
# MY BIOLOGY EXERCISE BOOK

## Chefoo Schooling in Weihsien

**'Weihsien, Spring Term 1945'**

by Peter Bazire

For much of the time in Weihsien the older pupils of Chefoo School were housed in Block 61: the Hospital building. I think the whole of the ground floor was used as the camp hospital; the next floor up was used as dormitories for the girls; while the boys were in the top floor. In my dormitory there were, I think, 7 of us, with our mattresses around the large room. In the centre were 3 or 4 long benches with some wood on the right of each seat on which we could rest an exercise book or text book.

The 12 girls in our class came into our room for lessons. We had some text books but not in all subjects. In History and Science, for example, the teachers had to dictate notes for us to write in pencil in our exercise books. (No ink there.) These books were mostly of poor quality paper (I still have a few of them). There were few spare exercise books and sometimes we had to rub out our writing and start again on so-called fresh paper. To this day several older and younger ex-pupils recall this rubbing procedure.

My Biology exercise book was of better quality, and you can read 17 pages of pencil writing and diagrams. I am impressed with how much we covered that Spring Term, 1945, in rather difficult conditions. Our Science teacher, Miss Lucia, was well liked and most thorough in her work. There were no practical facilities for science experiments. * (See footnote).

How long was a school day? I don't remember, but shorter than in pre-war days. We boys in my year had jobs to do, mainly half-hour and later one-hour sessions pumping water into one of three large water towers in the camp. (Occasionally the water in the towers got dangerously low. It fell to us boys to do extra pumping through the night to top up the water. We would be woken up in turn by a teacher to do a half-hour stint, even in a bitterly cold winter's night.) The girls worked in the laundry in the basement of the hospital building.

There were some domestic chores to do e.g. cleaning our dormitories, making coal balls in the winters from coal dust and soil, and chopping what wood we could find for kindling. I do not recall doing any homework in the evenings. I think the reason was the poor lighting.

Besides our formal reading we were able to read books from a small library. In Peking, people about to be moved to Weihsien were asked to pack two or a few extra books to set up a library. I think that, aged 14 in the last year, I was too young to be allowed to borrow books, so a teacher would borrow them for me.

We at Chefoo had lost a lot of teaching time in the autumn of 1942 prior to moving across the city to our first prison camp: Temple Hill. Here we had morning lessons at first, and later on one or two periods in the afternoon. At the end of the war those of us going back to the UK had no schooling during the autumn, what with preparing to leave camp, a fortnight in Tsingtao, a month in Hong Kong and then the journey to the UK (arriving home on December 14th).

Our age group (mainly 15 in August 1945) are reckoned to have lost the equivalent of one to two years schooling from 1942 to the end of 1945.

Older Chefoo boys and girls took the Oxford School Certificate exams in a range of subjects. The staff had kept past papers to help set the exams. After the war Oxford University accepted these exam results. One lady, now aged 84, told me of the subjects she took in the summer 1944 in Weihsien: English Language, English Literature, Latin 1 & 2, French, Mathematics (Arithmetic, Algebra and Geometry), Religious Knowledge, General Science, Chemistry. Not History, but she and others were taught a course in History by Miss Burtt, a Quaker missionary from Yenching University, `Peking. This ex-Chefoo girl has shown me a wonderful Chemistry exercise book that she had written up from a Chemistry book written in camp by Eric Liddell for a class of older pupils.

I still have my elementary General Science text book. The first owner had it in 1938. I also have my Latin "Caesar" text book, and the Latin Primer, first used by a Chefoo pupil in 1935! During Latin lessons we had to balance these two books on our knees, and write in the exercise book on the wooden side piece by each bench seat.

