A

Absorption – movement of drug from site of administration into central compartment
Acid – proton donor (H+ ion) A− + H+ ⇔ AH
Acidosis/Alkalosis – excess acid/base (physiological process occurring in patient)
Acidaemia/Alkalaeemia – excess acid/base in patient’s blood (normal 7.35-7.45) (H+ 36-44nmol/L)
Affinity – attraction of a drug to a receptor
Afterload – impedance to ventricular ejection/ventricular wall tension/stress to eject stroke volume (as per Laplace’s law)
Agonist – substance which binds to receptor to produce a response (excitatory or inhibitory)
Alveolar gas – Ideal alveolar gas: gas from alveoli with a V/Q = 1 (PaO2 40mmHg)
End expired gas: end tidal from ideal alveoli + alveoli dead space (PetCO2 35-38mmHg)
Mixed expired gas: ideal alveoli gas + physiological dead space (30mmHg)
Anaemia – reduced O2 carrying capacity due to decreased quantity and quality of Hb
Anaesthesia – without sensation
General – altered level of reversible unconsciousness (not easily rousable)
Sedation – a spectrum of state of reduced consciousness
Hypnosis – induced sleep like state through REM sleep is not suppressed
Sleep – normal physiological state of reduced consciousness and readily rousable
Dissociative – trance state where eyes remained open with slow nystagmus gaze/non communicative/intense analgesia/amnesia
Anaphylaxis – severe and potentially life-threatening clinical syndrome produced by IgE hypersensitivity reaction (antigen/antibody reaction on mass cells). Manifest as red flush, bronchospasm, vasodilatation, cardiovascular collapse, bronchospasm (requires prior exposure)
Anaphylactoid – clinical indistinguishable from anaphylaxis, cause by complement/indirect histamine release from mast cell. Dose dependent
Anion – negatively charged ion
Anode – negative electrode (donates electrons)
Antagonist – drugs with affinity to receptor but no intrinsic activity (nil efficacy)
Antibiotic – agent used systemically to treat infection (antibacterial/antifungal/antiparasitic)
Anticoagulant – agent to reduce or prevent coagulation by interfering with fibrin plug formation
Automaticity – ability to self-depolarise and initiate own heart beat
ANS – provides efferent pathway of involuntary control of most organs. Divided to SNS & PNS
Autoregulation – local mechanism, ability of an organ to maintain adequate perfusion in the presence of altering physiological conditions (pressure autoregulation/metabolic autoregulation)
Avogadro’s Hypothesis – equal volume of gases at same temp and pressure contains equal number of molecules. (One mole of gas = 6 x 10^23 molecules occupies 22.4L at STP)
B
Bainbridge Reflex – increased intravascular volume in normovolemic pts causes reflex tachycardia independent of increased blood pressure
Baricity – density of liquid in relation with CSF
Basal Metabolic Rate – minimal metabolic rate, amount of energy liberated per unit time to maintain basal cellular function (J/s or W) at defined conditions (rest, room temperature, 12hr post-meal)
Base – proton acceptor (H+ ion) B+H+ ⇔ BH−
Base Excess – blood sample equilibrated to PaCO2 40mmHg (titrated with acid/base until pH is normal)
Beer-Lambert law – intensity of light passing through a solution decreases exponentially with concentration (Beers) and distance (Lambert)
\[ I \text{ Trans} = I \text{ Incident} e^{-\alpha d} \]
Benzoulli Effect – decreased pressure in tube as velocity of flow increases
Bitemetric Strip – two metal with different expansion coefficient
Bioavailability – proportion of drug which reaches systemic circulation \( FB=FA \times (1-\text{HER}) \)
Biotransformation – enzymatic conversion of a drug to a more polar molecule
Blood Brain Barrier – physiologically highly selective permeable barrier that separates blood from brain
Blood Pressure – pulsatile ejection of stroke volume into arterial vasculature

<table>
<thead>
<tr>
<th></th>
<th>Systolic Pressure</th>
<th>Diastolic Pressure</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Atrium</td>
<td>5</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Left Atrium</td>
<td>10</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Right Ventricle</td>
<td>25</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Left Ventricle</td>
<td>120</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Aorta</td>
<td>120</td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td>Pulmonary Artery</td>
<td>25</td>
<td>8</td>
<td>15</td>
</tr>
</tbody>
</table>
Blood Volume
Adult: 70ml/kg
Infant (28 days to 1 year): 80ml/kg
Neonate (0-28 days): 90ml/kg

<table>
<thead>
<tr>
<th>Blood Volume Distribution</th>
<th>Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veins</td>
<td>65% (55% supine)</td>
</tr>
<tr>
<td>Arteries</td>
<td>13%</td>
</tr>
<tr>
<td>Arterioles</td>
<td>2%</td>
</tr>
<tr>
<td>Capillaries</td>
<td>5%</td>
</tr>
<tr>
<td>Central Blood Volume (heart &amp; lungs)</td>
<td>15% (25% supine)</td>
</tr>
</tbody>
</table>

Blood Gas Partition Coefficient – ratio of anaesthetic agent in equilibrium at 37°C contain same partial pressure between the 2 phases

Bohr Effect – the variable affinity of Hb to O2 in the variable concentration of H+ and PCO2

Bohr Equation – amount of physiological dead space in lung Vd/Vt=PaCO2 – PeCO2/PaCO2

Boiling Point – temperature which SVP = Patm (all substance enter vapour phase)

Buffer – substance which to receive or donate H+ in solution preventing the change in pH

Bulk Flow – net solvent movement in one direction

Bunsen Solubility Coefficient – volume of gas dissolved in a unit volume of solvent at a stated temperature and 1 atm pressure

