

# Oxygen

the ultimate nutrient

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**Hypoxia is a condition in which the body or a region of the body is deprived of adequate oxygen supply.**

**Hypoxia may be classified as either *generalized*, affecting the whole body, or *local*, affecting a region of the body.**

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## **Symptoms**

**Gradual onset - Light-headedness  
Numbness / tingling of extremities,  
Nausea and anorexia.**

**Tiredness**

**Visual deterioration**

**Memory loss**

**Feeling the cold**

**Degenerative changes**

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**Symptoms**

**Rapid onset - ataxia, confusion / disorientation / hallucinations / behavioral change, severe headaches / reduced level of consciousness, papilloedema, breathlessness, pallor, tachycardia and pulmonary hypertension.**

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**If hypoxia is very severe, a tissue may eventually gangrene. Extreme pain may also be felt at or around the site. Eventually leading to the late signs cyanosis, bradycardia / cor pulmonale and hypotension followed by death.**

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**Because haemoglobin is a darker red when it is not bound to oxygen (deoxyhaemoglobin), as opposed to the rich red colour that it has when bound to oxygen (oxyhaemoglobin), when seen through the skin it has an increased tendency to reflect blue light back to the eye.**

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**Hypoxia can result from a failure at any stage in the delivery of oxygen to cells. This can include decreased partial pressures of oxygen, problems with diffusion of oxygen in the lungs, insufficient available haemoglobin, problems with blood flow to the end tissue, and problems with breathing rhythm.**

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**History and Functional Testing for Hypoxia**

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**1. Bioimpedance actually determines the electrical impedance, or opposition to the flow of an electric current through body tissues which can then be used to calculate an estimate of total body water. TBW can be used to estimate fat-free body mass and, by difference with body weight, body fat.**

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**Electro Interstitial Scanner**

The EIS provides an electrical signal corresponding to the status of a patient's physiological parameters: Na<sup>+</sup>/K<sup>+</sup>ATPase pump activity, tissue pCO<sub>2</sub>, sympathetic system activity and microcirculation blood flow.

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**3. Oxygen saturation is a term referring to the concentration of oxygen in the blood. The human body requires and regulates a very precise and specific balance of oxygen in the blood. Normal blood oxygen levels in humans are considered 95-100 percent. If the level is below 90 percent, it is considered hypoxia.**

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**Blood oxygen levels below 80 percent may compromise organ function, such as the brain and heart, and should be promptly addressed. Continued low oxygen levels may lead to respiratory or cardiac arrest.**

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In medicine, oxygen saturation ( $SO_2$ ), commonly referred to as "sats", measures the percentage of hemoglobin binding sites in the bloodstream occupied by oxygen. At low partial pressures of oxygen, most hemoglobin is deoxygenated.

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At around 90% (the value varies according to the clinical context) oxygen saturation increases according to an oxygen-hemoglobin dissociation curve and approaches 100% at partial oxygen pressures of >10 kPa.

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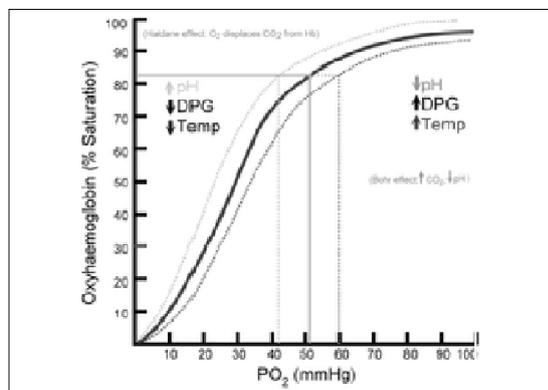
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**A pulse oximeter relies on the light absorption characteristics of saturated hemoglobin to give an indication of oxygen saturation.**

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**Applied Kinesiology testing**  
**i) All muscles weak on testing**  
**ii) Single muscle weakens on repeated muscle testing (aerobic challenge)**  
**iii) Positive eyes into distortion up and down**  
**iv) Weak muscle strengthens to Oxygen**  
**v) Strong muscle weakens to Xanthine oxidase**

