

GASEOUS EXCHANGE

####DEFINE####

**EXCHANGE IS BROUGHT BY CONC
GRADIENT BTWN LIVING AND
SURROUNDING MEDIUM.**

**IN SIMPLE ORGANISM G.E IS BY
DIFFUSION**

**IN HIGHER ORGANISM, ...SPECIAL
ORGANS**

IMPORTANCE

❖ **SUPPLIES OXYGEN NECESSARY FOR RESPIRATION**

❖ **REMOVES CO₂ FROM RESPIRATION**

❖ **REMOVE EXCESS WATER IN FORM OF VAPOR**

❖ **PLANTS ALSO OBTAIN CO₂ FOR PHOTOSYNTH**

GASEOUS EXCHANGE IN PLANTS

OCCURS THROUGH

❖ **STOMATA,**

❖ **PNEUMATOPHORES IN MANGROOVES**

❖ **LENTICEL**

❖ **CUTICLE**

#####-----□

G.E THROUGH THE STOMATA

- ❖ STOMATA IS A **TINY OPENING** ON THE LEAF
- ❖ IT IS **BODERED BY THE GUARD** CELL. #FUNCTION#
- ❖ THE GUARD CELLS MAINLY FACILLITATE ITS **OPENING AND CLOSING** AND EXIST AS PAIRS.
- ❖ THE INNER WALLS OF THE GUARDCELLS ARE THICK AND LESS ELASTIC THAN THE OUTER.

##---□

❖ **THIS CAUSES THE OUTER WALLS TO STRECH OUTWARDS INORDER TO ACCOMMODATE MORE WATER MOLECULES.**

❖ **WHEN THE GUARD CELLS BECOME TURGID, THE STOMATA OPENS.**

- ❖ **MOST OF THE STOMATA ARE FOUND ON
THE LOWER THAN THE UPPER LEAF
SURFACE**
- ❖ **HOWEVER THE DISTRIBUTION OF
STOMATA IS MAINLY RELATED TO THE
HABITAT OF THE PLANT.**
- ❖ **STOMATA ALLOWS GASEOUS EXCHANGE
TO TAKE PLACE IN THE PLANT.**

THEORIES OR THE MECHANISMS OF OPENING AND CLOSING OF STOMATA

- ❖ **POTASSIUM ION THEORY**
- ❖ **PHOTOSYNTHETIC THEORY**
- ❖ **SUGAR STARCH INTERCONVERSION
THEORY**

THEORIES OF OPENING AND CLOSING STOMATA

❖ **POTASSIUM ION THEORY:** THE ENERGY RELEASED FROM PHOTOSYNTHESIS DRIVES POTASSIUM IONS FROM ADJUSCENT EPIDERMAL CELLS INTO THE GUARD CELLS WHILE HYDROGEN IONS ARE MOVED OUT.

#####☐

❖ **ACCUMULATION OF POTASIUM ION IN THE GUARD CELL RAISES THE OSMOTIC PRESSURE AS THE GUARDCELL WILL ABSORB WATER, BECOME TURGID AND OPEN THE STOMATA.**

- ❖ IN THE **ABSENCE OF LIGHT**, ATP MOLECULES FALL THUS THERE IS **NO ENERGY** FOR THE POTASSIUM ION PUMP.
- ❖ **POTASSIUM MOVE OUT OF THE GUARD CELLS** TO THE EPIDERMAL CELLS BY **DIFFUSION**.
- ❖ **HYDROGEN IONS MOVE INTO** THE GUARD CELLS.
- ❖ **THIS LOWERS THE OSMOTIC PRESSURE** OF THE GUARD CELLS, THUS LOSE WATER.
 - ❖ **FINALLY THE STOMATA CLOSES.**

- ❖ **PHOTOSYNTHETIC THEORY:** DURING THE DAY, CHLOROPLAST OF THE GUARD CELL PRODUCES SUGARS THROUGH PHOTOSYNTHESIS.
- ❖ THIS SUGAR CAUSES THE OSMOTIC PRESSURE OF THE VACUOLE TO INCREASE.
- ❖ AS THIS HAPPENS, THE CELL DRAWS IN MORE WATER FROM NEIGHBOURING EPIDERMAL CELL.
- ❖ THE GUARDCELL BECOME TURGID AND BULGE OUTWARD MAKING THE STOMATA TO OPEN.

#####-----□

- ❖ **AT NIGHT, THE SUGAR IS CONVERTED TO STARCH AND ACCUMULATES IN THE GUARD CELL**
- ❖ **THIS LOWERS THE OSMOTIC PRESSURE OF THE GUARD CELL**
- ❖ **THE CELL THEN LOSES ITS WATER TO THE SURROUNDING EPIDERMAL CELLS**
- ❖ **THE GUARDCELLS HERE BECOME PLASMOLYSED THEREBY CLOSING THE STOMA.**

- ❖ **STARCH SUGAR INTERCONVERSION THEORY:** DURING THE DAY, **CO₂ IS USED FOR PHOTOSYNTHESIS AND THE PH BECOMES HIGH.**
- ❖ **THIS INCREASE IN PH FAVORS THE CONVERSION OF STARCH TO GLUCOSE**
- ❖ **SINCE GLUCOSE IS OSMOTICALLY ACTIVE, IT BRINGS ABOUT THE INCREASE IN OSMOTIC PRESSURE, MAKING THE GUARDCELL TO DRAW WATER FROM ADJUSCENT CELL.**
- ❖ **THIS THEN LEADS TO OPENING OF THE STOMATA.**