I know very little about the Chefoo Prep School in camp (for the youngest pupils), nor about other Schools in camp for pupils from Peking, Tientsin, and Tsingtao. (I do know that my father first worked as a carpenter, then in the shoe-repair shop, then as a stoker in one of the large Kitchens, then as a baker, and finally, for the last 6 months, he became headmaster of the Primary School for non-Chefoo Weihsien children.) Perhaps some of those ex-pupils will write to Topica or the Weihsien website about their schooling. I was captain of the Chefoo softball team of our age group that played the "Weihsien" team as they were called. Zandy Strangman was their captain and I have corresponded with him in recent years.

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*Footnote

*Here is a story about collecting frogs in the stream OUTSIDE camp, as told by my brother Theo at a Fiftieth Anniversary Celebration of Liberation banquet in Weifang, 17th August 1995.*

*"In Weihsien camp we did not have the apparatus necessary for the practical of Physics or Chemistry, so our Science studies had to be restricted to Biology. To complete our studies of Biology we had to know how frogs grow and what makes them 'work'; to achieve that we had to dissect frogs to find out. The problem was that we didn't have any frogs.*

*But then came the answer: the skies opened up, down came the rain and up came the frogs- but in the stream outside the camp.*

*So we went to the Japanese and explained that we wanted to go and collect frogs in order to cut them up. They thought this was unnecessarily barbaric but, nevertheless, gave us permission to do so. I was one of the frog-collectors. We set off outside the camp and all was going well until, at one point, we had to cross the stream.*

*The Japanese guard had polished his boots and didn't want to get them dirty, so he handed me his rifle, jumped over the stream and beckoned me to follow. I had no wish to cause trouble, so I waded across-through the cool water- holding the rifle over my head. When I got to the other side, I handed the rifle back to the guard-with a grin.*

*When we had finished collecting frogs, we had a lovely swim in the stream watched by all our friends on the top floor of the hospital block. Some weeks later however, when the Americans, including an Old Boy of our school, arrived by parachute, the laugh was on us because while the rest of the school was out in the fields gorging on the treasures dropped by parachute, we were indoors doing our final revision and sitting our examinations.*

*However, it was all worthwhile in the end because we were all successful."*

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# Biology Spring Term 1945.

## Physiology.

Digestive System – The Alimentary Tract

Nature of Food Foods are made up of

1) Carbohydrates – consist of $C, H_2 + O_2$ – the $H_2 + O_2$ are in the same proportion as in water. Grape sugar $C_6H_{12}O_6$
Starch $C_6H_{10}O_5$

2) Fats made up of $C, H_2 + O_2$ but in different proportions

3) Proteins made up of $N_2$ as well as $C, H_2 + O_2$ e.g. white of egg, lean meat

In the Alimentary tract all these foods are acted upon by digestive juices + they undergo physical + chemical changes so that they are made soluble for absorbtion by the blood

MOUTH

There are 3 pairs of salivary glands a gland is a mass of specialised cells that prepare + discharge some particular substance to carry out some special work.

Sight + smell of food sets salivary glands working. The saliva does three things 1) Moistens food making it easier to swallow 2) brings out the taste (3) It contains an enzyme called ptyalin which changes starch to sugar. An enzyme acts on one substance only causing it to change chemically; a small amount changes a large quantity + it doesn't change itself.

Oesophagus

tube conecting mouth with stomach walls made up of longitudinal + circular muscles.

The saliva continues its work.

Stomach

In its walls are circular, longitudinal + oblique muscles. food well mixed with digestive juices. Glands in wall of stomach – secrete gastric juice. Contains 0.2% Hydrochloric acid + 2 enzymes – rennin + pepsin

HCl helps to kill germs, stops the action of ptyalin helps the pepsin to work. Rennin curdles milk. Pepsin changes proteins into soluble peptones.

There is no digestion of starch or fats in the stomach but the fats are liquified

## Small Intestine

About 20ft long + 1" wide. The first 12" is duodenum. A U-shaped loop in which lies the pancreas. From the pancreas and the liver ducts open into the duodenum.