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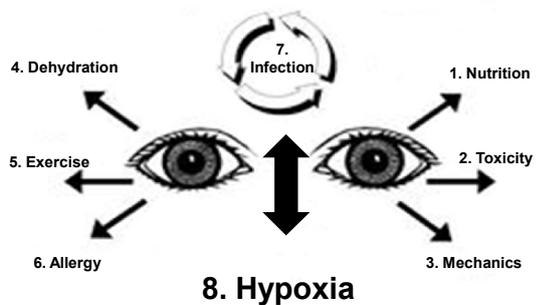
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**Eyes into Distortion (EID)**



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### Patient Protocol for Hypoxia

From weakness patient strengthens to HYPOXIC eye position

Confirm using OXYGEN vial to strengthen

Challenge using following vials

PHOSPHOLIPIDS	HEMOGLOBIN	Co-ENZYME Q10
EPO, BSO , Borage	ALA	Co-Q10 in Rice bran oil
Black cumin	PBG	
Flax , Chia	HMB	
Grape seed	UPG III	
Hazelnut, Hemp	CPG III	
Macademia	PPG IX	
Olive	PP IX	
Peanut		
Pumpkin		
Super Omega 3		
Walnut		
WGO		

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### Oxygen in the air

Alveolar membrane  
Red blood cell membrane

### Red blood cell

Red blood cell membrane  
Tissue cell membrane

### Tissue cell

Tissue cell mitochondrial membrane

### Tissue cell mitochondria

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### Reactive Oxygen Species

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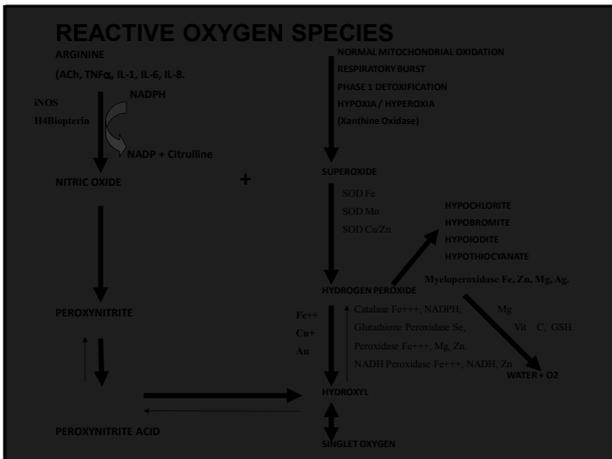
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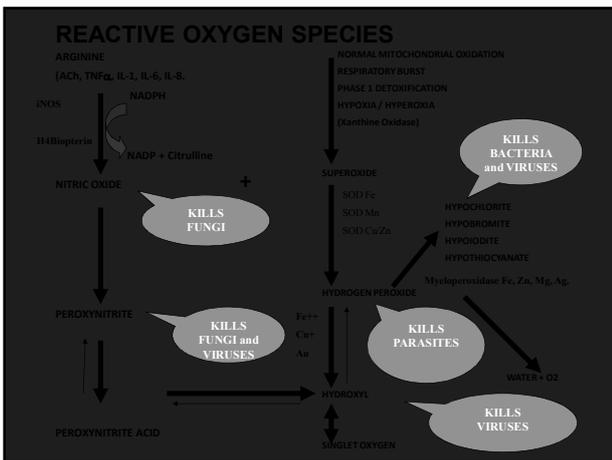
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**Oxygen transport**

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**Oxygen into the Lungs**  
By volume, dry air contains  
78.09% nitrogen  
20.95% oxygen  
0.93% argon  
0.039% carbon dioxide  
and small amounts of other gases.  
Air also contains a variable  
amount of water vapor, on average  
around 1%.

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At sea level the partial pressure of  
oxygen (pO<sub>2</sub>) in the lungs = 21%  
of atmospheric pressure 760mm  
Hg = 160mm Hg.  
At 16000ft with atmospheric  
pressure at 400mm Hg pO<sub>2</sub> =  
82mm Hg

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Henry's Law of Solution states  
that the quantity of a gas going  
into simple solution at constant  
temperature is proportional to the  
pressure. The solubilities of  
oxygen, carbon dioxide and  
nitrogen are in the ratio of  
2:50:1

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**Movement of gases is always from the region of high tension to a region of low tension.  
Oxygen will thus pass from the lung alveoli to the blood and then to the tissues.  
CO<sub>2</sub> tension is higher in the blood so passes from the blood to the alveoli.**

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**Oxygen is transported in the blood in 2 ways**