- ❖ **AT NIGHT PHOTOSYNTHESIS DOESN'T TAKE PLACE AND THEREFORE, CO₂ IS BARELY USED UP BY THE PLANT.**
- ❖ **HERE THE PH WILL BE VERY LOW.**
 - ❖ **THIS FAVORS CONVERSION OF GLUCOSE TO STARCH.**
- ❖ **PRESENCCE OF STARCH DISCOURAGE WATER INTAKE AND THUS THE GUARD CELLS BECOME FLACCID AND CLOSE THE STOMATA.**

MECHANISMS OF GASEOUS EXCHANGE IN PLANTS

MECHANISMS OF GASEOUS EXCHANGE

**WHEN THE STOMATA OPENS, CO₂ FROM
THE ATMOSPHERE DIFFUSES INTO THE
SUBSTOMATAL AIR CHAMBERS.**

**FROM HERE IT MOVES TO THE
INTERCELLULAR SPACES IN THE SPONGY
MESOPHYL.THE CO₂ GOES INTO SOLUTION
DIFFUSING IN CYTOPLASMS**

❖ A **CONC GRADIENT** IS MAINTAINED BETWEEN THE CYTOPLASM AND **THE INTERCELLULAR SPACE**. HERE, CO₂ THEN DIFFUSE INTO THE CELL.

❖ OXYGEN PRODUCED IN PHOTOSYNTHESIS MOVES OUT OF THE CELLS AND INTO THE INTERCELLULAR SPACE.

❖ IT THEN **MOVES TO THE SUBSTOMATAL AIR CHAMBERS**, AND DIFFUSE OUT THROUGH THE STOMATA.

STOMATA HABITAT OF PLANTS

**DIFFERENT PLANTS HAVE DIFFERENT SIZES
AND NUMBER OF STOMATA.**

- ❖ **HYDROPHYTES** - MANY UPPER AND LOWER
- ❖ **XEROPHYTES** - FEW OR NO ON UPPER OR LOW
- ❖ **MESOPHYTES** - MOIST AREAS. MODERTAE
AND LARGE STOMATA ON UPPER AND LOWER

ADAPTATION OF PLANTS GROWING IN VARIOUS HABITATS

HYDROPHYTES

GROW IN WET AREAS;

- ❖ **HAVE MANY STOMATA**
- ❖ **MANY ON THE UPPER SIDE OF LEAF**
- ❖ **HAVE LARGE AERENCHYMA TISSUE FOR GASEOUS EXCHANGE AND BUOYANCY**
- ❖ **LEAVES ARE VERY LARGE**
- ❖ **VERY SHALLOW ROOTS**
- ❖ **MAY HAVE PNEUMATOPHORES (BREATHN ROOT)**

MESOPHYTES/ TERRESTRIAL PLANTS

GROW IN MOIST AREAS;

- ❖ **GROW IN AREAS WITH ADEQUATE WATER**
- ❖ **MODERATE STOMATA NUMBER**
- ❖ **MEDIUM IN SIZE STOMATA**
- ❖ **DEEP ROOTS COMPARED TO
HYDROPHYTES**
- ❖ **MEDIUM SIZED LEAF**

XEROPHYTES

GROW IN ARID/ DESERT AREAS;

- ❖ **HAVE FEW STOMATA**
- ❖ **SMALL SIZED STOMATA ON LOWER SURFACE**
- ❖ **STOMATA ARE SUNKEN**
- ❖ **OPEN STOMATA AT NIGHT AND CLOSE AT DAY**
- ❖ **DEEP ROOTS**
- ❖ **NEEDLE LIKE LEAVES**

AQUATIC PLANTS	TERRESTRIAL PLANTS
NO MECHANICAL STRENGTHENING	THEY HAVE LIGNIN
SHALLOW AND FIBROUS ROOT	DEEP AND WELL ESTABLISHED ROOT
HAVE LARGE AIR SPACE	HAVE NO AIR SPACE
NO TO REDUCED	HAVE DEVELOPED

HAVE NO CUTICLE	HAVE A CUTICLE
NO ROOT HAIRS	HAVE ROOT HAIRS
LARGE STOMATA	STOMATAL SIZE VARIES
FOUND IN AQUATIC AREAS	FOUND IN TERRESTRIAL AREAS
NO TO REDUCED	HAVE DEVELOPED

PROCESS OF GASEOUS EXCHANGE IN PLANTS

GASEOUS EXCHANGE IN THE LEAVES

**MAINLY TAKES PLACE IN THE SPONGE
MESOPHYL WHERE THERE ARE AIR SPACES.**

**DURING THE DAY, CO₂ IN THE ATMOSPHERE
IS AT HIGHER CONCENTRATION THAN IN THE
LEAF TISSUE. BY THIS, CO₂ DIFFUSES IN THE
LEAF THROUGH THE STOMATA. ###----**

**AT NIGHT, THE LEAF TAKES IN OXYGEN
FOR RESPIRATION GIVING OUT
CARBON (IV) OXIDE**

**THE CO₂ HERE IS USED IN THE DARK
STAGE PHOTOSYNTHESIS**

GASEOUS EXCHANGE THROUGH THE LENTICEL

#####DIAGRAM

**LENTICELS ARE OPENINGS FOUND IN THE
STEM AND ROOTS OF SOME WOODY
PLANTS.**

**THEY ARE MADE UP OF LOOSELY PACKED
CORK CELLS ALLOWING GASEOUS
EXCHANGE THROUGH DIFFUSION**

GASEOUS EX THROUGH EPIDERMIS N CUTICLE
SOME G.E ALSO TAKES PLACE IN SOME
EPIDERMIS AND CUTICLE OF THE
YOUNG STEM AND ROOTS

HERE, OXYGEN AND CARBON (IV) OXIDE
DIFFUSE THROUGH THE EPIDERMIS.

