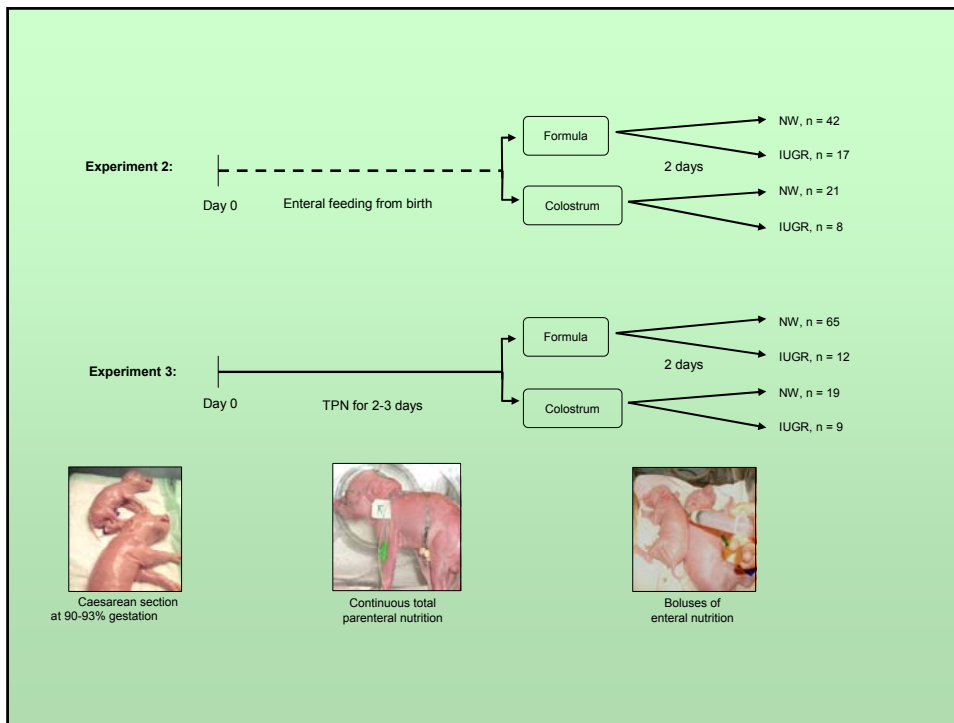
## Growth & maturation – not the same:

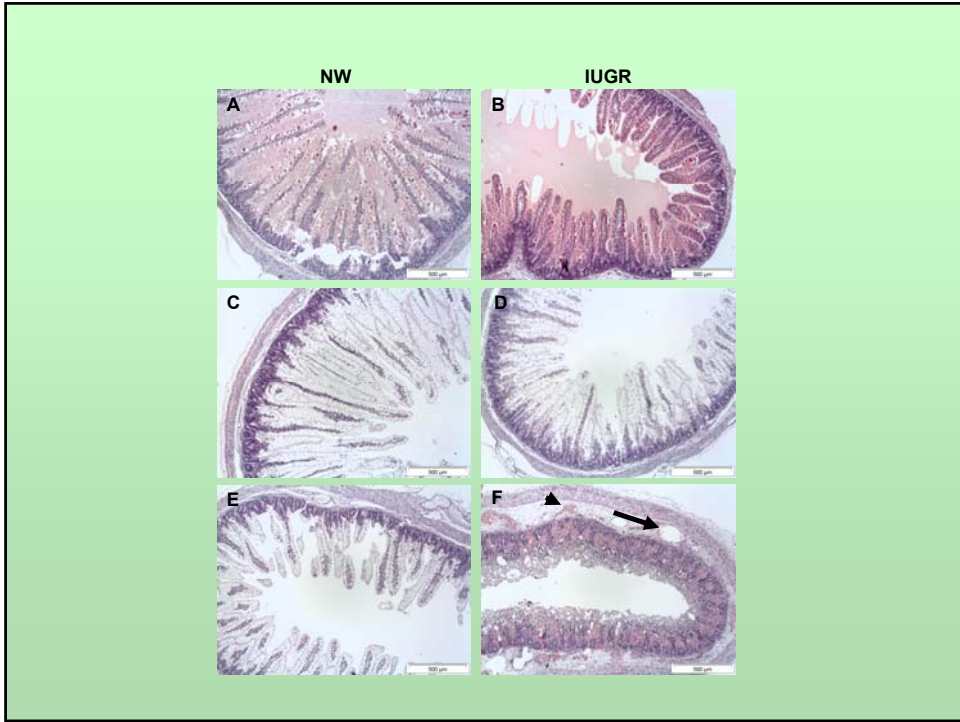
What affects  
fetal preparation for birth?