- 1. Dissolved in the plasma = 0.3 volume %. Small but important in determining the oxygen tension gradient from the plasma to the tissues.**
- 2. Combined with haemoglobin in the red cell.**

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**Almost all the oxygen in the blood is bound to hemoglobin, so interfering with this carrier molecule limits oxygen delivery to the periphery.**

**Hemoglobin increases the oxygen-carrying capacity of blood by about 40-fold,**

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with the ability of hemoglobin to carry oxygen influenced by the partial pressure of oxygen in the environment, a relationship described in the oxygen-haemoglobin dissociation curve. When the ability of hemoglobin to carry oxygen is interfered with, a hypoxic state can result.

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At tensions above 100mm Hg the haemoglobin is fully saturated with oxygen and the dissociation curve is plotted as a percentage saturation against tension.

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#### **The Bohr Effect**

In addition to tension and haemoglobin content, the oxygen content of the blood depends upon the CO<sub>2</sub> being carried simultaneously. An increase in pCO<sub>2</sub> from the normal value of 40mm Hg shifts the oxygen dissociation curve thus less oxygen is carried at a given tension.

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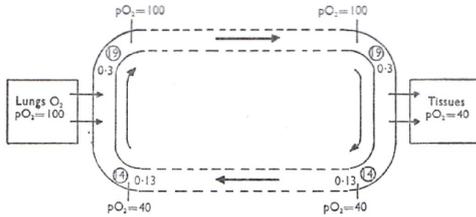
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### Oxygen transport



Blood leaves the lungs at an oxygen tension of 100mm Hg and returns at 40mm Hg

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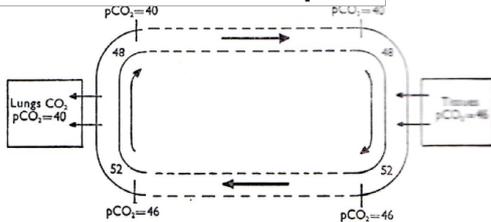
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### Carbon dioxide transport



Only 4ml% is gives off in the passage through the lungs which equals the amount taken up by the tissues

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### Mechanics of Breathing

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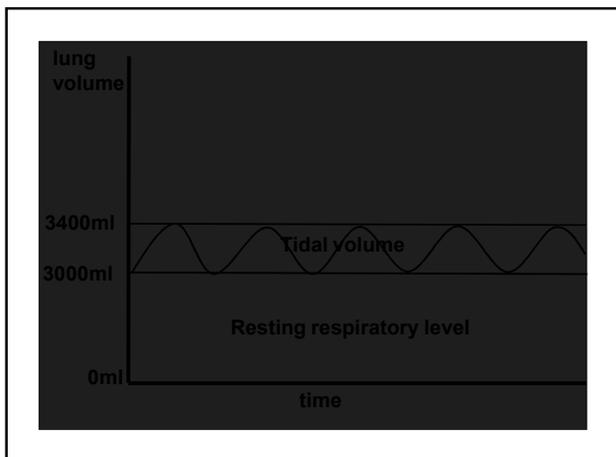
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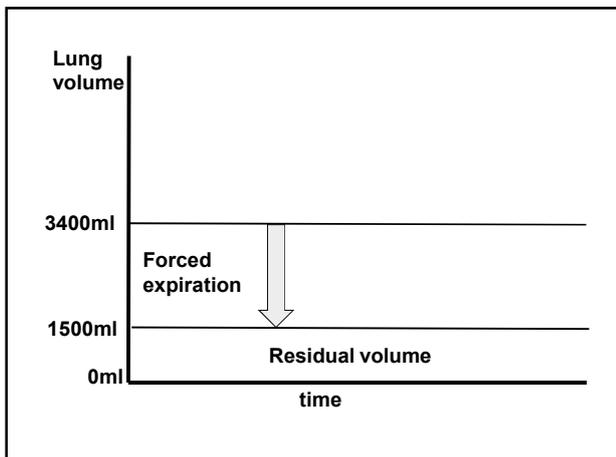
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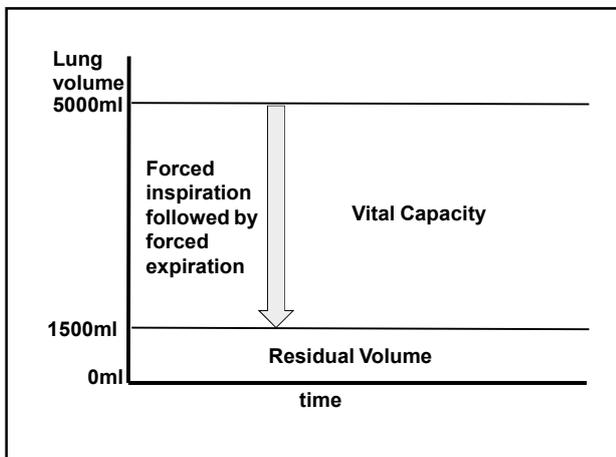
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**Tidal volume = 400ml**  
**Only 250ml of this air reaches the alveoli, the last 150ml remains in the bronchial tubes and is called dead space air.**