GASEOUS EX IN AQUATIC PLANTS

**TAKES PLACE THROUGH THE STOMATA,
EPIDERMIS, SPECIALIZED ROOTS AND
THE AERENCHYMA CELLS.**

#####-----□

ADAPTATIONS OF AQUATIC PLANTS TO GASEOUS EXCHANGE

- ❖ **FLOATING LEAVES** WITH STOMATA ON
THE UPPER SIDE
- ❖ MANGROOVES HAVE **PNEUMATOPHORES**
- ❖ SOME HAVE **AERENCHYMA TISSUE** FOR
GASEOUS EXCHANGE AND BUOYANCY

GASEOUS EXCHANGE IN ANIMALS

DIFFERENT TYPES OF RESPIRATORY SURFACE;

- ❖ **CELL MEMBRANE - AMOEBA**
- ❖ **GILL FILAMENTS - FISH AND TADPOLES**
- ❖ **TRACHEOLES - INSECTS**
- ❖ **ALVEOLI/ LUNGS - KINGDOM CHORDATA**
- ❖ **SKIN - FROG AND EARTHWORM**
- ❖ **BUCCAL CAVITY - FROGS**

❖ **GASEOUS EXCHANGE** TAKES PLACE IN
THE RESPIRATORY SURFACE BY
DIFFUSION.

THE CHARACTERISTICS ARE;

- ❖ **LARGE SURFACE AREA**
 - ❖ **MOIST SURFACE**
- ❖ **LARGE CAPILLARY NETWORK**
 - ❖ **THIN**

GASEOUS EXCHANGE IN UNICELLULAR
THEY USE THEIR CELL MEMBRANES AS
RESPIRATORY SURFACE.

EXAMPLES OF ORGANISM;

❖ **PROTOZOA**

❖ **BACTERIA**

#####DIAGRAM

GASEOUS EXCHANGE IN INSECTS

**THE INSECT HAS LARGE NETWORK OF AIR
TUBES CALLED THE **TRACHEAL SYSTEM**.**

**THIS PENETRATES TO ALL BODY PARTS TO
IMPROVE GASEOUS EXCHANGE EFFICIENCY.**

IT MAINLY CONSIST OF **SPIRACLES,
TRACHEA AND THE **TRACHEOLES**. ##**

- ❖ **SPIRACLES ARE THE EXTERNAL OPENINGS ON EITHER SIDE OF THE ABDOMEN AND THORAX OF AN INSECT WHEREBY AIR ENTERS THE BODY.**
- ❖ **EACH SPIRACLE HAS A MUSCULAR VALVE THAT CONTROLS ITS OPENING.**
- ❖ **ON THE VALVE, THERE ARE HAIR LIKE PROJECTIONS PREVENTING EXCESS WATERLOSS FROM THE BODY BY EVERPORATION. ##**

❖ **THE SPIRACLES OPEN INTO LARGE AIR TUBES CALLED **THE TRACHEA**, WHICH PENETRATE THE WHOLE BODY OF THE INSECT.**

❖ **THE TUBES ARE REINFORCED **WITH A CHITIN BAND** AS THIS KEEPS THEM OPEN.**

❖ **THE TRACHEA THEN **SUBDIVIDES TO TRACHEOLES** FACILLITATING THE SUPPLY OF MATERIALS TO THE BODY TISSUES.**

MECHANISM OF GASEOUS EXCHANGE IN THE TRACHEAL SYSTEM

AIR IS DRAWN INTO AND OUT OF THE TRACHEAL SYSTEM BY THE MUSCULAR MOVEMENT OF THE ABDOMINAL WALLS.

FOR EXAMPLE, IN WASP AND BEES, THE ABDOMINAL WALLS MOVE LONGITUDINALLY WHILE IN COCKROACH AND LOCUST, THE MUSCLES MOVE Laterally.

##

❖ **WHEN THE SPIRACLE VALVE ARE OPEN, AIR IS DRAWN INTO THE TRACHEAL SYSTEM.**

❖ **AFTER THAT, THE VALVES CLOSE AND AIR IS FORCED ALONG THE SYSTEM BY MUSCLE MOVEMENTS. OXYGEN DIFFUSES IN DUE TO HIGH DIFFUSION GRADIENT AS CO₂ DIFFUSES OUT AND INTO THE TRACHEAL SYSTEM DUE TO LOW DIFFUSION GRADIENT.**

+DIAGRAM##

❖ **THE THORACIC SPIRACLE VALVE CLOSE AS ABDOMINAL SPIRACLE VALVE OPEN. HERE THE GAS IS RELEASED THROUGH THE SPIRACLE OPENING INTO THE ABDOMEN OF THE INSECT.**