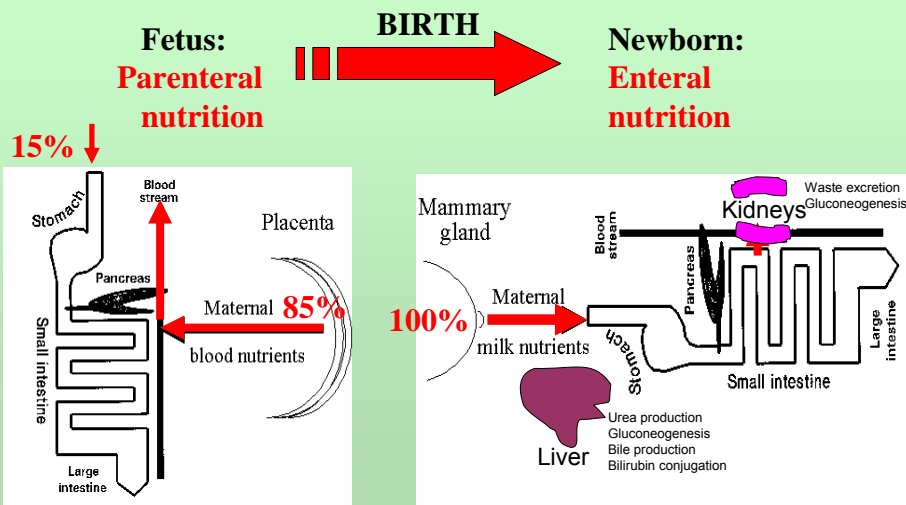
"Am I ready yet?  
Where's the check  
list for what I need  
out there?  
Lungs, gut, kidneys,  
eyes, ears, arms,  
and legs – all working  
well – and of course  
my brain."

(P.W. Nathanielsz)





## The nutritional transition at birth:



# Preterm & term milk – differences?

Table 8.6 How infant formulas are modified compared to breast milk

MACRONUTRIENTS	BREAST MILK	COW'S-MILK-BASED FORMULA	SOYBEAN-BASED FORMULA
Protein	7% of calories	9–12%	11–13%
Carbohydrates	38% of calories	41–43%	39–45%
Fats	55% of calories	48–50%	45–49%

OTHER WAYS INFANT FORMULAS ARE MODIFIED COMPARED TO BREAST MILK		
What Is Modified	How It Is Modified	Examples from Two Major Manufacturers
Calorie level	Increase in calories from 20 calories/fl oz to 22 or 24 calories/fl oz (for preterm infants).	EnfaCare Lipil is 22 calories/fl oz. Similac with Iron 24 is 24 calories/fl oz.
Form of protein	Protein is broken down to short amino acid fragments (hydrolyzed protein) or into single amino acids. Source of protein changed.	Similac Neosure Advance has amino acids. Enfamil Nutramigen has hydrolyzed milk protein. Prosobee has hydrolyzed soy protein in place of milk-based protein.
Type of sugar	Lactose is replaced by other sugars, such as sucrose or glucose polymers from various carbohydrate sources.	Enfamil LactoFree has lactose replaced by corn syrup solids (which provides glucose). Prosobee has carbohydrates from corn syrup solids. Neither has sucrose or lactose.
Type of fat	Long-chain fatty acids partially replaced with medium-chain fatty acids (MCT) and source of fat changed.	Pregestimil has about half of the long-chain fats, replaced by a mixture of vegetable oils. Enfamil Nutramigen has no MCT oil, but has vegetable oils in place of animal-based fats.
Allergy/intolerance	Replacement of milk-based protein with protein from soybeans or replacement of whole proteins with amino acid fragments or single amino acids.	Similac Isomil and Enfamil Prosobee have milk protein replaced by soy protein.
Micronutrients	Increased calcium and phosphorus concentration for preterm infants. Decreased minerals related to renal function. Added essential fatty acids (see above). Lower supplemental iron.	Enfamil PrematureLipil Similac PM 60/40 is modified in calcium, phosphorus, and is low in iron. Similac Special Care Advance 24 is a low-iron formula sold only to hospitals for preterm infants. Enfamil Low Iron and Similac Low Iron have lower levels of iron than the standard formula.
Thickness	Added rice or fiber for gastrointestinal problems.	Similac Isomil D.E. (DF = diarrhea free) for short-term use; it has added fiber from soy. Enfamil A.R. has added rice.
Age of infant	Target age 0–12 months Target age 9–24 months	Similac Isomil Advance Similac Isomil 2

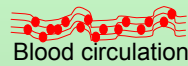
# Haemodynamics & jaundice (Brown p. 184-187)

**Fetus:**  
Parenteral nutrition  
and placental O<sub>2</sub>

**BIRTH**

**Newborn:**  
Enteral nutrition  
and lung O<sub>2</sub>

**Fetal** Hb/blood cells  
(elevated oxygen binding)



Blood circulation

Placental metabolism  
Liver



Amniotic fluid ingestion  
Meconium plug



**Adult** Hb/blood cells  
(elevated oxygen binding)



Breast milk-stimulated  
re-absorption and/or  
haem synthesis.  
Inadequate feeding,  
poor liver function &  
immature gut motility

Bilirubin (BR)  
conjugation &  
bile excretion



Excretion or  
bilirubin re-  
absorption

**JAUNDICE**  
Bilirubin re-  
absorption



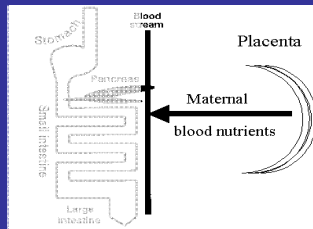
# Nutritional transition at birth:

Parenteral nutrition  
in utero

Enteral nutrition  
ex utero



Birth



How does  
the gut  
adapt?

