THE DIFINITIVE GUIDE TO HUMAN ANATOMY & PHYSIOLOGY (HAP 2).

THE CORONARY VESSELS

The Coronary Arteries:

The main systemic artery into which the left ventricle pumps blood in the ascending **aorta** (aorta is a coronary artery).

Other coronary arteries are:

THE LEFT AND RIGHT CORONARY ARTERIES BOTH ARISE FROM THE BASE OF THE AORTA AND ENCIRCLE THE HEART IN THE CORONARY SULCUS (GROOVE). THEY PROVIDE THE ARTERIAL SUPPLY FOR CORONARY CIRCULATION.

Right coronary artery:

Stemming from the **base** of the **aorta**, the **RIGHT** coronary artery runs towards the right side of the heart and splits into its **TWO** branches: the **Marginal artery** and the **Posterior interventricular artery**.

Left coronary artery:

Stemming from the **base** of the **aorta**, the **LEFT** coronary artery runs towards the left side of the heart and splits into its **TWO** branches: the **Anterior interventricular artery** and the **Circumflex artery**.

BLOOD TYPING: ANTIBODIES

THE IMMUNE SYSTEM RECOGNISES FORIGEN ANTIGENS AND RESPONDS TO DESTROY THEM.

ANTIBODIES BIND TO FOREIGN ANTIGENS AND DESTROY THEM.

ANTI-A ANTIBODIES BIND TO AND DESTROY A ANTIGENS.

ANTI-B ANTIBODIES BIND TO AND DESTROY B ANTIGENS.

Under normal circumstances your **immune system does not produce antibodies to self-antigens**.
However, your **immune system does produce antibodies to foreign antigens**.
Thus meaning, **antibodies are only present in** your **plasma if** the **antigens** are **normally absent** on your **erythrocytes**.

ARTERIES:

Aorta:

The aorta is the largest artery in the body.

It originates from the **LEFT ventricle.**

The aortic valve guards the base of the heart preventing backflow during diastole (relaxation).

Aortic arch:

From the **LEFT ventricle,** blood is pumped into the **aortic trunk.** As the aortic trunk continues it moves superiorly and curves around to the posterior side of the heart: this curve or arch is termed, the aortic arch.

Off the aortic arch stem **three** arteries or major branches: the BRACHIOCEPHALIC TRUNK (ARTERY); THE LEFT COMMON CAROTID ARTERY; AND THE LEFT SUBCLAVIAN ARTERY.

Brachiocephalic trunk:

SPLITS TO FORM THE RIGHT COMMON CAROTID ARTERY AND THE RIGHT SUBCLAVIAN ARTERY.

Supplies blood flow to the **head** and **neck:** by **splitting** to form the **right common carotid artery; AND** to the **right upper limb:** by splitting to form the **right subclavian** artery.

Respiratory System

(1) Pulmonary ventilation: **(air of the lungs)**

- movement of **air in**to the **lungs**
- movement of **air out** of the **lungs**

The movement of air in and out of the lungs.

(2) Pulmonary gas exchange: (external respiration):

(blood of the lungs)

- **movement** of **oxygen**: lungs → blood
- **movement** of **carbon dioxide**: blood → lungs

(air moves into capillaries GAS EXCHANGE)

The movement of gases between the lungs and the blood.

Cardiovascular System

(3) Transport of respiratory gases:

- transport of oxygen: blood → body tissues
- transport of carbon dioxide: body tissues → blood

The movement of gases through the blood.

(4) Internal respiration:

- movement of oxygen: blood → tissue cells
- movement of carbon dioxide: tissue cells → blood

The movement of gases between the blood and the tissues.

PULMONARY VOLUMES:

TIDAL VOLUME TV

The amount of air inspired or expired during normal, quiet ventilation: approximately 500mL of air.

INSPIRATORY RESERVE VOLUME IRV

The volume of air that can be forcibly inspired after a normal tidal inspiration. **1900 F | 3100 M**

EXPIRATORY RESERVE VOLUME ERV

The amount of air that can be forcibly expired after a normal tidal expiration. **700 F | 1200 M**

RESIDUAL VOLUME RV

The amount of air that remains in the lungs after a forceful expiration. **1100 F | 1200 M**
Air remains in the lungs after a forceful expiration due to intrapleural pressure, and the outward recoil of the chest wall, both of which keep the lungs slightly inflated.

EXTERNAL RESPIRATION:

Exchange across the respiratory membrane between the alveolar air and the pulmonary capillary blood.

INTERNAL RESPIRATION:

Diffusion of oxygen and carbon dioxide between TISSUES and systemic capillary blood.