Pancreas - secretes pancreatic juice - contains 3 enzymes - 1 acts on starch (2) acts on proteins (3) decomposes the fats forming fatty acids + glycerine. These acids combine with certain alkalis forming soluble soaps.

The Liver - The largest gland in the body - secretes bile which passes into the gall-bladder + passes into the duodenum. The bile works with the pancreatic juice in the digestion of the fats.

The walls of the small intestine are covered with a large number of finger-like projections called villi. Between the villi at the base are many small glands whose secretions complete the digestive process. The food is now made soluble.

In each villus is an artery + a vein + a lacteal tube.

The sugar + soluble peptones pass through the thin walls into the bloodstream + go to the liver. The fats made soluble enter the lacteal + are carried to the lymph circulation + enter the bloodstream in the left jugular vein.

## Large Intestine

Its work is to absorb into the blood most of the liquid so that the waste from the digestive process becomes much more solid.

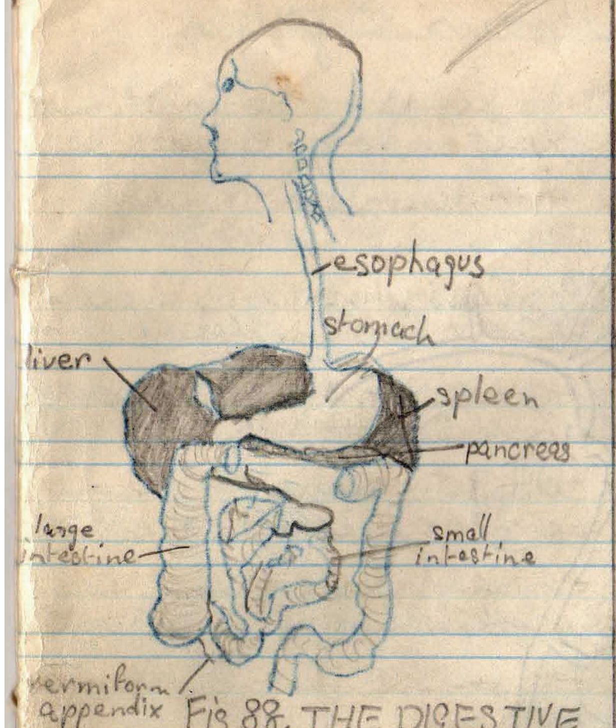
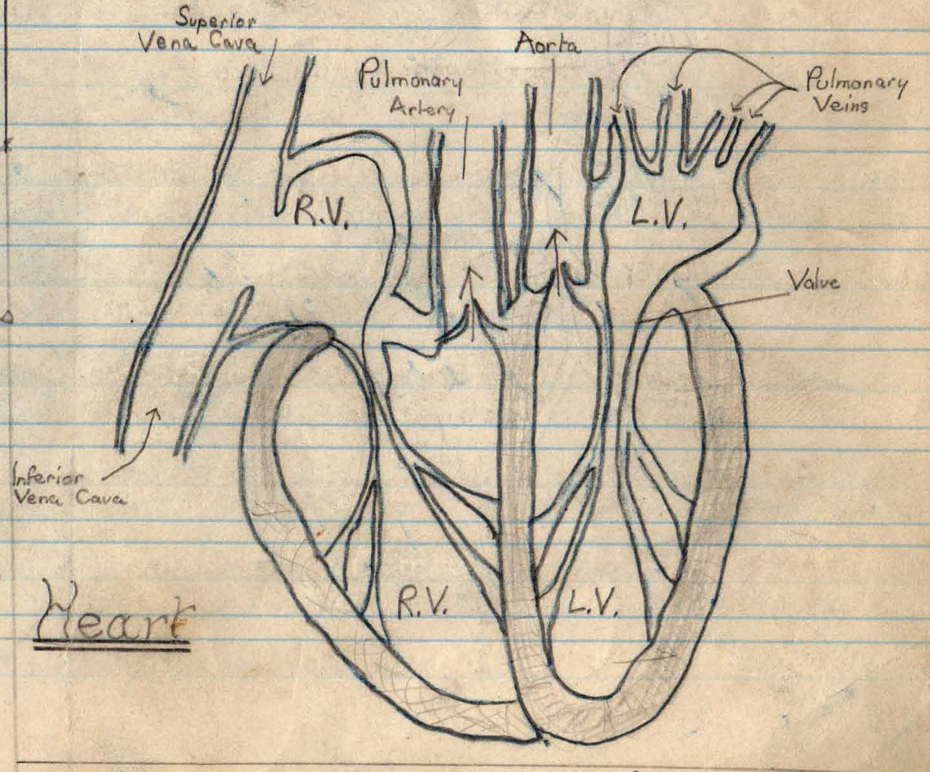