INSECTS LIVING IN WATER

THE INSECTS **LIVING SUBMERGED IN WATER**

**USE TRACHEAL GILLS THAT ARE SEEN AS
PIRATED PLATES ON EITHER SIDE OF THE
ABDOMEN.**

E.G DRAGONFLY AND THE MAYFLY LARVAE

####DIAGRAM

##

❖ **MOST OF THESE INSECTS ARE NOT TRULY
AQUATIC SINCE THEY MUST COME OUT
AND BREATHE.**

❖ **EXAMPLE IS THE MOSQUITO LARVAE
WHICH HAS SPIRACLES NEAR THE
RECTUM ON A TUBE CALLED RESPIRATORY
SIPHON.**

#####DIAGRAM##

❖ **THE SIPHON IS OPENED WHEN THE LARVAE COMES TO THE SURFACE OF THE WATER TO TAKE IN AIR.**

❖ **IT IS THEN IMMEDIATELY CLOSED BY VALVES WHEN THE LARVAE IS SUBMERGED.**

❖ **IT THEN OPEN JUST BEHIND THE HEAD AND PIERCE THROUGH WATER FOR GAS EXC ##**

❖ **SOME WATER INSECTS LIKE THE WATER
BEETLE AND WATER BUGS USE BUBBLES OF
AIR TRAPPED BY HAIRS ON THEIR BODIES
FOR G.E.**

❖ **THE AIR BUBBLES GIVES THESE ORGANISMS
A SILVERY APPEARANCE WHEN THEY COME
FROM THE OPEN AIR INTO THE WATER.**

##

❖ **HOWEVER, NOT ALL WILL COME TO THE
SURFACE TO GET AIR.**

❖ **OTHERS USE A RESPIRATORY DEVICE
CALLED THE PLASTRON. THIS IS A VERY
FINE NON WASHABLE HAIR COVERING
THE CUTICLE. IT HOLDS OFF WATER
MAINTAINING A LAYER OF AIR AROUND
THE BODY.**

ADAPTATION OF THE TRACHEAL SYSTEM OF THE INSECT

❖ SPIRACLES HAVE **STIFF HAIR TO TRAP PARTICLES**

❖ SPIRACLES **WARM THE AIR** FOR
EFFICIENT DIFFUSION

❖ TRACHEAE HAVE **CHITIN OR TAENIDIUM**
KEEPING THEM OPEN

❖ TRACHEAE ARE **HOLLOW** FOR GAS
PASSAGE

❖ THEY ARE **NUMEROUS, THIN, MOST AND
WELL VENTILATED**

MECHANISM OF VENTILATION IN INSECTS

- ❖ **WHEN SPIRACLE VALVE OPEN, OXYGEN ENTERS THE TRACHEAL SYSTEM DUE TO THE LOW PRESSURE CREATED AS A RESULT OF RELAXATION OF THE ABDOMINAL MUSCLES.**
- ❖ **THE SPIRACLE VALVE CLOSE**
- ❖ **OXYGEN FORCED INTO THE TRACHEOLE SYSTEM**
- ❖ **G.E TAKES PLACE IN THE TRACHEOLE WHICH ARE INDIRECT CONTACT WITH THE TISSUE FLUID.**

❖ **HERE, OXYGEN DIFFUSES ALONG THE CONCENTRATION GRADIENT INTO THE TISSUE FLUID WHERE ITS CONCENTRATION IS LOW.**

❖ **CO₂ DIFFUSES ALONG THE CONCENTRATION GRADIENT INTO THE TRACHEOLE WHERE IT IS EXPELLED THROUGH THE SPIRACLES INTO THE AIR AFTER CONTRACTION OF THE ABDOMINAL MUSCLES.**

❖ **HERE, OXYGEN DIFFUSES ALONG THE CONCENTRATION GRADIENT INTO THE TISSUE FLUID WHERE ITS CONCENTRATION IS LOW.**

❖ **CO₂ DIFFUSES ALONG THE CONCENTRATION GRADIENT INTO THE TRACHEOLE WHERE IT IS EXPELLED THROUGH THE SPIRACLES INTO THE AIR AFTER CONTRACTION OF THE ABDOMINAL MUSCLES.**

GASEOUS EXCHANGE IN BONY FISH

❖ **MAINLY TAKES PLACE IN THE GILL
FILAMENT**

✓ **DURING INSPIRATION, MOUTH
OPENS AND THE FLOOR LOWERED.**

❖ **THE OPERCULUM ALSO PRESSES
AGAINST BODY WALL.**

❖ **THIS LOWERS PRESSURE IN THE
MOUTH AS WATER FLOWS IN**

- ❖ **THE FLOOR IS THEN RAISED AND THE OPERCULUM BULGES OUTWARDS**
- ❖ **WATER IS SUCKED INTO THE OPERCULUM CAVITY WHERE GASEOUS EXCHANGE TAKES PLACE.**

✓ **DURING EXPIRATION, THE FLOOR OF THE MOUTH IS RAISED FURTHER, THE ORAL VALVE CLOSES AND OPERCULUM MOVES INWARDS.**

✦ **THIS INCREASES PRESSURE IN THE BUCAL AND OPERCULAR CAVITY LIFTING THE FREE EDGE OF OPERCULUM FROM THE BODY WALL AND FORCING WATER OUT.**

❖ **WATER FLOWS IN OPPOSITE DIRECTION WITH BLOOD AS THIS IS CALLED COUNTER CURRENT FLOW.**

❖ **AS THIS HAPPENS, OXYGEN DIFFUSES FROM WATER INTO THE BLOOD AS CARBON (IV) OXIDE FROM THE BLOOD TO THE WATER.**

#####

- ❖ **BLOOD LEAVING THE RESPIRATORY SURFACE HAS MUCH OXYGEN**
- ❖ **THIS IS BECAUSE AS WATER MOVES ALONG, LESS OXYGEN DIFFUSES OUT AS BLOOD BECOMES MORE CONCENTRATED WITH OXYGEN.**

ADAPTATIONS OF THE GILLS AND THEIR FUNCTIONS

❖ **THE GILL BAR OR GILL ARCH IS MADE OF A BONY CARTILLAGES TO HOLD THE GILL FILAMENT AND GILL RAKERS IN POSITION.**

❖ **THEY HAVE BLOOD VESSELS TO REPLENISH AIR IN THE GILL FILAMENT THROUGH THE COUNTER CURRENT FLOW SYSTEM.**

❖ **THE GILL RAKERS** POINT INTO THE DIRECTION TO WHICH WATER FLOWS INSIDE THE GILL TO TRAP PARTICLES IN WATER.