C

Calorie – heat energy necessary to raise the temp of 1g of H2O by 1°C

Cardiac Output – volume of blood ejected from heart per unit time (CO=HR x SV)

<table>
<thead>
<tr>
<th>Whole body</th>
<th>Weight (g)</th>
<th>Flow (% CO)</th>
<th>VO2 (% CO)</th>
<th>Autoregulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart</td>
<td>300</td>
<td>5% (70% LCA; 30% RCA)</td>
<td>10%</td>
<td>Myogenic Metabolic (main)</td>
</tr>
<tr>
<td>Kidneys</td>
<td>300</td>
<td>25% (90% Cortex; 5% Medulla)</td>
<td>7%</td>
<td>Myogenic Tubuloglomerular F</td>
</tr>
<tr>
<td>Brain</td>
<td>1.5kg</td>
<td>15% (65% Grey; 33% White)</td>
<td>20%</td>
<td>Myogenic (main) Metabolic (regional)</td>
</tr>
<tr>
<td>Liver</td>
<td>2.5kg</td>
<td>30% (30% Hep Art; 70% Portal Vein)</td>
<td>25%</td>
<td>Metabolic (Hepatic Art)</td>
</tr>
<tr>
<td>Skin</td>
<td>3kg</td>
<td>5%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Skeletal Muscle</td>
<td>30kg</td>
<td>20%</td>
<td>20%</td>
<td>Metabolic</td>
</tr>
</tbody>
</table>

Cardiac Properties

Automaticity: ability to initiate own beat

Dromotropy: speed of conduction via AV node

Inotropy: contractility

Lusitropy: active relaxation

Bathmotropy: excitability, ease of myocyte depolarise by stimulus (slope phase 0)

Irritability: size of stimulus required to depolarise cell in context to resting phase (difference between threshold and RMP)

Cathode – positive electrode which receives electron

Cardiovascular Collapse: Convulsion Dose (CC: CD) – ratio of blood levels of local anaesthetics causing toxicity

Ceiling Effect – phenomenon where a drug reaches its maximal effect and effectiveness does not increase with further increase in dose

Cell – smallest structure, functional and biological unit of all organism

Chelate – to incorporate a metal into an organic complex

Chiral – asymmetric in which the structure and its mirror image is not superimposable

Clearance – volume of plasma clear of a drug per unit time

Closing Capacity – the lung volume at which dependant airways begin to close (CV+RV)

Closing Volume – lung volume at which dependant airway begin to close to the start of RV

Colligative Properties – properties of a solution that depends only on the number of freely moving particles and not on the nature of those particles

i.e. – Osmotic pressure, Boiling point elevation, Freezing point depression, Vapour pressure depression

Colloid – substances unable to pass semipermeable membrane (suspension of solutes)
Compliance – change in volume over change in pressure. (Normal 200ml/cmH₂O) affected by lung elastic recoil/lung volume/disease/pulmonary blood volume

**Static Compliance:** patient inspiring sequentially to different known volume, relaxing against a closed glottis (time for equilibrium to occur) =V₁/(Pₚlₐₜₐ urlString=’) PEEP)’

**Dynamic Compliance:** against normal breathing, volume and pressure at point of no flow =V₁/(Pₑₚₑₐₑ urlString=’) PEEP)

**Specific Compliance:** compliance divided by FRC (Normal: 0.05/cmH₂O)

Concentration – amount per volume

**Concentration effect** – the higher inspired concentration of a gas, the more rapid rise in alveolar concentration

Conduction – mode of heat transfer between 2 objects that are in contact

Context sensitive half time – time for plasma concentration of a drug to decrease by 50% after stopping the infusion designed to maintain steady state

Dependant on: Duration of infusion/Distribution/Clearance

Contractility – myocardial performance factor that is independent of heart rate and loading factors

Coronary Perfusion Pressure – Diastolic BP-LVEDP

Counter Current Exchange – provides circulatory perfusion to LOH and CD while maintaining hypertonic interstitial medullary gradient

Counter Current Multiplier – concentrating effect of the medullary interstitium multiplied by the counter current flow of tubular fluid within LOH

Critical Pressure – pressure required to liquefy a vapour at its critical temperature

Critical Temperature – temperature above which substance cannot be liquefied however much pressure applied

Critical Velocity – velocity above which laminar flow become turbulent

Crossmatch – part of blood compatibility testing (to prevent haemolysis post transfusion)

- Major – patient serum + donors’ RBC
  - Saline agglutination: reconfirms ABO grouping
  - Indirect Coombs: reconfirms presence of minor antibodies

- Minor – patient RBC + donors’ serum

Crystalloid – substances able to pass semipermeable membrane

**Dalton’s Law** – the pressure exerted by a mixture of gas = the sum of pressures of each individual gasses

Damping – resistance to free oscillation

Under damping: overshoot common, system oscillates

Over damping: slow signal response with inability to respond to rapid change

Critical damping: point of overshoot is just avoided

Optimal damping: 64% critical damping, minimal overshoot and minimal response reduction

Dead space – tidal volume that does not take part in ventilation

- Physiological – alveolar + anatomical (Bohr’s equation)
- Anatomical – volume of conducting airways (Fowler’s method)
- Alveolar – volume beyond conducting airways that do not take part in ventilation (V/Q mismatch)

Decontamination – process which removes/destroys contaminants

- Cleaning: physical removal of foreign material
- Disinfection: process of eliminating most pathogenic organism except spores
- Disinfectant: chemical used to disinfect non-living surfaces
- Antiseptic: chemical used to disinfect living surfaces
- Sterilisation: process of killing all microbes

