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 CO_2 FROM RESPIRATION
- REMOVE EXCESS WATER INFORM OF VAPOR
- PLANTS ALSO OBTAIN CO_2 FOR PHOTOSYNTH

GASEOUS EXCHANGE IN PLANTS

OCCURES THROUGH

- STOMATA,
- PNEUMATOPHORES IN MANGROOVES
- LENTICEL
- CUTICLE

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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. ##---ㅂ

- **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.**

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- 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.

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- 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, CO_2 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 XYLEM AND PHLOEM	HAVE DEVELOPED XYLEM AND PHLOEM

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 XYLEM AND PHLOEM	HAVE DEVELOPED XYLEM AND PHLOEM

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, CO_2 IN THE ATMOSPHERE IS AT HIGHER CONCENTRATION THAN IN THE LEAF TISSUE. BY THIS, CO_2 DIFFUSES IN THE LEAF THROUGH THE STOMATA. ###----

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

THE CO_2 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, SPECIALLIZED ROOTS AND THE AERENCHYMA CELLS.

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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 CHORDRATA
- SKIN – FROG AND EARTHWORM
- BUCAL CAVITY - FROGS

❖ **GASEOUS EXCHANGE TAKES PLACE IN THE RESPIRATORY SURFCE 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 COCKROCH AND LOCUST, THE MUSCLES MOVE LATERALLY.

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- **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 CO_2 DIFFUSES OUT AND INTO THE TRACHEAL SYSTEM DUE TO LOW DIFFUSION GRADIENT.**

+DIAGRAM##

❖ **THE THORACIC SPIRACLE VALVE CLOSE AS ABDOMINAL SPIRACLE VALEV 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

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- **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 IMMIDIATELY 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, MOSIT 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.**
- **CO_2 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.**
- **CO_2 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.**

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- **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 CARTILLAGE TO HOLD THE GILL FILAMENT AND GILL RAKERS IN POSITION.**
- **THEY HAVE BLOOD VESSLES 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 CHRACTERISTIC 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 --------ᵇ

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- **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 CO_2 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 CARTILLAGE
- ✓ OPENS UP TRACHEA
- ✓ PREVENT IT FROM COLLASPING
- ❖ ORIGINATES FROM THE MOUTH TO THE LUNGS

THE NASAL BRONCHI

- ❖ THEY HAVE STRONG CARTILLAGE
- ❖ 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 ALEVEOLAR** 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 RPOVIDE 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.

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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 INFLAMATION 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 TMPARATURES EXCPECIALLY 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.**

SYMPTIOMS 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-------

SYMPTIOMS OF CHRONIC BRONCHITIS

- COUGH.
- PRODUCTION OF GREENIH YELLOW SPUTUM OR PHELGM DUE TO PUS FROM RESPIRATORY SURFACE
- SHORTNESS OF BREATH.
- SLIGHT FEVER AND CHILLS.
- CHEST DISCOMFORT.

TREATMENT AND CONTROL

- SEEK MEDICAL ASSISTANCE WHEN THE DISEASE ITS 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 INFLAMATION OF THE LUNGS**
- **CONVULSIONS AND COMA**

- **ULCERS AND CARDIAC FAILURE**
- **MALNUTRITION SIGNS FOR PROTEIN AND ENERGY DEFINCIENCY. 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

- **INFLAMATION 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.

SYMPTIOMS 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.

SYMPTIOMS 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 DESEASE BUT TAR, FOUND IN TOBACCO, ACCELERATES THIS.

THIS CANCER DESTROYS LUNG CELLS INTERFEREING 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
- RADIOTHERAPHY 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.

SYMPTIOMS 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 IMMIDIATELY CONTROL## END