❖ **THE GILL FILAMENT** ARE HIGHLY FOLDED AND VERY MANY THUS PROVIDING A LARGE SURFACE AREA FOR GASEOUS EXCHANGE.

❖ THEY HAVE ALL CHARACTERISTIC OF A RESPIRATORY SYSTEM.

GASEOUS EXCHANGE IN AMPHIBIANS

❖ **AMPHIBIANS ARE ADAPTED TO
EXTRACT OXYGEN FROM BOTH WATER
AND AIR. THE TADPOLES USE GILLS
WHILE THE ADULTS USE EITHER SKINS,
LUNGS, MOUTH OR THE BUCAL CAVITY.**

THE MOUTH -----□

#####

❖ **WHEN THE FROG LOWERS THE FLOOR OF MOUTH THE VOLUME OF THE MOUTH INCREASES AS THE PRESSURE DECREASES.**

❖ **AIR IS SUCKED INTO THE MOUTH VIA THE NOSTRILS**

❖ **OXYGEN DISSOLVES SINCE THE MOUTH LINING IS MOIST.**

#####

THE DISSOLVED OXYGEN DIFFUSES INTO THE BLOOD CAPILLARIES WHILE CARBON (IV) OXIDE DIFFUSES FROM THE BLOOD INTO THE MOUTH CAVITY. WHEN THE FLOOR OF THE MOUTH IS RAISED, THIS REDUCES THE VOLUME IN THE MOUTH WHILE PRESSURE INCREASES, AIR IS THEN EXPELLED THROUGH THE NOSTRILS.

ADAPTATIONS OF THE BUCCAL CAVITY

- ❖ **THIN EPITHELIUM TO REDUCE DISTANCE FOR GASEOUS EXCHANGE**
- ❖ **RICHLY SUPPLIED WITH BLOOD CAPILLARIES**
- ❖ **MOIST TO DISSOLVE GASES**
- ❖ **DENSILY PACKED TO INCREASE SURFACE AREA FOR THE DISSOLUTION OF GASES.**

THE SKIN-----□

**GASEOUS EXCHANGE IN SKIN TAKES PLACE
WHEN THE FROG IS IN LAND AND IN WATER.**

**IN FROG'S SKIN, IS A RICH SUPPLY OF
BLOOD CAPILLARIES.**

**OXYGEN FROM THE AIR AND LAND
DIFFUSES THROUGH THE SKIN INTO THE
BLOOD STREAM.**

**CO₂ ALSO DIFFUSES OUT AS OXYGEN
DIFFUSES INTO THE BODY.**

#####LUNGS-----□

**THE LUNGS ARE LOCATED IN THE BODY
CAVITY**

**WHEN THE NOSTRILS ARE CLOSED, AIR
CAN BE FORCED INTO THE LUNGS BY
THE PUMPING ACTION OF THE MOUTH
FLOOR.**

**OXYGEN IN THE AIR DISSOLVES INTO
THE MOIST INNER LINING OF THE
ALVEOLI.**

**IT THEN DIFFUSES INTO THE BLOOD
ACROSS THE WALLS OF THE
CAPILLARIES, COMBINES WITH
HAEMOGLOBIN AND TRANSPORTED TO
BODY.**

**THE CO₂ IS CARRIED BY THE BLOOD AND
DIFFUSES INTO THE ALVEOLI. IT IS THEN
PUMPED OUT BY PUMPING ACTION OF
THE MOUTH**

GASEOUS EXCHANGE IN MAMMALS

**THE MAMMALS HAVE A BREATHING
SYSTEM WHERE GASEOUS EXCHANGE
HAPPENS IN THE ALVEOLI.**

#####DIAGRAM

ADAPTATIONS OF GASEOUS EXCHANGE IN MAMMALIAN RESPIRATORY SYSTEM

THE NASAL CAVITY

- ❖ IT **HAS CILIA** TO FILTER DUST PARTICLES
- ❖ IT **HAS MUCUS LINING** TO TRAP DUST AND MICRO ORGANISM
- ❖ IT **SWEEPS THE PARTICLES TO THE PHARYNX** EITHER FOR SWALLOWING OF SPITTING
- ❖ IT **HAS SENSITIVE RECEPTOR CELLS** TO DETECT SMELL AND QUANTITY OF AIR.
- ❖ IT IS **WELL SUPPLIED WITH BLOOD CAPILLARIES**

THE TRACHEA

- ❖ IT HAS STRONG CARTILLAGES
- ✓ OPENS UP TRACHEA
- ✓ PREVENT IT FROM COLLAPSING
- ❖ ORIGINATES FROM THE MOUTH TO THE LUNGS

THE NASAL BRONCHI

- ❖ THEY HAVE STRONG CARTILLAGES
- ❖ THEY ARE HOLLOW

THE LUNGS

- ❖ THEY HAVE **NUMEROUS ALVEOLI** TO ACCOMMODATE LARGE VOLUMES OF OXYGEN TO MAKE GASEOUS EXCHANGE EFFICIENT.
- ❖ THEY HAVE **NUMEROUS BLOOD CAPILLARIES**
- ❖ VERY **THIN ALVEOLAR** WALLS
- ❖ **MOIST** WALLS

- ❖ **WELL SUPPLIED WITH TUBULES**
- ❖ **COVERED BY PLEURAL MEMBRANE**
WHICH IS GAS TIGHT THUS CHANGES
IN PRESSURE WITHIN THE LUNGS
CAN OCCURE WITHOUT EXTERNAL
INTERFERENCE

IT ALSO PREVENTING FRICTION
DURING VENTILATION.