Density – mass per unit volume

Dependence – psychophysical requirement of continued supply of substance

- Physical dependence: characterised by withdrawal symptoms after discontinuation of a drug or after administration of an antagonist
- Psychological dependence: a chronic state, characterised by the compulsive use of a substance resulting in harm (physical, psychological or social) and continued use despite harm

Desensitisation

- Tachyphylaxis: acute decrease in response to repeated dose of a drug
- Tolerance: chronic decrease in response to repeated dose of a drug

Dibucaine Number - % inhibition of plasma cholinesterase activity after addition of dibucaine (quality of plasma cholinesterase)

Diffusion – movement of substances down its concentration gradient (obeys Fick’s law of diffusion)
**Definitions**

**Diffusional Hypoxia** – reduced alveolar O\textsubscript{2} concentration from dilution by N\textsubscript{2}O leaving the blood stream and entering the alveoli

**Doppler Effect** – frequency shift effect where the frequency and wavelength of a signal changes in relation to changes in soundwaves when source moves in relation to stationary observer

**Double Burst Stimulation** – 2 short burst of tetanus (50Hz) separated by 0.75sec

**Down-regulation** – decrease responsiveness of target tissue due to decrease active receptor numbers (decrease effect) (due to decrease production/inactivation of receptor)

**E**

**ECG** – graphical presentation of surface recording of electrical activity of heart

**EEG** – graphical presentation of surface recording of electrical activity of neural cells (specifically the post-synaptic potentials of subcortical neurons perpendicular to electrode)

- PR interval: 0.12-0.2s
- QRS complex: 0.06-0.12s
- QT interval: 0.36-0.44s

**Efficacy** – maximal effect attainable by drug

**Elimination** – amount of drug excreted by the body

**Emulsion** – pair of immiscible fluid (droplet disperse throughout another) inherently unstable and tend to coalesce so need emulsifier to improve solubility

**Enzyme** – biological catalyst

**Ergot** – fungal derivative

**Eutectic** – mixture in which the physicochemical properties are different to that of its individual component

**Evaporation** – mode of heat transfer via vaporisation of H\textsubscript{2}O from surface

**Exercise** – hypermetabolic state produces changes (increase O\textsubscript{2} flux and removal of waste products)

**Exponential Function** – rate of change of a quantity is proportional to the quantity at that time

**Excitability** – slope of phase 0, the ease which a myocardial cell respond to a stimuli to depolarise

**F**

**Fasting** – abstinence from food +/- water

**Fick Principle** – blood flow to an organ equals rate of substrate uptake/ removal divided by A-V concentration difference for that substance

**Filling Ratio** – weight of fluid/weight of H\textsubscript{2}O required to fill the cylinder (N\textsubscript{2}O)

**First Pass Metabolism** – metabolism of substance once absorbed, before reaching the systemic circulation

**Flow** – quantity of fluid (gas/liquid) passing a point per unit time

- Laminar: organised, parabolic, flow proportional to pressure
- Turbulent: disorganised, eddies, flow\textsuperscript{2} proportional to pressure

**Force** – mass x acceleration (unit: Newton)

**Fourier’s Analysis** – construction of complex waveform from multiple basic sine waves of different frequency

- Slowest component: fundamental frequency
- Faster component: harmonics

**Functional Residual Capacity** – lung volume at the end of normal tidal expiration, equilibrium point where the chest wall expand outwards and the lung collapsing

**G**

**Gas** – substance in gaseous phase above its critical temperature

**Gas Laws**

- Avogadro’s Law (PV=n) at STP 1 mole=22.4L
- Boyle’s Law (1\textsuperscript{st} gas law): at a constant temperature, volume of gas is inversely proportional with absolute pressure (PV=k, T constant)
- Charles’ Law (2\textsuperscript{nd} gas law): at a constant pressure, volume of gas is directly proportional to absolute temperature (V~T, P constant)
- Amonton’s Law (3\textsuperscript{rd} gas law): at a constant volume, pressure is directly proportional to temperature (P~T, V constant)
- Dalton’s Law: the pressure exerted by a mixture of gas = the sum of pressures of each individual gasses
- Henry’s Law: at given temperature, amount of a given gas dissolved in a given liquid is directly proportional to the partial pressure of the gas in equilibrium with the liquid

**Poynting effect**: formation of a gaseous mixture of O\textsubscript{2} and N\textsubscript{2}O when O\textsubscript{2} is bubbled through liquid N2O

**Gibbs-Donnan Effect** – distribution of charged diffusible ions in the presence of non-diffusible ions across a semi-permeable membrane

- Responsible for: Oncotic pressure
Definitions by M Chong & B Chen

Cell volume stability (double Donnan)
RMP

G-Proteins – cell membrane associated proteins which are important in signal transduction mechanisms