Fig 88. THE DIGESTIVE SYSTEM

| PART | DIGESTIVE JUICE | ENZYMES | WORK |
|---|---|---|---|
| Mouth | Saliva | Ptyalin | Starts changing Starch → Sugar |
| Stomach | Gastric juice | Rennin<br>Pepsin<br>[HCl] | Curdles milk<br>changes proteins to peptones<br>kills germs + helps pepsin to work |
| Liver | bile | — | Acts on fat |
| Pancreas | Pancreatic juice into small intestine | 3 enzymes | Acts on 3 classes of food. |
| Small Intestine | Intestinal juice | 2 enzymes | Acts on starch + proteins |
| | | | Food absorbed in small intestine |

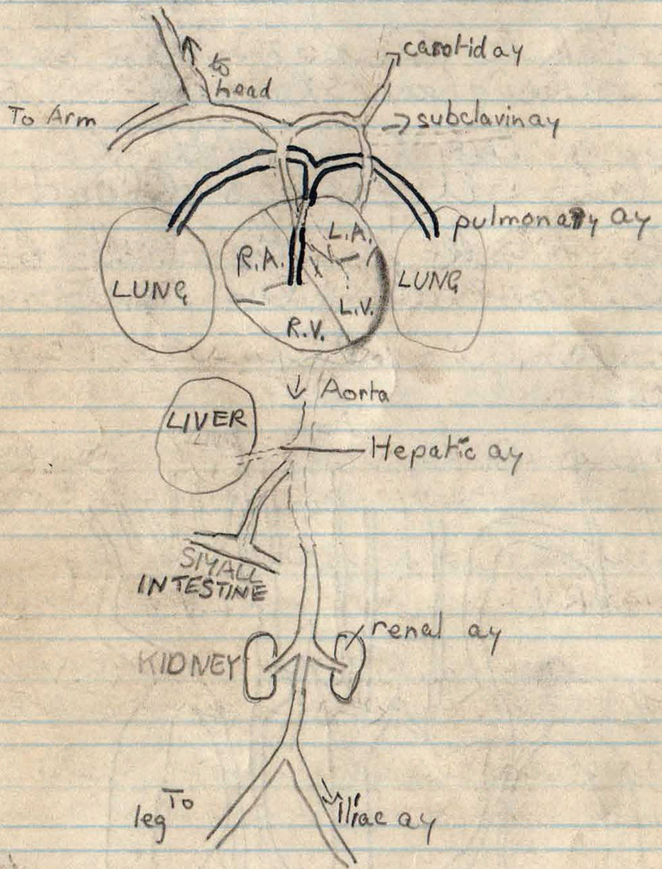
## The Heart + Blood Circulation

The heart is a muscular organ which lies in chest cavity between the lungs. It is divided into two parts + each half into halves. The blood leaves the heart by arteries from the ventricles. It flows back to the heart in veins which enter the auricles. The left ventricel is the most muscular part of the heart + by its contraction it forces blood through the aorta to all parts of the body except lungs. The two auricles contract + then the two ventricals.