THE ALVEOLI

- ❖ THEY ARE **WELL VENTILATED**
- ❖ THEY **ARE NUMEROUS**, SMALL AND HIGHLY FOLDED TO PROVIDE A LARGE S.A FOR GASEOUS EXCHANGE
- ❖ THEY ARE **THIN** TO MINIMIZE DIFFUSION DISTANCE BETWEEN THE BLOOD IN THE CAPILLARIES AND THE AIR IN THE LUNGS.
- ❖ THEY ARE ALSO **MOIST** TO ALLOW GASES TO DIFFUSE IN SOLUTION FORM.

###--□

**DIAGRAM TO SHOW GASEOUS
EXCHANGE IN ALVEOLI.**

**BLOOD FROM THE PULMONARY
ARTERY ENTERS ALVEOLI AND
LEAVES TO THE PULMONARY VEIN**

**O₂ DIFFUSING IN AND CO₂
DIFFUSING OUT**

MECHANISM OF GASEOUS EXCHANGE IN MAMMALS

**HUMANS BREATHE BY ALTERNATING
INHALLATION AND EXHALLATION BROUGHT
ABOUT BY THE INTERCOSTAL MUSCLES AND
THE DIAPHRAM.**

**DURING INHALATION, THE INTERCOATAL
MUSCLES RELAX AND THE EXTERNAL
INTERCOSTAL MUSCLES CONTRACT THEREBY
RAISING THE RIB CAGE UPWARDS AND
OUTWARDS.**

####-----□

**THE DIAPHRAM THEN CONTRACTS AND
FLATTENS.**

**THE SIZE OF THE THORACIC CAVITY
INCREASES AND SIZE OF THE INTERNAL
PRESSURE IS REDUCED CAUSING THE LUNGS
TO EXPAND TO FILL THE ENLARGED SPACE.**

**THE AIR FROM THE ATMOSPHERE MOVES
INTO THE LUNGS DUE TO THE ATMOSPHERIC
PRESSURE WHICH BECOMES HIGHER THAN
THE INTERNAL PRESSURE.**

**DURING EXHALATION, THE EXTERNAL
INTERCOSTAL MUSCLES RELAX AND THE
INTERNAL INTERCOSTAL MUSCLES
CONTRACT THEREBY MOVING RIBCAGE
DOWNWARDS AND INWARDS.**

**THE DIAPHRAM RELAXES AND RESUMES
DOME SHAPE, PUSHING UPWARDS.**

**SIZE OF THORACIC CAVITY DECREASES,
INCREASING PLEURAL PRESSURE.**

LUNGS SHRINK AND AIR IS EXPELLED.

LUNG VOLUMES AND DEFINITIONS

- ❖ **TIDAL VOLUME** - VOLUME OF AIR TAKEN IN AND OUT DURING QUIET BREATHING. ABOUT 450CM³
- ❖ **INSPIRATORY RESERVE VOLUME** - EXTRA AIR BREATHE IN AFTER NORMAL TIDAL BREATHING
- ❖ **EXPIRATORY RESERVE VOLUME** - EXTRA VOLUME EXHALLED AFTER THE END OF NORMAL EXPIRATION.

- ❖ **VITAL CAPACITY** - TOTAL AMOUNT OF AIR EXHALLED AFTER TAKING THE DEEPEST POSSIBLE BREATH.
- ❖ **RESIDUAL VOLUME** - VOLUME OF AIR LEFT IN THE LUNGS AFTER MAXIMUM EXPIRATION
- ❖ **FUNCTIONAL VOLUME** - THE AIR THAT IS ALWAYS LEFT IN THE LUNG AFTER TIDAL EXPIRATION
- ❖ **LUNG CAPACITY**

FACTORS AFFECTING BREATHING RATE

- ❖ **AGE** - YOUNG BREATHE FASTER FOR RESPIRTION
- ❖ **TEMPREATURE** - INCREASE INCREASES BREATHING AS MORE CO₂ IS PRODUCED THROUGH RESPIRATION
- ❖ **EXERCISE** - DURING EXERCISE THE BODY NEEDS MORE ENERGY INCREASING BREATHING RATE.
- ❖ **EMOTIONS** - SADNESS AND JOY AFFECT HORMONAL SECRETIONS AND NERVE ACTIVITY. THIS AFFECTS BREATHING.

- ❖ **ALTITUDE** - HIGHER AT HIGH ALTITUDES THAN LOWER. THERE IS LOWER OXYGEN CONCENTRATIONS IN HIGHER ALTITUDES.
- ❖ **CO2 CONCENTRATION** -
- ❖ **SMOKING** - CO FROM SMOKING LOWERS THE HAEMOGLOBIN CONCENTRATION LOWERING THE OXYGEN DELIVERY AND INCREASING BREATHING.