H
Haldane Effect – Deoxygenated Hb has increased ability to carry CO₂
Half-Life – the time necessary for drug concentration to decrease by 50%
Haemostasis – physiological process of maintaining blood in a fluid clot free-state in normal vessel or producing rapid localised coagulation at site of injured vessel
Heart Failure – impaired cardiac performance to produce sufficient cardiac output to maintain adequate tissue perfusion and meet metabolic demand (contractility primary problem)
Heat – form of kinetic energy transferred from hotter to colder substance (Joules)
  - Conduction – via contact/collision of molecules
  - Convection – via bulk flow of fluid
  - Radiation – via emission of electromagnetic radiation
  - Evaporation – via vaporisation of water (0.56kcal energy for 1g H₂O)
Heat Capacity – amount of heat required to raise the temperature of a given object by 1 Kelvin
Henderson-Hesselbalch Equation – pH = pKa + log (base)/ (acid)
Henry’s Law – mass of dissolved gas in a given volume of liquid is directly proportional to the pressure of the gas at a constant temperature
Hormone – chemical messenger produced by ductless glands and transported to act on distant target sites via circulation in trace amount
  Types: Peptides – glucagon, insulin, PTH, ACTH, LH, FSH
  Amines – derived from tyramine (T3/T4, NAdr, Adr) or tryptophan (5HT, Melatonin)
  Steroids – synthesised from cholesterol (androgens, sex hormones, vit D)
Hufner’s Number – 1.34 is amount of oxygen which can combine with 1g of Hb when fully saturated
Humidity –
  Absolute: mass of H₂O in a given volume of air (mg/L)
  Relative: ratio of mass of H₂O vapour in a given volume of air to the mass required to saturate the volume at the same temperature
Hyperalgesia – increase in response to noxious stimulus
Hypersensitivity – abnormal response to drugs that are dependent on immunological mechanism
  Type 1: IgE mediated
  Type 2: IgM & IgG mediated
  Type 3: IgM & IgG mediated
  Type 4: Cell mediated
Hypothalamus – Portion of the diencephalon (posterior forebrain) beneath the thalamus forming the floor of the 3rd ventricle. Function: neuroendocrine, control of pituitary secretion, ANS, thermoregulation, control of motion, thirst, hunger & sexual activity
Hysteresis – dependence of the output of a system on its current input & past history
Hypoxaemia – presence of low O₂ tension in arterial blood
Hypoxia – presence of low O₂ tension in tissue for effective oxidative phosphorylation to occur

I
Idiosyncrasy – genetically determined abnormal reactions to a drug

Inhalational Agents

<table>
<thead>
<tr>
<th></th>
<th>Halo</th>
<th>Iso</th>
<th>Enf</th>
<th>Sevo</th>
<th>Des</th>
<th>N₂O</th>
<th>Xenon</th>
<th>Methoxy</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAC</td>
<td>0.75</td>
<td>102</td>
<td>1.7</td>
<td>2.0</td>
<td>6.8</td>
<td>105</td>
<td>70</td>
<td>0.2</td>
</tr>
<tr>
<td>SVP</td>
<td>240</td>
<td>240</td>
<td>170</td>
<td>160</td>
<td>680</td>
<td>-</td>
<td>-</td>
<td>23</td>
</tr>
<tr>
<td>BP</td>
<td>50</td>
<td>-50</td>
<td>-50</td>
<td>-05</td>
<td>23</td>
<td>-</td>
<td>-</td>
<td>105</td>
</tr>
<tr>
<td>BGPC</td>
<td>2.3</td>
<td>1.4</td>
<td>1.8</td>
<td>0.69</td>
<td>0.42</td>
<td>0.47</td>
<td>0.14</td>
<td>13</td>
</tr>
<tr>
<td>OGPC</td>
<td>220</td>
<td>-100</td>
<td>-100</td>
<td>-50</td>
<td>-20</td>
<td>1.4</td>
<td>1.9</td>
<td>950</td>
</tr>
<tr>
<td>Metabolism</td>
<td>20%</td>
<td>0.2%</td>
<td>2%</td>
<td>2%</td>
<td>0.02%</td>
<td>0.01%</td>
<td>-</td>
<td>50%</td>
</tr>
</tbody>
</table>

Immunity – bodily defence system against antigens
  Innate immunity: Humoral – complement system
  Cellular – macrophages, neutrophils, barrier
  Acquired immunity: Humoral – B-cell, immunoglobulins
  Cellular – T-cell mediated
Inotrope – drugs which enhances contractility
Interthreshold Range – range of body temperature where ANS is not triggered
Intraocular pressure – pressure of aqueous humour (10-20mmHg) affected by aqueous humour, extraocular muscles and choroidal blood flow

### Intravenous Agents

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>pH</th>
<th>pKa</th>
<th>Vd</th>
<th>Clearance</th>
<th>Additives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiopentol</td>
<td>3-7mg/kg</td>
<td>11</td>
<td>7.5</td>
<td>2L/kg</td>
<td>5ml/kg/min</td>
<td>Na2HCO3, N2</td>
</tr>
<tr>
<td>Propofol</td>
<td>2.5mg/kg</td>
<td>8</td>
<td>11</td>
<td>4L/kg</td>
<td>30-60ml/kg/min</td>
<td>10% soybean oil</td>
</tr>
<tr>
<td>Ketamine</td>
<td>1-2mg/kg IV</td>
<td></td>
<td></td>
<td></td>
<td>15ml/kg/min</td>
<td>2.5% glycerol</td>
</tr>
<tr>
<td></td>
<td>5-10mg/kg IM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.25% egg phosphatide</td>
</tr>
<tr>
<td></td>
<td>0.3mg/kg</td>
<td>3-5</td>
<td></td>
<td></td>
<td></td>
<td>NaOH</td>
</tr>
<tr>
<td>Etomidate</td>
<td></td>
<td>8</td>
<td>7.5</td>
<td>4L/kg</td>
<td>15ml/kg/min</td>
<td>EDTA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10% soybean oil</td>
</tr>
</tbody>
</table>

