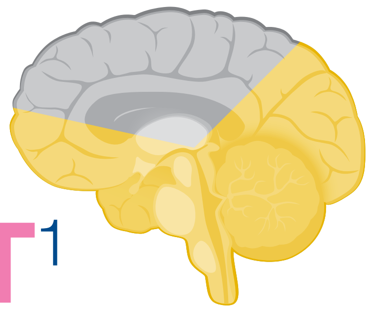
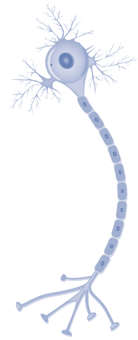
The importance of docosahexaenoic acid (DHA)

FX Medicine



60% of the structure of the BRAIN IS FAT[1]

OMEGA-3 FATTY ACIDS play a vital role in **NEURONAL STRUCTURE**[2]



DHA represents about **97%** of all omega-3 fatty acids in the brain[3-5]

Approximately **70%** of the total brain cells to last a person's lifetime have divided **BEFORE BIRTH**[1]

The amount of **DHA** has been closely tied to **INTELLIGENCE** and **COGNITIVE PERFORMANCE** in infancy and childhood[6]

IMPORTANCE OF DHA[7-12]

DHA is the most abundant omega-3 fatty acid in the brain and is found in high concentrations in the brain, central nervous system and retina of the eye. It is an important nutrient for brain development, structure and function, and healthy development of eyes. It provides support for memory and cognitive function.

DHA intake supports a healthy pregnancy and assists in achieving healthy pregnancy outcomes. Supplementation of DHA in women in their first pregnancy with low dietary intake may contribute to healthy birth size for the baby. Maternal intake of DHA may assist in children's general growth and development, cognition, vision and behaviour in infants.

Unable to be synthesised endogenously, DHA must be acquired from the diet or from alpha-linolenic acid (ALA). ALA must undergo desaturation and elongation to produce firstly eicosapentaenoic acid (EPA) and then DHA.

While preformed DHA is efficiently absorbed, with plasma levels increasing incrementally with increased intake, as little as 8-9% of dietary ALA may be converted to DHA, making ALA a relatively poor source of DHA.

As inefficient as it is in humans, the conversion rate of ALA to DHA has been observed to be higher in women compared with men and increases in pregnancy. However, in the foetus and newborn up to 16 weeks of age, the conversion pathways are not yet fully developed, and hence foetal supply of DHA is solely dependent on maternal intake.

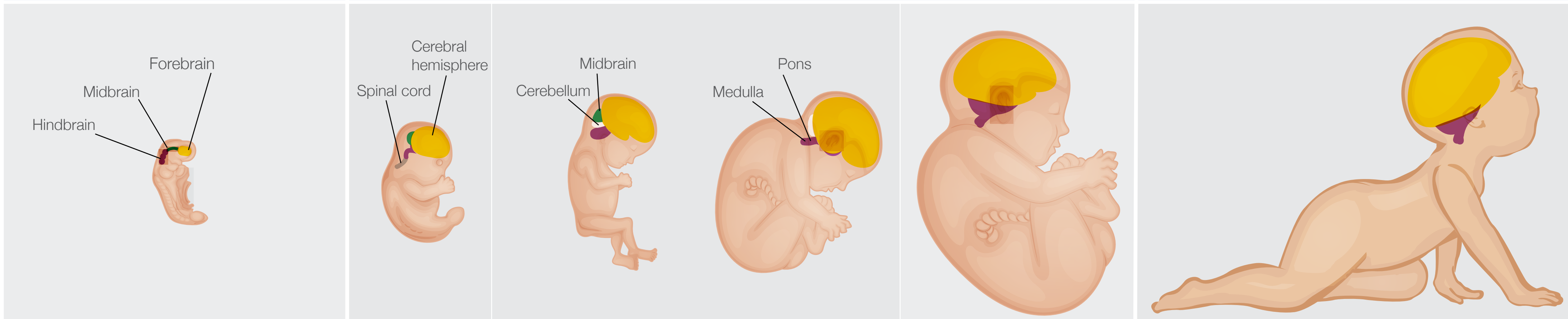
DHA plays a role in numerous functions in the brain and nervous system including:

- influences neurogenesis, neuronal migration and outgrowth
- important for myelination
- enhances flexibility to the cell membrane
- increases speed of signal transduction and neurotransmission
- contributes to formation of lipid rafts
- inhibits oxidative stress
- inhibits induction of pro-inflammatory genes and apoptosis.

DHA AND NEURODEVELOPMENT[1-19]

STAGES OF BRAIN DEVELOPMENT

EMBRYONIC PERIOD (1-8 weeks) | FOETAL PERIOD (8 weeks until birth) | INFANCY



DESCRIPTION

EMBRYONIC PERIOD (1-8 weeks)

The first 8 weeks after implantation are termed the embryonic period.

During this time all the organs, systems and tissues of the future are being induced, differentiated and put into place.

The most active period of brain cell division is in the first few weeks.

At around 3 weeks the development of what will become the nervous system, the neural plate, takes place. By 4 weeks the neural plate has "curled up" to form the neural tube.

Neuron production begins at around 6 weeks and extends through midgestation in most brain areas. DHA is an essential structural unit of neurons.

By the end of the first two months, the head makes up almost half of the embryo, illustrating the overriding priority that human physiology devotes to brain development.

At this stage, nutrition is solely dependent on the mother's health, nutrition and metabolism because the placenta has not yet formed.

FOETAL PERIOD (8 weeks until birth)

The remaining 30-40 weeks of gestation are devoted to growth, development and refinement of the organs, systems and tissues.

At this stage, foetal accumulation of DHA occurs via selective placental transfer, the rate varying as the pregnancy progresses.

Myelination of the neurons begins in the third month and will continue throughout the first few months after birth.

During the third trimester, when there is significant development of brain and fat tissues, maternal DHA levels decrease while foetal accretion of omega-3 fatty acids (mainly DHA) increases to an average of 60mg a day. Over the length of a full-term pregnancy an estimated 600g of EFAs are transmitted from the maternal circulation to the foetus.

The foetal brain is consuming 70% of dietary energy fed to it by the mother to meet the demands for its rapid rate of growth.

INFANCY

When the baby is born it will use up to 60% of the energy from its mother's milk for growth.

Synaptic connections in the brain are made at a furious rate and the surface area of the membranes constructed to serve these purposes requires DHA as one of the basic building blocks.

During lactation, a sufficient supply of DHA from the breast milk is important for the healthy development of the newborn. Maternal supplementation with DHA during the breastfeeding period has a much greater impact on DHA levels in the breast milk than during pregnancy alone, thus highlighting how strongly diet affects the DHA content of breast milk.

Adequate DHA intake is also important for the mother postpartum, as maternal plasma DHA concentrations are commonly reduced at the end of the pregnancy to levels lower than that of the umbilical cord and foetal plasma.

MATERNAL DHA DOSAGE GUIDELINES

TRIMESTER 1		TRIMESTER 2	TRIMESTER 3	LACTATION
430-860mg		860-1720mg	1720-2580mg	1720-2580mg (0-4 months) 860-1720mg (4+ months)