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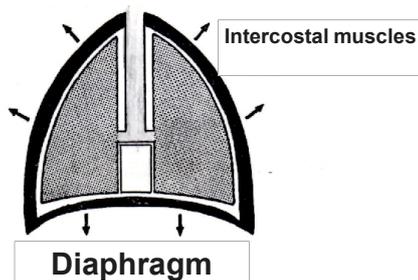
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**Chief muscles of breathing are the Diaphragm and the Intercostals.**



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**Inspiration is an active process of depressing the diaphragm downwards and contracting the intercostal muscles \ moving the chest wall upwards and outwards.**

**Expiration is brought about by passive elastic recoil of the lungs and relaxation of the inspiratory muscles.**

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**Mechanical Faults**

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1. Cranial
2. Cervical spine
3. Thoracic spine
4. Diaphragm
5. M/S joint
6. Sternoclavicular joint
7. Acromioclavicular joint
8. Ribs
9. Lumbar spine

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**Oxygen into the Blood**

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**The alveoli are located in the respiratory zone of the lungs, at the distal termination of the alveolar ducts and atria. These air sacs are the forming and termination point of the respiratory tract. They provide total surface area of about 100 m<sup>2</sup>.**

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**The alveoli consist of an epithelial layer and extracellular matrix surrounded by capillaries. The alveoli contain some collagen and elastin fibres. The elastic fibres allow the alveoli to stretch as they are filled with air during inhalation. They then spring back during exhalation in order to expel the carbon dioxide-rich air.**

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**There are three major cell types in the alveolar wall**  
**1. Type I (Squamous Alveolar) cells that form the structure of an alveolar wall**

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**2. Type II (Great Alveolar) cells that secrete pulmonary surfactant to lower the surface tension of water and allows the membrane to separate, therefore increasing its capability to exchange gases.**

**3. Macrophages that destroy foreign material, such as bacteria.**

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**Re-inflation of the alveoli following exhalation is made easier by pulmonary surfactant, which is a phospholipid and protein mixture that reduces surface tension in the thin fluid coating within all alveoli. The fluid coating is produced by the body in order to facilitate the transfer of gases between blood and alveolar air.**

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**Great alveolar cells also repair the endothelium of the alveolus when it becomes damaged. Insufficient pulmonary surfactant in the alveoli can contribute to atelectasis (collapse of part or all of the lung). Without pulmonary surfactant, atelectasis is common.**

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**Plasma membranes consist of both lipids and proteins. The fundamental structure of the membrane is the phospholipid bilayer, which forms a stable barrier between two aqueous compartments. In the case of the plasma membrane, these compartments are the inside and the outside of the cell.**

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**Plasma membranes of human cells contain four major phospholipids**  
**1. Phosphatidylcholine,**  
**2. Phosphatidylethanolamine**  
**3. Phosphatidylserine,**  
**4. Sphingomyelin**  
**which together account for more than half of the lipid in most membranes.**

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**These phospholipids in human red blood cells are asymmetrically distributed between the two halves of the membrane bilayer.**

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**The outer leaflet consists mainly of phosphatidylcholine, sphingomyelin and glycolipids**

**Where as phosphatidylethanolamine and phosphatidylserine are the predominant phospholipids of the inner leaflet.**

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**A fifth phospholipid, phosphatidylinositol, is also localized to the inner half of the plasma membrane.**

**Although phosphatidylinositol is a quantitatively minor membrane component, it plays an important role in cell signalling.**