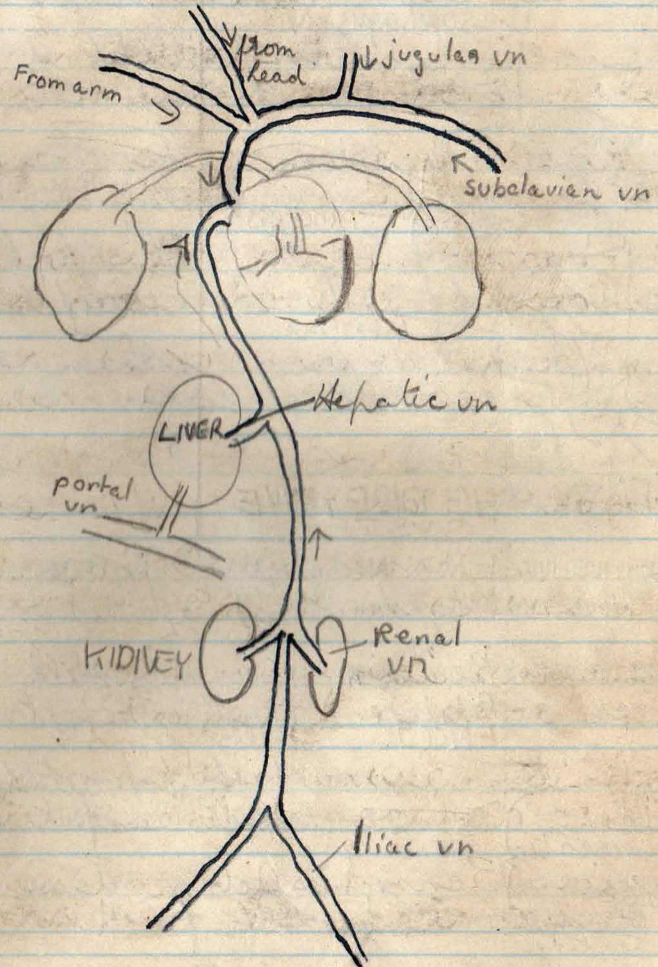



Heart

# Arterial System




# Venous System



# THE BLOOD

The blood is composed of the plasma red + white corpuscles.(a). The plasma - a colourless liquid, two thirds of the bulk of blood. It is water containing many substances in solution — salts + soluble food for distribution + waste product that it carries to the kidney (b) red corpuscles. 5,000000 in 1 cu.mm. of blood. — minute disc shaped cells biconcave O 8. red colour is due to a compound of iron called haemoglobin which carries $O_2$ from the lungs to all tissues. The more $O_2$ the brighter the red. Red corpuscles formed in the marrow of bones. When enter bloodstream they have no nucleus. probably live for 2 weeks. then the spleen breaks it up + the liver deals with the haemoglobin + uses part of it to to form bile (c) white corpuscles. white ↔ red = 1 ↔ 500 much larger than the red shaped like an amoeba, live a few weeks. They are formed in the lymph glands + bone marrow — they kill bacteria by engulfing + destroying them

## The Work of the Blood

1). <u>The process of resparation.</u>
The blood carries $O_2$ from the lungs to all parts. It's the red corpuscles that carry the $O_2$.

2). <u>The distibution of Food.</u>
The dissolved food absorbed by the capillaries in the villi are carried to the liver in the portal vien + then to the tissues that need them.

3). <u>The Removal of Waste Products</u>
$CO_2$ + water vapour are taken to the lungs. Nitrogenous waste products are continually being formed, they enter the blood, are taken to the liver, here changed into urea ($CON_2H_4$). Urea is given to the blood + carried in solution to the kidneys

4). <u>Defence against Disease</u>
Harmful bacteria enter body + produce poisons called toxins. The blood makes anti-toxins, which neutralise the toxins. White corpuscles eat up the bacteria

5a "Carrying Chemical Messengers."
In certain parts of the body there are formed minute amounts of soluble substances called hormones. These are carried by the blood to other parts of the body + cause them to carry on certain activities.