### Intravenous Fluids

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Na</th>
<th>Cl</th>
<th>K</th>
<th>Ca</th>
<th>Osm</th>
<th>pH</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>135</td>
<td>95</td>
<td>3.5</td>
<td>2</td>
<td>278</td>
<td>7.35-7.45</td>
<td></td>
</tr>
<tr>
<td>0.9% NaCl</td>
<td>154</td>
<td>154</td>
<td></td>
<td></td>
<td>308</td>
<td>5-7</td>
<td></td>
</tr>
<tr>
<td>Hartmanns</td>
<td>131</td>
<td>111</td>
<td>5</td>
<td>2</td>
<td>278</td>
<td>5-7</td>
<td>Lactate 29</td>
</tr>
<tr>
<td>Plasmalyte</td>
<td>140</td>
<td>98</td>
<td>5</td>
<td>2</td>
<td>295</td>
<td>4-6</td>
<td>Glucose 23 Acetate 27</td>
</tr>
<tr>
<td>5% Dextrose</td>
<td>140</td>
<td>98</td>
<td>5</td>
<td>2</td>
<td>295</td>
<td>4-6</td>
<td>Glucose 50g/L</td>
</tr>
<tr>
<td>Mannitol</td>
<td>1100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mannitol 200g</td>
</tr>
</tbody>
</table>

### Definitions

**Isobestic Point** – unchanged absorbance of light regardless of change during chemical/physical change of a sample

**Isomer** – compounds with the same molecular weight but different structural or spatial arrangement

- Structural isomers: positional/tautomers
- Stereoisomers: enantiomers/diastereomers/geometric isomers

**Irritability** – phase 4, indicating the size of the stimulus needed to depolarise the cell (difference between RMP and threshold potential)

**Joule** – work done when a force of 1N moves its point of application 1m in the direction of the force (Nm)

**Kidney Function**

- Filtration/Absorption/Secretion (H2O, electrolyte)
  - Acid-base balance
  - Removal waste and foreign chemicals
  - BP regulation
  - Metabolism (glucose/glycolysis)
  - Endocrine (Vitamin D activation/Erythropoietin)

**Latent Heat** – heat required to convert 1kg of a substance from one phase to another at a given temperature

**Liver Function**

- Metabolism (lipid/protein/carbohydrate)
- Endocrine (erythropoietin/somatostatin)
- Detoxification drugs
- Immunity (innate: macrophages/Kupffer cells)
- Coagulation (factors, fibrinogen, protein C & S)
- Acid-base (fixed acids elimination, endogenous & exogenous acids)
- Bilirubin production (breakdown of RBC reticuloendothelial system)
- Reservoir (500mls blood)
- Urea production (ammonium to urea)
- Storage (ammonia to urea)
- Haematopoiesis (fetus)
### Local Anaesthetics

<table>
<thead>
<tr>
<th>Potency</th>
<th>pKa</th>
<th>PPB %</th>
<th>Vd</th>
<th>Cl</th>
<th>CC:CD</th>
<th>Max Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast acting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mepivacaine</td>
<td>2</td>
<td>7.6</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Prilocaine</td>
<td>2</td>
<td>7.9</td>
<td>50</td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Etidocaine</td>
<td>6</td>
<td>7.7</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Lignocaine</td>
<td>2</td>
<td>7.9</td>
<td>70</td>
<td>1</td>
<td>10</td>
<td>7:1 CNS 5mcg/ml CVS 10mcg/ml 3/7 Adr</td>
</tr>
<tr>
<td>Medium acting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ropivacaine</td>
<td>6</td>
<td>8.1</td>
<td>94</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>8</td>
<td>8.1</td>
<td>95</td>
<td>1</td>
<td>3</td>
<td>4:1 CNS 4mcg/ml CVS 5mcg/ml</td>
</tr>
<tr>
<td>Slow acting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amethocaine</td>
<td>8</td>
<td>8.5</td>
<td></td>
<td></td>
<td></td>
<td>1.5</td>
</tr>
<tr>
<td>Procaine</td>
<td>1</td>
<td>8.9</td>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

Nerve sensitivity to LA blockade: B > Aδ > C > Aγ > Aβ > Aα

### Lung Function
- Facilitate gas exchange
- Filtration (dust, inhalation)
- Immunological (mucociliary mechanism)
- Reservoir (500mls blood)
- Metabolic (angiensins, bradykinin)
- Thermoregulation
- Inhalational agents
- Taking up drugs (lidocaine, fentanyl)
- Surfactant production (type 2 pneumocytes)

### Lymph
- Interstitial fluid which enters lymphatics vessels (high lipid content)

### Lymphatic Capillaries
- Blinding ending with flap valve vessels. Present in almost all tissues

**MAC**
- Minimal alveolar concentration of inhalational agent at 1atm required to prevent purposeful movement to a standard surgical stimuli (skin incision) in 50% of the population
  - MAC Awake: (0.3-0.5) 50% of patients will be awaken from anaesthesia during emergence or loss of appropriate response on induction
  - MAC Super: (1.3) at which no movement to noxious stimuli in 95% of patients
  - MAC Bar: (1.5) at which ANS is blunted to noxious stimuli in 50% of patients
  - MAC Hour: time in hours of delivery of inhalational agent at 1MAC (quantify exposure to toxic effect)

**Margin of Safety**
- % post synaptic nAchR blocked to prevent NMJ transmission (80% NDMB, 20% DMB), more conservative approach compared to therapeutic index (LD1/ED99)

**Manometer**
- Decide to measure pressure of gas

**Mean Arterial Pressure (MAP)**
- The product of CO x SVR
  - \( = \text{DBP} + 1/3(\text{SBP} - \text{DBP}) \)

**Metabolism**
- Literally means change, referring to all types of chemical and energy transformation that occurs in the body

**Metabolic Rate**
- Amount of heat energy liberated over time

**Mixed Venous Blood**
- Mixture of blood from all systemic venous capillaries of the body
  - \( O_2: \text{PvO}_2 40\text{mmHg}, \text{SvO}_2 75\%, \text{CvO}_2 15\text{mlO}_2/\text{dL} \)
  - \( CO_2: \text{PvCO}_2 46\text{mmHg}, \text{CvCO}_2 52\text{mlCO}_2/\text{dL} \)