❖ **HEALTH** - SICK HAVE AN INCREASED BREATHING RATE SINCE THE BODY IS METABOLICALLY ACTIVE TO PRODUCE ANTIBODIES AND OXYGEN FOR OXIDATIVE KILLING OF THE BACTERIA.

SOME ILLNESSES LIKE ASTHMA, BRONCHITIS AND COMMON COLD MAY BLOCK RESPIRATORY TRACT LOWERING THE RATE OF BREATHING.

DISEASES OF THE RESPIRATORY SYSTEM

1. ASTHMA

**OCCURES TO PEOPLE WHO ARE
SENSITIVE TO CERTAIN MATERIALS IN
AIR.**

**THE BRONCHIOLES GET BLOCKED
BECAUSE OF THE CONTRACTION OF THE
SMOOTH MUSCLES LINING THEM
CAUSING DIFFICULTY IN BRATHING.**

**IT IS COMMON WHEN THERE IS COLD.
THE RESPIRATORY PASSAGE PRODUCES
MUCUS WHICH BLOCKS AIR PASAGE.**

IT IS CONTROLLED BY

- ❖ **AVOIDING THE CAUSATIVE AGENT**
- ❖ **USING MUSCLE-RELAXANT DIRECTLY INTO THE BRONCHIOLES**
- ❖ **TAKING PILLS PRESCRIBED BY A DOCTOR.**

2. BRONCHITIS

THIS IS AN INFLAMMATION OF THE BRONCHIAL TUBES. A LOT OF MUCUS IS PRODUCED LINING THE BRONCHIAL TUBES.

THERE ARE TWO TYPES OF BRONCHITIS;

- ❖ ACUTE BRONCHITIS**
- ❖ CHRONIC BRONCHITIS**

ACUTE BRONCHITIS

MAINLY WIDESPREAD IN CHILDREN AND WEAK ADULTS. IT IS CAUSED BY;

- ❖ COMPLICATION OF THE COMMON COLD WHEN EXPOSED TO LOW TEMPERATURES ESPECIALLY IN LOW ALTITUDE. IT RESULTS IN CHILLING OF THE BODY, GIVING AWAY BACTERIAL INFECTION.**

#####NEXT-----□

- ❖ **A COMPLICATION** RESULTING FROM PREVIOUS DISEASE ATTACK, FOR EXAMPLE,
 - ❖ MEASLES,
 - ❖ **DENGUE,**
 - ❖ WHOOPING COUGH
 - ❖ **INFLUENZA.**

SYMPTOMS OF ACUTE BRONCHITIS

- ❖ **HEADACHES**
- ❖ **MILD FEVER**
- ❖ **COUGHING WITH YELLOW, OR GREEN MUCUS.**
- ❖ **CHEST CONGESTION OR TIGHTNESS.**
 - ❖ **SHORTNESS OF BREATH**
 - ❖ **WHEEZING**
 - ❖ **SORE THROAT**
 - ❖ **FEVER AND CHILLS**
 - ❖ **BODY ACHES**

CHRONIC BRONCHITIS

**DEVELOPS AFTER SEVERAL ATTACKS OF
ACUTE BRONCHITIS. IT MIGHT BE
FATAL.**

#####-----NEXT-----□

SYMPTOMS OF CHRONIC BRONCHITIS

❖ **COUGH.**

❖ **PRODUCTION OF GREENISH YELLOW
SPUTUM OR PHLEGM DUE TO PUS FROM
RESPIRATORY SURFACE**

❖ **SHORTNESS OF BREATH.**

❖ **SLIGHT FEVER AND CHILLS.**

❖ **CHEST DISCOMFORT.**

TREATMENT AND CONTROL

- ❖ **SEEK MEDICAL ASSISTANCE WHEN THE DISEASE IS AT EARLY STAGE**
 - ❖ **ADMINISTER APPROPRIATE ANTIBODIES**
 - ❖ **DO NOT SMOKE**
 - ❖ **HAVE PLENTY OF REST**
- ❖ **OCCASIONALLY TAKE HERBAL OR LEMON TEA**
 - ❖ **GO FOR MEDICAL CHECKUPS**

3. WHOOPING COUGH

**RESULTS FROM ACUTE INFECTION OF THE
RESPIRATORY TRACT **BY BACTERIUM**
CALLED *Bordetella pertussis***

WHOOPING COUGH SYMPTOMS

- ❖ **PROLONGED COUGHING AND VOMITTING**
 - ❖ **SERVERE BRONCHO PNEUMONIA
CAUSING INFLAMMATION OF THE LUNGS**
 - ❖ **CONVULSIONS AND COMA**

- ❖ **ULCERS AND CARDIAC FAILURE**
- ❖ **MALNUTRITION SIGNS FOR PROTEIN AND ENERGY DEFICIENCY. THIS IS BROUGHT BY REPEATED VOMITTING AND DIFFICULTY IN BREATHING.**

#####-----TREATMENT-----□

TREATMENT AND CONTROL

- ❖ **COMPLICATED CASES SHOULD ALL BE ADMITTED TO HOSPITAL**
- ❖ **INTAKE OF PROTEINS SHOULD BE ENCOURAGED**
- ❖ **IMMUNIZATION OF CHILDREN AT AN EARLY AGE**
- ❖ **USE OF APPROPRIATE ANTIBIOTICS**

4. PNEUMONIA

❖ **INFLAMMATION OF THE LUNGS BY A VIRUS, BACTERIUM OR A FUNGI.**

BACTERIAL PNEUMONIA IS THE MOST COMMON, CAUSED BY THE *Streptococcus pneumoniae*.