6). The Distribution of Heat.
The blood flowing through active tissues is warmed - it flows all over the body. Most of the heat of the body is produced in the liver + muscles. It regulates the temp. of the body by suppling more or less liquid to the sweat glands.

7). The Formation of Clots.
The Plasma contains a soluble protein called fibrinogen. The white corpuscles in blood flowing from a wound make a ferment called fibrin-ferment. These two react forming a stickey network of threads + the red corpuscles are entangled.

Through the capillary walls of arteries + veins, the plasma oozed + tak[es] with it dissolved food + oxygen + some white corpuscles - it is called lymph. The blood goes to every part of the body + the lymph takes to food + $O_2$ to every cell, + the waste from the cells to the blood. The lymph drains into lymph spaces + then into a system of tubes called lymphatics which finally empty into the left juglar vein.

Resparation
This is the process by which each cell of the body takes in $O_2$ + gives out $CO_2$ + $H_2O$. The circulation of the blood is needed because of the distance of the cells from the outer air. It is between the lymph + the cell that resparaiton takes place.

External Resparation
Air passes to the lungs by the way of the nostrils, pharynx, larynse, thrachea, bronchial tubes.

The Nose
As the air passes up nostrils it is moistened, warmed + purified

Pharynx — back of the mouth
Air leaves pharynx through the glottis. Larynx or voice box, This is connected to the lungs by the straight tube called the trachea

Trachea or wind pipe. Strengthened by incomplete rings of cartilage lined by mucous secreting membrane to trap any dust. The trachea divides into 2 tubes called bronci, which lead to the lungs.

Lungs. A mass of minute air-sacs have extremely thin walls and and are rich in blood capillaries. Here the $O_2$ in the air passes into the blood, joins with the haemoglobin, the $CO_2$ passes from the blood into the air.

The Mechanism of Breathing or How We Breath — The lungs + heart are in an air-tight cavity — this is enlarged involuntarily by 1. raising of the ribs by strong muscles. 2 the flattening of the diaphragm-muscular partition. It is the enlargement of this cavity that causes air to be enhaled. After a short pause, the muscles relax, compressing the lung ∴ forcing air out

Internal Resparation
The energy needed by a living organism is set free within the tissues. It is a result of the process of internal resparation. i.e. the oxidation of food

$C_6H_{12}O_6 + 6O_2 = 6CO_2 + 6H_2O + \text{energy}$

sugar + oxygen = carbon dioxide + water + energy

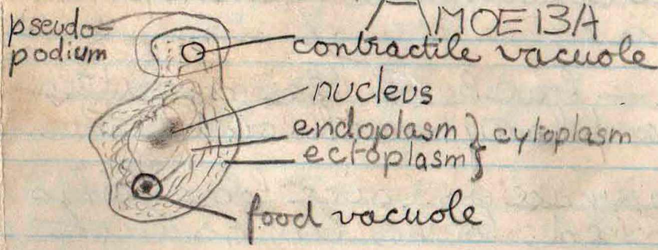
∴ whenever resperation takes place energy set free is used by the tissues in performing activities, some heat is produced, + $CO_2$ + $H_2O$ are formed as waste products.

# Excretion –

5 Excretion is the process by which wastes are eliminated from the body. The chemical changes which are always taking place in the body, result in certain waste products. $CO_2$, $H_2O$, + nitrogenous products pass from the tissues into the blood. $CO_2$ + some $H_2O$ escape from the lungs, some is passed out through the skin as sweat. The $N_2$ compounds are carried in the blood to the liver – there made into urea. – $CON_2H_4$. This goes into the blood again + is carried to the kidneys.–

The kidneys – glands fastened to the back wall of the abdomen Consists of a mass of fine tubes surrounded by blood capillaries + bound together by connective tissue. – The renal ar. + vn. takes blood to + from the kidneys. The cells of walls of the tubes remove water, dissolved urea + salts, from the blood in the cappilaries + this liquid is called urine + is carried from each kidney to the bladder.