CARBON DIOXIDE TRANSPORT IN THE BLOOD: GAS EXCHANGE:

The carbon dioxide produced by our cells' metabolic reactions is transported through the blood from tissue cells to alveoli.

Carbon dioxide is transported in the blood in 3 ways:

(1) DISSOLVED IN PLASMA:

Carbon dioxide has a higher solubility in water than oxygen, allowing for more carbon dioxide to dissolve directly into the plasma (than oxygen).

7% of carbon dioxide is physically dissolved in blood plasma.

VESSEL SUPPLY:

Superior mesenteric artery (branch of the abdominal aorta) brings oxygen-rich, nutrient- poor blood supply.

Veins (carrying nutrient-rich, oxygen-poor blood) drain into superior mesenteric veins → hepatic portal vein → liver.

SPLANCHNIC CIRCULATION:

Celiac Trunk

Liver Stomach Pancreas Duodenum

Superior Mesenteric Artery

The remainder of the small intestine: jejunum, ileum.

Most of the large intestine.

Inferior Mesenteric Artery

The remainder of the large intestine.

Inferior Mesenteric Vein

The remainder of the large intestine.

Superior Mesenteric Vein

The remainder of the small intestine: jejunum, ileum.

Most of the large intestine.

Portal Vein

Liver Stomach Pancreas Duodenum

BLOOD SUPPLY:

The kidneys receive **25%** of the **TOTAL CARDIAC OUTPUT!**

THE **RENAL ARTERIES** BRANCH OFF THE **ABDOMINAL AORTA.**

[1]RENAL ARTERY enters at the **HILUM**, branching into **[2]SEGMENTAL ARTERIES** soon after entry.
As the **SEGMENTAL ARTERIES** branch, travelling along/through the **RENAL COLUMNS**, they become **[3]INTERLOBAR ARTERIES** [each **RENAL PYRAMID** makes up its own **LOBE**].
When the **INTERLOBAR ARTERIES** reach the superior aspect of the **RENAL MEDULLAS**, bordering and **ARCHING AROUND** the **RENAL CORTEX**, they are known as the **[4]ARCUATE ARTERIES**.
Extending laterally from the **ARCUATE ARTERIES**, toward the **RENAL CORTEX**, are the **[5]RADIATE ARTERIES INTERLOBULAR]**.
The **RADIATE ARTERIES** split, one branch continues to the **RENAL CORTEX**, and the other branch is the **[6]AFFERENT ARTERIOLE**, which enters the **[7]GLOMERULUS**.
Exiting the **GLOMERULUS** is the **[8]EFFERENT ARTERIOLE**.

The **EFFERENT ARTERIOLE** feeds into a capillary bed known as the **[9]PERITUBULAR CAPILLARIES**, which form a capillary network around the **RENAL TUBULE** of each **NEPHRON**.

REGULATION OF GLOMERULAR FILTRATION RATE

INTRINSIC CONTROLS

AUTOREGULATION

[1] MYOGENIC MECHANISM:

The **GLOMERULAR HYDROSTATIC PRESSURE** is the **RESULT** of the **SYSTEMIC BLOOD PRESSURE: AUTOREGULATION** is an **INTERNAL MECHANISM** of the **KIDNEYS** to ensure that they **MAINTAIN** a **CONSTANT FILTRATION RATE**.

Increased blood pressure → causes **STRETCH** in the **AFFERENT ARTERIOLES** → this in turn causes smooth muscle **CONTRACTIONS** of the **AFFERENT ARTERIOLE** in the **GLOMERULUS** → **[VASOCONSTRICTION]** **DECREASES BLOOD FLOW** into the **GLOMERULUS**, thus **RETURNING** the **GLOMERULAR FILTRATION RATE** to **NORMAL**.

Autoregulation works within a range slightly wider than the normal blood pressure range **[80 – 180 mm Hg]**

HORMONAL CONTROL:

MALE REPRODUCTION

The HORMONES of the REPRODUCTIVE SYSTEM interact in a relationship called the **[HPG AXIS]**

HYPOTHALAMIC–PITUITARY–GONADAL AXIS

COMMUNICATION BETWEEN THE HYPOTHALAMUS, PITUITARY GLAND AND THE GONADS.