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**The head groups of both phosphatidylserine and phosphatidylinositol are negatively charged, so their predominance in the inner leaflet results in a net negative charge on the cytosolic face of the plasma membrane.**

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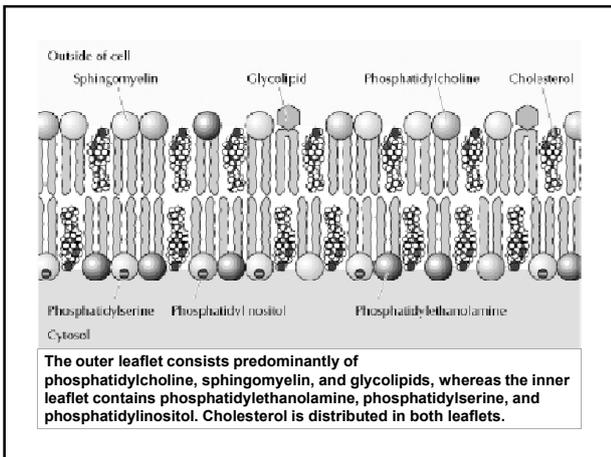
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**In addition to the phospholipids, the plasma membranes of animal cells contain glycolipids and cholesterol. The glycolipids are found exclusively in the outer leaflet of the plasma membrane, with their carbohydrate portions exposed on the cell surface.**

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**They are relatively minor membrane components, constituting only about 2% of the lipids of most plasma membranes. Cholesterol is a major membrane constituent of human cells, being present in about the same molar amounts as the phospholipids.**