AMOEBA




Unicellular animal – found in mud of fresh water. One kind lives in man. The Structure
The clear outer protoplasm is called ectoplasm. – The inner granular protoplasm is called endoplasm. Near the middle is the densest protoplasm called the nucleus. This controls + directs all the activities of the cell

MOVEMENT The ectoplasm projects + the endoplasm + forms a pseudopodium (false foot.

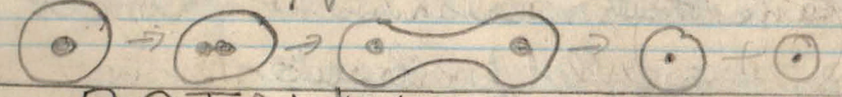
FEEDING If it touches a small object suitable for food, pseudopodia flow round + enclose the object with a film of water – it is called a food vacuole. The protoplasm secreates an acid substance which kills the organism, then breaks it up. Then there is an alkaline secretion. The resultant solution is absorbed + diffuses through the whole cell. Any indigestible remains are left behind.

GROWTH - Resut of intake of food is growth

SECRETION: The waste liquid is drained into a contractile vacuole which suddenly empties this liquid contains uric acid

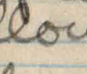
RESPARATION No breathing movements take place. It absorbes $O_2$ at all parts of its surface. The $O_2$ oxidizes some of the protoplasm + produces energy which the cell needs to carry on activities of life. Waste products $H_2O$ $CO_2$ + Uric acid formed. $CO_2$ given out from all surfaces. When put in cold boiled water ∴ no free $O_2$ - movement ceases.

REPRODUCTION Nucleus lengthens becomes dumbell-districted, in the middle + finally splits in two. The cytoplasm changes shape with the nucleus cell becomes dumbell shaped + finally splits in two. This is called binnary fission.



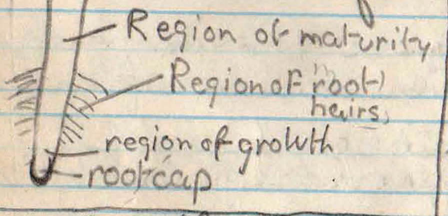
# BOTANY

ROOT Functions of root. (1). To absorb water and salts in solution from soil (2). To fix the plant in the soil.

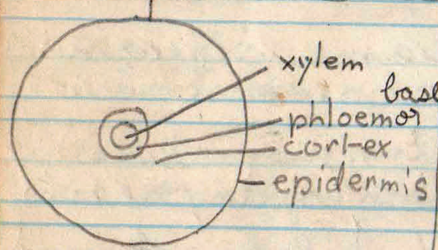
Kinds of Roots 1. Tap root e.g. carrot, bean - a long root that goes straight down into the ground - has branches of the same structure (2). Fibrous roots e.g. grasses - no main root. (3). Adventitious roots e.g. ivy, - roots which do not grow from the main first root.  Willow and Geranium put out these roots at the cut stem.

SPECIAL FUNCTIONS of ROOTS 1. Food storage e.g. carrot, beat, raddish (2) Climbing e.g. Ivy. (3) Propping e.g. Banyan tree adventitious roots grow from the branches + finally fix themselves in in the ground (4). To obtain food from another plant or tree e.g. mistletoe. The roots grow into their host + obtain their nurishment from it. They are called parasites

## Structure of root




New root hairs grow below the shortest, + the longest ones gradually die off and that region changes to the 'region of maturity'.

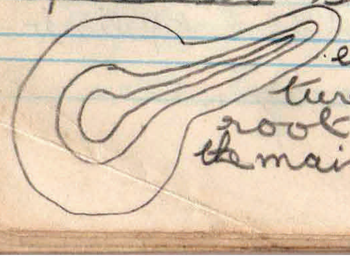



Xylem - conducts $H_2O$ up the plant. It is the woody part ∴ adds strength to the root.