**Mole**
- Amount of a chemical substance that contains as many elementary entities as there are in 12g of Carbon-12 (containing 6 x 10^{23} molecules)

**Molecular Weight**
- Mass of 1 molecule/ (1/12th) mass of 1 Carbon-12 atom (ratio)

**Monro-Kellie Doctrine**
- The cranium is a rigid closed vault. Total volume is fixed, any increase in intracranial content will result in large increase in pressure (blood/brain/CSF)

**Motor Unit**
- Consist of anterior horn cell, motor axon and muscle fibre

**Muller’s Manoeuvre**
- Forced inspiration against a closed glottis

**Muscle Spindle**
- Intrafusal muscle fibre (10 in a capsule) which are concerned with proprioception

### Muscle Relaxant

<table>
<thead>
<tr>
<th>Dose</th>
<th>Speed Onset</th>
<th>Duration</th>
<th>Vd</th>
<th>Metabolism</th>
<th>Excretion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suxamethonium</td>
<td>1 IV/5-10 IM</td>
<td>0.5-1</td>
<td>3-5</td>
<td>0.2</td>
<td>PChEsterase</td>
</tr>
<tr>
<td>Pancuronium</td>
<td>0.1</td>
<td>3-5</td>
<td>60</td>
<td>0.2</td>
<td>Hepatic 10%</td>
</tr>
</tbody>
</table>
### Definitions

By M Chong & B Chen

<table>
<thead>
<tr>
<th>Drug</th>
<th>Potency</th>
<th>pKa</th>
<th>% unionised</th>
<th>PPB %</th>
<th>Vd</th>
<th>Cl</th>
<th>T1/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocuronium</td>
<td>0.6</td>
<td>1-2</td>
<td>30</td>
<td>0.2</td>
<td>Hepatic 15%</td>
<td>Bile 10%</td>
<td></td>
</tr>
<tr>
<td>Vecuronium</td>
<td>0.1</td>
<td>3-5</td>
<td>30</td>
<td>0.2</td>
<td>Hepatic 60%</td>
<td>Unchanged Renal 10% Bile 40%</td>
<td></td>
</tr>
<tr>
<td>Atracurium</td>
<td>0.6</td>
<td>3-5</td>
<td>30</td>
<td>0.2</td>
<td>Unchanged Renal 20% Bile 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cis-Atracurium</td>
<td>0.1</td>
<td>3-5</td>
<td>30</td>
<td>0.2</td>
<td>Hoffman/ P. Esterase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mivacurium</td>
<td>0.1</td>
<td>3-5</td>
<td>15</td>
<td>0.2</td>
<td>Hoffman/PChEsterase</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Myogenic Theory** – autoregulation, contraction/dilatation of blood vessels in response to change in transmural pressure

**N**

**Nausea** – unpleasant subjective sensation referred to the pharynx and upper abdomen, associated with vomiting

**Neuromuscular Blockade**
- **Depolarising/Phase 1 block** – fasciculation, T4/T1 >0.7 no fade, no post tetanic facilitation
- **Non-depolarising/Phase 2 block** – no fasciculation, fade (T4/T1<0.4) in TOF, post tetanic facilitation, antagonism by neostigmine and DMB

**Nociception** – encoding and processing of harmful stimuli in nervous system

**O**

**Ohm’s Law** – V=IR

**Opiate** – substances derived from opium (naturally occurring)

**Opioids** – agonist at opioid receptors (naturally occurring and synthetic) (endogenous: enkephalin, endorphins, and dynorphins)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Potency</th>
<th>pKa</th>
<th>% unionised</th>
<th>PPB %</th>
<th>Vd</th>
<th>Cl</th>
<th>T1/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pethidine</td>
<td>0.1</td>
<td>–8</td>
<td>–86</td>
<td>30</td>
<td>3</td>
<td>15</td>
<td>3hr</td>
</tr>
<tr>
<td>Tramadol</td>
<td>0.1</td>
<td>–8</td>
<td>–86</td>
<td>30</td>
<td>3</td>
<td>15</td>
<td>3hr</td>
</tr>
<tr>
<td>Morphine</td>
<td>1</td>
<td>–8</td>
<td>25</td>
<td>30</td>
<td>3</td>
<td>15</td>
<td>3hr</td>
</tr>
<tr>
<td>Oxycodone</td>
<td>1</td>
<td>–8</td>
<td>–86</td>
<td>30</td>
<td>3</td>
<td>15</td>
<td>3hr</td>
</tr>
<tr>
<td>Methadone</td>
<td>2-4</td>
<td></td>
<td>–86</td>
<td>30</td>
<td>3</td>
<td>15</td>
<td>3hr</td>
</tr>
<tr>
<td>Alfentanil</td>
<td>10</td>
<td>6.5</td>
<td>90</td>
<td>&gt;90</td>
<td>3</td>
<td>5</td>
<td>1.5hr</td>
</tr>
<tr>
<td>Buprenorphine</td>
<td>30</td>
<td></td>
<td>&gt;90</td>
<td>30</td>
<td>3</td>
<td>15</td>
<td>3hr</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>100</td>
<td>8.5</td>
<td>10</td>
<td>80</td>
<td>0.3</td>
<td>15</td>
<td>3hr</td>
</tr>
<tr>
<td>Remifentanil</td>
<td>100</td>
<td>7</td>
<td>10</td>
<td>80</td>
<td>0.3</td>
<td>15</td>
<td>3hr</td>
</tr>
<tr>
<td>Sufentanil</td>
<td>1000</td>
<td>3</td>
<td>10</td>
<td>80</td>
<td>0.3</td>
<td>15</td>
<td>3hr</td>
</tr>
<tr>
<td>Naloxone</td>
<td>1000</td>
<td>3</td>
<td>10</td>
<td>80</td>
<td>0.3</td>
<td>15</td>
<td>3hr</td>
</tr>
</tbody>
</table>