IT IS AN AIRBORNE DISEASE WITH A SHORT INCUBATION PERIOD.

SYMPTOMS OF PNEUMONIA

- ❖ **COUGHING**
- ❖ **CHEST PAINS**
- ❖ **FEVER**
- ❖ **DEPOSITS OF FLUIDS IN THE LUNGS**
 - ❖ **DIFFICULTY IN BREATHING**
 - ❖ **SHORTNESS OF BREATH**
 - ❖ **SHALLOW BREATHING**
- ❖ **LOSS OF APPETITE, LOW ENERGY, AND FATIGUE**

TREATMENT AND CONTROL

- ❖ **VACCINATION OF CHILDREN AT AN EARLY AGE**
- ❖ **AVOID LOW AND COLD TEMPERATURES**
 - ❖ **MAINTAIN HYGIENE**
 - ❖ **TREAT USING ANTIBIOTICS**
 - ❖ **GET ENOUGH SLEEP**
 - ❖ **AVOID SMOKING**
- ❖ **KEEP AWAY FROM SICK PEOPLE**
- ❖ **AVOID OVERCROWDED AREAS.**

5. PULMONARY TUBERCULOSIS

IT IS CAUSED BY A BACTERIUM CALLED;
Mycobacterium tuberculosis

**IT IS ALSO AN AIRBORNE DISEASE
CAUSED WHEN THE PATIENT SNEEZES
OR COUGHS**

**IT INFECTS THE LUNG TISSUES FORMING
STRUCTURES CALLED TUBERCULES
HENCE AFFECTS GASEOUS EXCHANGE.**

SYMPTOMS PULMONARY TUBERCULOSIS

❖ **BREATHING DIFFICULTY.**

❖ **CHEST PAIN.**

❖ **COUGH (USUALLY WITH MUCUS)**

❖ **COUGH UP BLOOD.**

❖ **EXCESSIVE SWEATING, PARTICULARLY
AT NIGHT.**

❖ **FATIGUE.**

❖ **FEVER.**

❖ **WEIGHT LOSS**

TREATMENT AND CONTROL

- ❖ **VACCINATE CHILDREN USING BCG AT EARLY AGE**
- ❖ **PASTRISATION OF MILK BEFORE CONSUMPTION**
- ❖ **TREAT DISEASE AT EARLY STAGES**
- ❖ **PROPER NUTRITION TO BOOST THE BODY IMMUNE SYSTEM**
- ❖ **AVOID OVERCROWDED AREAS**
- ❖ **TREAT USING SUITABLE ANTIBIOTICS**

5. LUNG CANCER

THIS IS CAUSED BY ABNORMAL CELL DIVISION IN THE LUNGS RESULTING TO TUMORS.

THERE IS NO SPECIFIC CAUSE FOR THIS DISEASE BUT TAR, FOUND IN TOBACCO, ACCELERATES THIS.

THIS CANCER DESTROYS LUNG CELLS INTERFERING WITH BREATHING.

SYMPTIOMS PULMONARY TUBERCULOSIS

- ❖ **PERSISTENT COUGH.**
- ❖ **CHEST PAIN THAT GETS WORSE WITH DEEP BREATHING, LAUGHING OR COUGHING.**
- ❖ **UNEXPLAINED LOSS OF APPETITE AND WEIGHT.**
- ❖ **COUGHING UP BLOOD OR RUST-COLORED PHLEGM.**
 - ❖ **SHORTNESS OF BREATH.**
 - ❖ **FEELING WEAK AND TIRED.**
 - ❖ **HOARSENESS OF VOICE**

TREATMENT AND CONTROL

- ❖ **SURGERY TO REMOVE THE TUMOR**
- ❖ **RADIOTHERAPY TO DESTROY THE
CELLS**
- ❖ **CHEMOTHERAPY TO DESTROY THE
CELLS**
- ❖ **AVOID ACTIVE AND PASSIVE SMOKING**

6. INFLUENZA

**THIS IS A VIRAL DISEASE WHICH
CAUSES THE PATIENT TO SUFFER FROM
FEVER, SORE THROAT, COUGHING AND
SNEEZING.**

7. EMPHYSEMA

THIS IS A CONDITION IN WHICH THE AIR SACS OF THE LUNGS ARE DAMAGED AND ENLARGED, CAUSING BREATHLESSNESS.

IT CAN ALSO BE LED BY THE ABNORMALLY PRESENT AIR WITHIN THE BODY TISSUES.

SYMPTOMS PULMONARY TUBERCULOSIS

- ❖ **FREQUENT LUNG INFECTIONS.**
- ❖ **PRODUCTION OF LOT OF MUCUS.**
- ❖ **WHEEZING DURING BREATHING.**
- ❖ **REDUCED APPETITE AND WEIGHT LOSS.**
 - ❖ **FATIGUE AND WEAKNESS.**
- ❖ **BLUE LIPS OR FINGERNAIL BEDS, OR CYANOSIS, DUE TO A LACK OF OXYGEN.**
 - ❖ **ANXIETY AND DEPRESSION.**
 - ❖ **SLEEP PROBLEMS.**

TREATMENT AND CONTROL

❖ **AVOID SMOKING**

❖ **AVOID OVERCROWDED AREAS**

❖ **TREAT USING SUITABLE DRUGS**

❖ **DIAGNOSE AT EARLY STAGE**

❖ **USE ORAL MEDICATION TO**

IMMEDIATELY CONTROL ## END