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# Phospholipids

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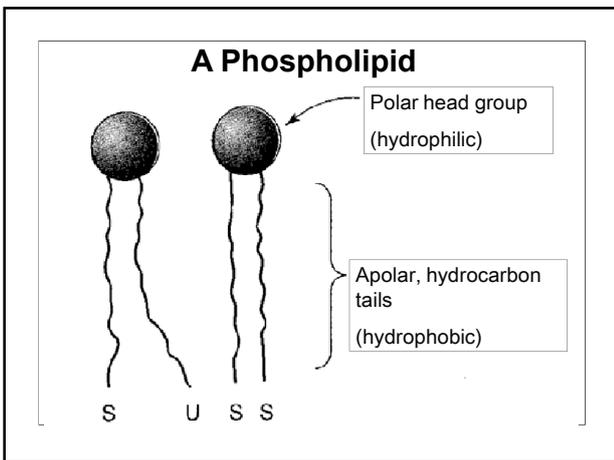
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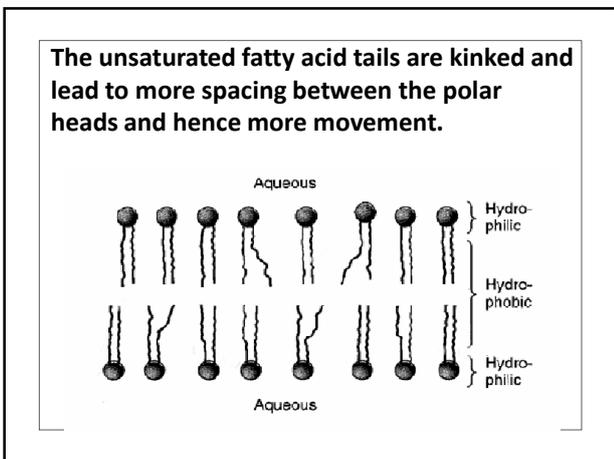
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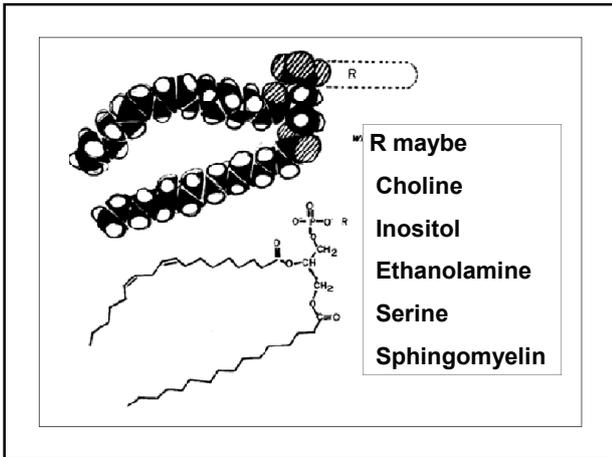
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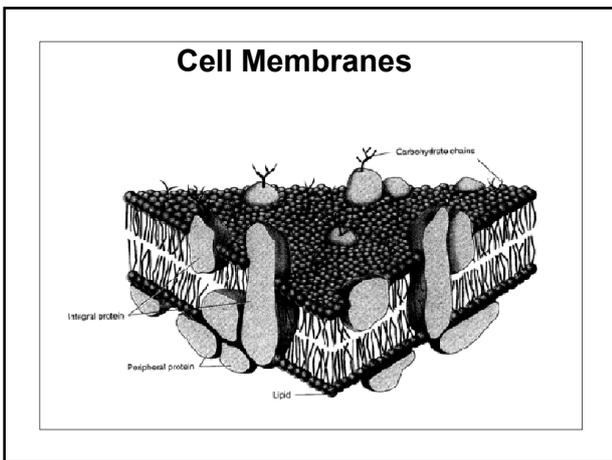
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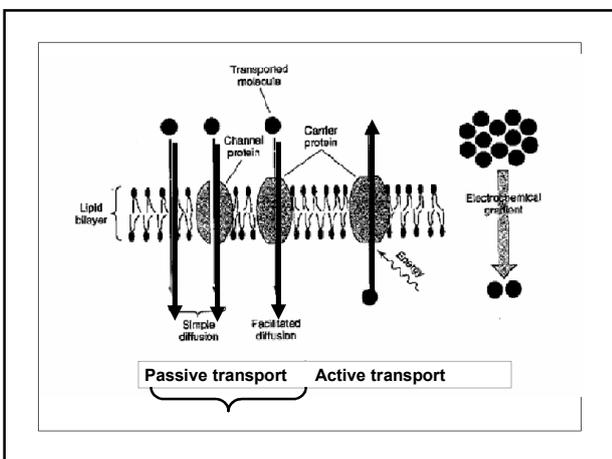
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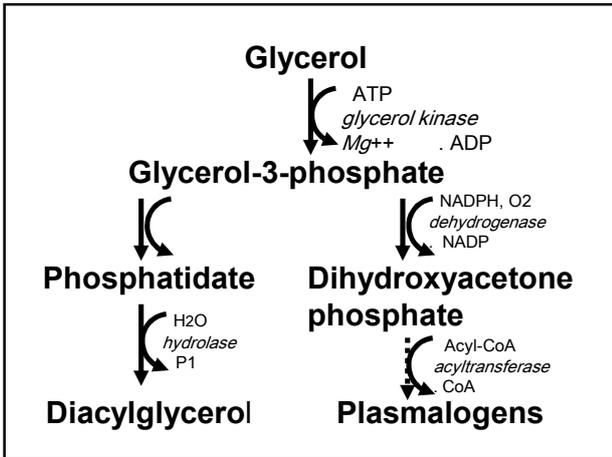
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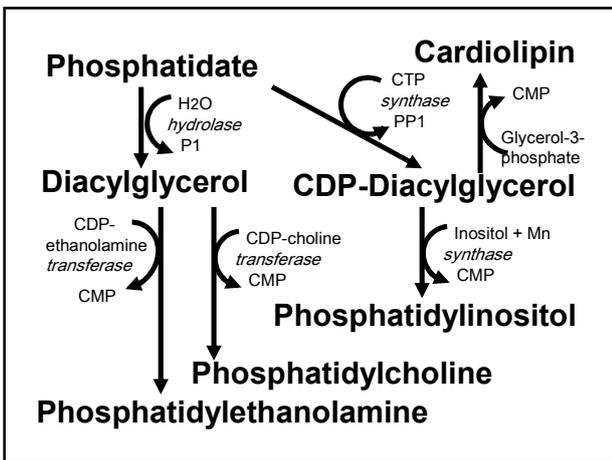
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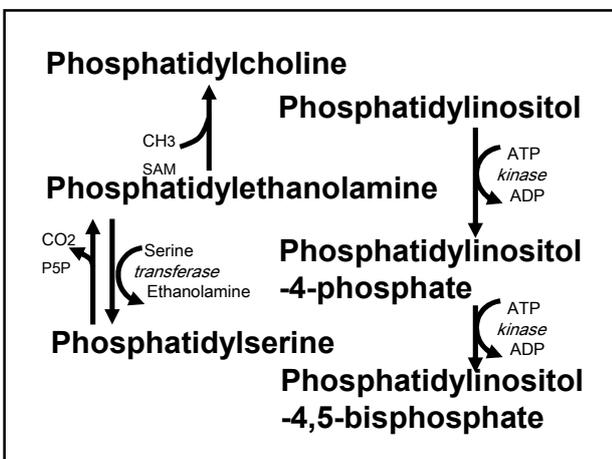
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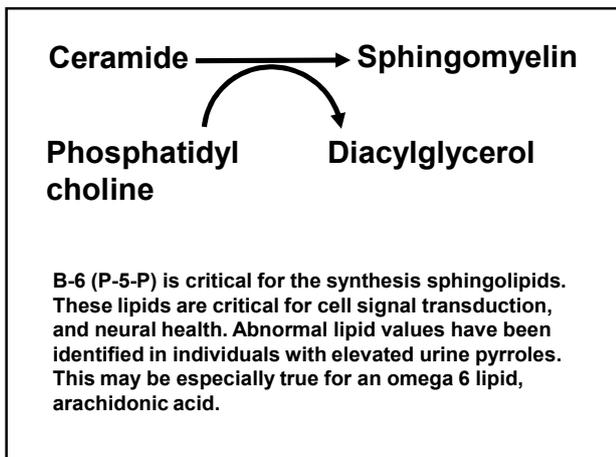
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**Key nutrients for synthesising the phospholipids**  
Acetyl CoA (Vit B5, Magnesium, P5P)  
NAD, NADPH (Vit B3 complex)  
Mg, Zn, SAM (Mg, P-5-P, Folates, B12)  
Choline  
Serine  
Inositol  
Saturated fatty acids C16-18  
Unsaturated fatty acids C18-24  
Lecithin