[1] The **HYPOTHALAMUS RELEASES GONADOTROPIN RELEASING HORMONE [GNRH].**

[2] The **ANTERIOR PITUITARY GLAND DETECTS** the **PRESENCE** of **GONADOTROPIN RELEASING HORMONE**, which **STIMULATES** it to **SECRETE FOLLICLE-STIMULATING HORMONE [FSH]** and **LUTENIZING HORMONE [LH].**

[3] In the **TESTES**: **LUTENIZING HORMONE STIMULATES** the **LEYDIG CELLS** to **PRODUCE TESTOSTERONE**.

FOLLICLE-STIMULATING HORMONE STIMULATES SERTOLI CELLS to **SECRETE ANDROGEN-BINDING PROTEIN**, which **BINDS/CONCENTRATES TESTOSTERONE** in the **INTERSTITIAL SPACE** around the **SPERMATOGENIC [SPERM-FORMING CELLS].**

HORMONAL CONTROL:

HIGH TESTOSTERONE LEVELS:

INHIBITS the release of

GONADOTROPIN RELEASING HORMONE from the **HYPOTHALAMUS.**

HIGH SPERM COUNT:

INHIBIN **INHIBITS** the release of

GONADOTROPIN RELEASING HORMONE from the **HYPOTHALAMUS.**

and FOLLICLE-STIMULATING HORMONE from the ANTERIOR PITUIARY GLAND.

HYPOTHALAMUS **RELEASES** **GONADOTROPIN RELEASING HORMONE**

⇓⇓⇓

STIMULATES **ANTERIOR PITUITARY GLAND** to **SECRETE** **FOLLICLE-STIMULATING HORMONE** **[FSH]** and **LUTENIZING HORMONE** **[LH]**

⇓⇓⇓

LUTENIZING HORMONE **STIMULATES** the **LEYDIG CELLS** to **PRODUCE TESTOSTERONE**

⇓⇓⇓

FOLLICLE-STIMULATING HORMONE **STIMULATES** **SERTOLI CELLS** to **SECRETE** **ANDROGEN-BINDING PROTEIN**, and **INHIBIN**

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ANDROGEN-BINDING PROTEIN, **BINDS TESTOSTERONE** around the **SPERM-FORMING CELLS**, which **STIMULATES SPERMOGENESIS**

⇓⇓⇓

HIGH SPERM COUNT INHIBITS the **RELEASE** of **GONADOTROPIN RELEASING HORMONE** from the **HYPOTHALAMUS**

⇓⇓⇓

HIGH TESTOSTERONE LEVELS INHIBIT the **RELEASE** of

MOVEMENT ACROSS CELL MEMBRANES!

OXYGEN: ← IN

NUTRIENTS: ← IN

WATER: ← BOTH →

CARBON DIOXIDE: → OUT

NITROGENOUS WASTES: → OUT

UNIDIRECTIONAL MOVEMENT:

OXYGEN: LUNGS → BLOOD → TISSUE CELLS.

CARBON DIOXIDE: TISSUE CELLS → BLOOD → LUNGS.

NUTRIENTS: GASTROINTESTINAL TRACT → BLOOD → TISSUE CELLS.

NITROGENOUS WASTES: TISSUE CELLS → BLOOD → KIDNEYS.

TWO-WAY MOVEMENT:

WATER:

[CONTAINING SOLUTES/IONS]

→ GASTROINTESTINAL TRACT ← → EXTRACELLULAR FLUID → ← CELLS

→ KIDNEYS ← → EXTRACELLULAR FLUID → ← CELLS

ACID-BASE BALANCE

HYDROGEN = **ACIDIC**.

BICARBONATE = **ALKALINE**.

ACID:

any **SUBSTANCE** that **DONATES**/separates/**DISASSOCIATES** its **HYDROGEN IONS** [when added to **WATER**].

BASE:

any **SUBSTANCE** that **ACCEPTS**/binds **HYDROGEN** ions [when mixed together in **WATER**]. REDUCES ACIDITY.

STRONG ACIDS DISSOCIATE **COMPLETELY** IN WATER → **SIGNIFICANT IMPACT ON pH.**

WEAK ACIDS ONLY **PARTIALLY** DISSOCIATES IN WATER **[STAYS BOUND]** → **MINIMAL IMPACT ON pH.**

STONG BASES QUICKLY BIND/ATTRACT/TIE-UP **HYDROGEN IONS** → **SIGNIFICANT IMPACT ON pH.**

WEAK BASES SLOWLY BIND/ATTRACT/TIE-UP **HYDROGEN IONS** → **MINIMAL IMPACT ON pH.**

TWO TYPES: METABOLIC ACIDS + BASES AND INGESTED ACIDS + BASES.

MAJORITY OF ACIDS + BASES ARE FORMED FROM THE BODIES METABOLIC REACTIONS.