**Osmoles** – concentration of osmotically active particles

**Osmolarity** – number of osmole per litre of solvent dependant on temperature

**Osmolality** – number of osmole per kg of solute non dependant on temperature

**Osmosis** – diffusion of solvent (H₂O) down its concentration gradient

**Osmotic Pressure** – minimum pressure necessary to prevent the movement of solvent

**Overton-Meyer Theory** – volatile anaesthetics with the highest solubility are higher potency

**Oxygen Cascade** – series of steps of PO₂ from atmospheric air to mitochondrial in cells

**P**

**P50** – PO₂ at which Hb is 50% saturated. Relates to Hb affinity

**pH** – negative log of H⁺ concentration

**pKa** – negative log of acid dissociation constant (Ka), where Ka = (H⁺)(A⁻)/(HA), buffering capacity of the buff (pKa +/- 1 for closed system) or degree of ionisation (50% @pH=pKa)

**Pain** – unpleasant sensory and emotional experience associated with potential or actual tissue damage or described in such terms

Comprises of ascending and descending pathway

- **Primary hyperalgesia** – peripheral sensitisation, stimulus at site produces more pain
- **Secondary hyperalgesia** – central sensitisation, increased responsiveness in surrounding site
- **Allodynia** – previously non-painful stimulus now painful
- **Wind-up** – central sensitisation to pain which impulse strengthens with repetitive stimulation (includes long term potentiation)
Gate Control Theory (of Melzack) – modulation of ascending pathway via activity of transmission cells in substantia gelatinosa (lamina II)

**Partition Coefficient** – ratio of concentration of substance in 2 phases in equilibrium (equal volume and pressure) at stated temperature (normally 37°C), related to solubility of substances in different phases

- BGPC (blood: gas) inversely proportional to speed of onset/offset
- OGPC (oil: gas) proportional to potency and metabolism
- TGPC (tissue: gas) proportional to tissue uptake/offset

**Piezoelectricity** – ability to interconvert between mechanical energy and electrical energy

**Pharmaceutics** – branch of pharmacology that looks at the formulation, packaging and physicochemical properties of a drug

**Pharmacodynamics** – branch of pharmacology that looks at biochemical and physiological effects of the drug on the body

**Pharmacokinetics** – branch of pharmacology that looks at the fate of the drug administered into the body

E.g.:  
- PK – suxamethonium apnoea, acetylators (fast/slow: codeine)
- PD – malignant hyperthermia, porphyria (thiopental)

**Post Tetanic Count** – number of responses to 1Hz stimulation for 3 seconds after 5sec of 50Hz tetanus

- PTC 8-10: first TOF
- PTC 0: no buck or cough

**Potency** – drug dose required to achieve certain response, related to receptor affinity (PD) and PK

**Pouseuille’s Law** – Flow = (P1 - P2) πr4 / 8ηL for laminar flow of fluid

**Preload**

- Isolated: initial fibre length prior to contraction = amount of stretch of ventricular muscle fibre at the end of ventricular filling
- Intact: compliance x transmural pressure (filling pressure – extrinsic pressure)

**Pressure** – force per unit area (Pascal or N/m²)

- Gauge Pressure – pressure above/below atmospheric pressure
- Absolute Pressure – gauge + atmospheric pressure

**Prodrug** – inactive substance metabolised to active drug within the body (clopidogrel, dabigatran, enalapril, codeine, heroin, parecoxib, and prednisone)

**Pseudo-Critical Temperature** – temperature which a gas mixture will separate into its constituents

**Respiratory Quotient** – the ratio in steady state of volume of CO2 produced per volume of O2 consumed per unit time (Carbohydrate: 1, Protein: 0.8, Fat: 0.7)

**Resting Membrane Potential** – electrical potential across semipermeable membrane at cell’s resting state

**Resonance** – tendency at which system oscillates at greater amplitude at certain frequency

Reynold’s Number – Re = PʋD/η turbulent if Re >2000
Sarcomere – contractile unit of a myofibril separated on each ends by Z lines

Saturated Vapour Pressure – the pressure of a vapour which is in equilibrium with its liquid phase, indicator of volatility

Saturation

\[ \text{SpO}_2 = \text{oxygen saturation as measured by pulse oximeter} \]
\[ \text{SaO}_2 = \text{oxygen saturation as measured by blood analysis (e.g. a blood gas)} \]

Functional \( \text{SaO}_2 = \frac{\text{HbO}_2 \times 100}{\text{HbO}_2 + \text{Hb}} \)

Fractional \( \text{SaO}_2 = \frac{\text{HbO}_2 + \text{Hb} + \text{MetHbO}_2 + \text{COHb}}{100} \)

\( \text{PaO}_2 \) = partial pressure of oxygen in the blood, as measured by blood analysis

Second Gas Effect – uptake of large volume of primary gas accelerates the rate of rise of second gas given concurrently

Shelf Life – period which minimum of 90% of drugs remain intact and available for delivery

Shunt – blood entering the arterial system without passing through ventilated lung

Physiological Shunt:

- True Shunt: Thebesian veins & bronchial arteries
- Others: V/Q mismatch (V/Q ratio <1)

Pathological Shunt: patent foramen ovale, atelectasis, pneumonia

Shock (electrical)Macroshock: current >10mA or current passes through the trunk/heart in electrocution

Microshock: low current passes through cardiac muscles sufficient to cause cardiac arrhythmias