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**Lecithin is a generic term to designate any group of yellow-brownish fatty substances occurring in animal and plant tissues composed of phosphoric acid, choline, fatty acids, glycerol, glycolipids, triglycerides, and phospholipids (e.g., phosphatidylcholine, phosphatidylethanolamine, and phosphatidylinositol).**

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**Soybean-derived Lecithin dietary supplements are composed of 19-21% Phosphatidylcholine, 8-20% Phosphatidylethanolamine, 20-21% Inositol phosphatides, 33-35% Soybean oil, 2-5% Sterols, 5% Carbohydrates/free, 1% Moisture, and 5-11% Other phosphatides.<sup>1</sup>**

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**Lecithin is only found natural in natural fats, and is not found in processed foods. Foods containing lecithin include: chia seeds, butter, eggs, soy, pumpkin seeds and beef. Lecithin helps break up fats (emulsifier), and helps the body to absorb and use vitamins and calcium.**

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**Pumpkin Seeds. These little miraculous seeds are high in nitric oxide which is what the body needs to heal and repair anything that needs to be healed. They have anti-inflammatory properties and are useful with arthritis and other joint discomforts.**

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**They are high in minerals especially zinc, that help to increase bone density. They support the immune system and are an anti-parasitic.**

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**Hemoglobin saturation  
The quantity of oxygen carried by the saturated blood will depend upon the haemoglobin content of the red cells. With a normal haemoglobin of 14.5gm/100ml blood 20ml of oxygen will combine with the haemoglobin in every 100ml of blood (20 volume %).**

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**The amount carried when fully saturated is called the oxygen capacity.**

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**What hypoxia does to the brain**

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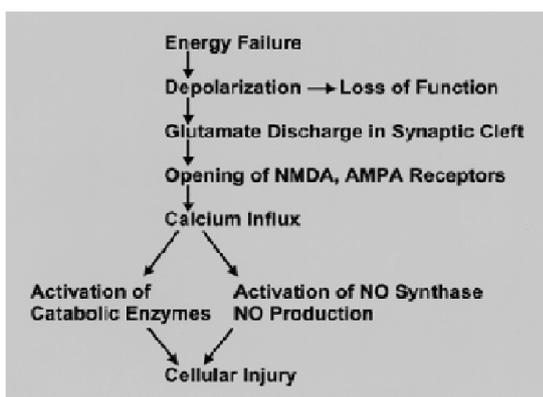
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