Shock (physiological) – inadequate circulation to deliver oxygen to tissues/organs

- Hypovolemic: haemorrhage, burns
- Cardiogenic: post myocardial infarct, acute myocarditis
- Obstructive: tension pneumothorax, cardiac tamponade, pulmonary embolism
- Distributive: sepsis shock, anaphylaxis

Side Effect – undesirable effect of a drug

SIMV (Synchronised Intermittent Mandatory Ventilation) – patient is allowed to breath spontaneously between present mechanical breaths delivered by ventilator

Sleep – physiological decrease level of consciousness and awareness but easily rousable

Specific Heat Capacity – amount of heat required to raise the temperature of 1kg of a substance by 1 Kelvin

Starling’s Forces – sum of hydrostatic and oncotic pressures in determining movement of fluid across semipermeable membrane

Starling’s Law of the Heart – the force of contraction is dependent on the end-diastolic muscle fibre length

Starling’s Mechanism – stroke volume of the heart increases in response to an increase in end-diastolic volume when all other factors remain constant (contractility and afterload)

Starling’s Resistor – a 3rd extrinsic pressure having an influence on the intrinsic pressure gradient

Stats

Contingency table

<table>
<thead>
<tr>
<th>Test +ve</th>
<th>Gold Standard +ve</th>
<th>Gold Standard -ve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test -ve</td>
<td>TP</td>
<td>FN</td>
</tr>
</tbody>
</table>

Sensitivity: proportion of true positive correctly identified (ability to exclude FN) \( \text{FN} = \frac{\text{TP}}{\text{TP} + \text{FN}} \)

Specificity: proportion of true negative correctly identified (ability to exclude FP) \( \text{FP} = \frac{\text{TN}}{\text{TN} + \text{FP}} \)

Positive Predictive Value: proportion of TP given a positive test result \( \text{PPV} = \frac{\text{TP}}{\text{TP} + \text{FP}} \)

Negative Predictive Value: proportion of TN given a negative test result \( \text{NPV} = \frac{\text{TN}}{\text{TN} + \text{FN}} \)

Surfactant – surface active mixture of phospholipids [80% dipalmitoylphosphatidycholine (DPPC)]

Synergism – implies 2 drugs interact to produce effect greater than additional effect

T

Temperature – thermal state of a substance which determines whether it will give heat to another substance or receive heat (unit SI – Kelvin)

Therapeutic Index – ratio of drug dose causing adverse effect over dose causing desirable effect (LDS0/ED50)

Thermoneutral Zone – range of ambient temperature at which VO2 (metabolic rate) is at minimum (thermoregulation can occur via changes to skin blood flow alone)

- Adult: 25-30°C
- Term: 32-34°C
- Prem: 34-36°C

Time Constant (t) – the time it would take for an exponential process to be completed should the initial rate of change remains the same \( \text{1t: 63% completed} \)
Definitions
by M Chong & B Chen

\[ \tau: \text{86.5\% completed} \]
\[ 3\tau: \text{95\% completed} \]

**Tonicity** – effective osmolality of a solution

**Total Lung Capacity** – maximum volume that the lung can contain

**Toxicity** – excess plasma concentration of drug causing deleterious effects

**Train of Four** – 4 pulses of supramaximal stimulus at 2Hz

**Transducer** – a device which changes one form of energy to another

**Tubulo-Glomerular Feedback** – renal autoregulation to ensure constant GFR (via detection of Na/Cl by macula densa)

**U**

**Ultrafiltration** – process which water is removed from blood during various forms of dialysis. Water passing through a semi-permeable membrane as a result of positive pressure on the blood side of membrane

**Up-regulation** – increase responsiveness of target tissue due to increase active receptor numbers (increase effect) (due to increase synthesis/activation of receptor)

**Universal Gas Law** – \[ PV = nRT \]

\[ \frac{V}{Q} \text{– whole body}=0.8 \text{ (Vent 4L/min; Perf 5L/min)} \]
\[ \frac{V}{Q} \text{scattering (erect lung due to gravity)} \]
\[ \text{Vent apex:base }=1:4 \]
\[ \text{Perf apex:base }=1:18 \]
\[ \frac{V}{Q} \text{ apex:base }=3.3:0.63 \]

Due to \( \frac{V}{Q} \) difference

\[ \text{PaO}_2 \text{ apex:base }130:90\text{mmHg} \]
\[ \text{PaCO}_2 \text{ apex:base }28:42\text{mmHg} \]
\[ \text{PaN}_2 \text{ apex:base }550:580\text{mmHg} \]

**Valsalva Manoeuvre** – forced expiration against a closed glottis (standardised, forced expiration against a closed glottis for 10-15secs at 40mmHg)

**Vapour** – substance in gaseous phase below its critical temperature

**Vapour pressure** – pressure exerted by molecules in vapour phase

**Venous Admixture** – the theoretical amount of mixed venous blood added into pulmonary capillary for an observed drop in \( \text{PaO}_2 \)

**Ventilation** – process of exchange of air between lung and ambient air

\[ \text{Total Ventilation: total volume leaving lung each minute} \]
\[ \text{Alveolar Ventilation: effective ventilation of the alveoli, where gas exchange with blood takes place} \]

**Viscosity** – property of liquid which creates resistance/impedence to free flow, given by shear stress/shear rate

\[ \text{Elastic Resistance }60\% \text{ (Surface Tension }70\%; \text{ Elastic Tissue }30\%)\]

**W**

**Windkessel Effect** – hydraulic effect of large elastic arteries which converts the intermittent output of heart to a steady flow through capillaries (maintain perfusion of organ during diastole when cardiac ejection cease)