Phloem - conducts sap (food) down

Cortex - is for storage + strengthening

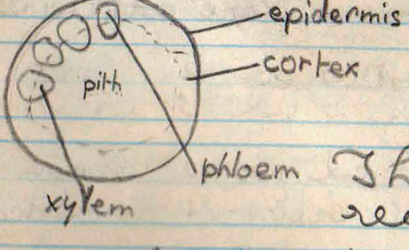
Epidermis - skin for protection.



The latteral roots have exactly the same structure + functions as the main root. They originate within the main root.

# STEM

Main functions of stems.
1. To act as a transport for wat and manufactured food. 2. To hold the leaves, flowers + fruit in a position suitable to do their wo




Transverse section of a sun-flower stem.

There are 3 main regions (1). a ring of vascular bundles containing the important transport systems, (2) Pith in the centre, (3). cortex covered round the outside with ski

Between the xylem + the phloem there are a large no: of delicate cells called cambium, It is in these cells that growth takes place + causes the stem to wide

## Special Functions of Stems

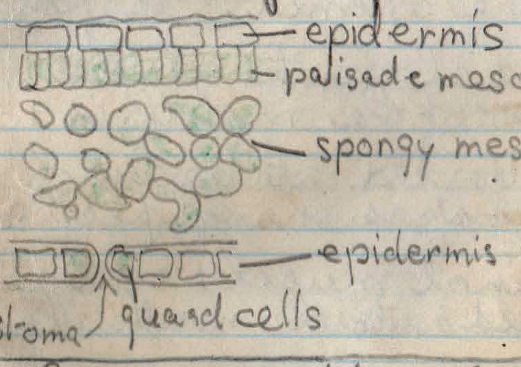
1. Climbing e.g. morning-glory a stem bearing prickles e.g. rose. tendri e.g. beans lufer.
2. Protection. a stem may protect a plan from being eaten by bearing prickles,

hairs, spine
3. Food storage e.g. putatoes, iris

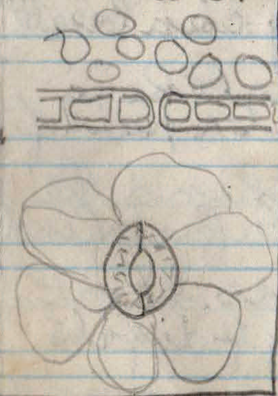
## LEAVES

Without green leaves, animal life would be impossible. It is the only structure which manufactures food.

### Structure of a Green Leaf




The cross section of a leaf consists of three parts - a middle mesophyll + + upper + lower tough thin epidermis. The mesophyll is green owing to the presence of chlorophyll - it consists of two layers - the upper palisade layer where the cells are aranged in order. These contain more chlorophyll. The spongy tissue which is thicker + the cells are irregular in arrangement + shape ∴ the air spaces are left. The lower epidermis has a number of small openings called stomata.



Photosynthesis is the plant process of sunlight shining on the chlorophyl in the living plant cell combining $H_2O$ from the soil + $CO_2$ from the air forming carbohydrates + liberating $O_2$.

### To show that light is necessary.

Exp I Cover a leaf with light-proof paper for several hours. Boil leaf in water then in spirits, wash + then add iodine. The leaf in brown showing no starch.

### To know that Chlorophyll is necessary

Use a variegated leaf partly green + partly white, make a sketch showing the green parts. (afternoon) Test it for starch. Result, only only the green parts contain starch

# FROG

5. External Appearance. Streamlined shape - to move through the water quickly. Nostrils + large eyes placed so that the frog can breath + see. Large mouth for catching food. No external ears. But a pair of circular ear dreums behind the eyes. No neck. Long powerful hind limbs with 5 webbed toes. Short fore-limbs for landing. 4 digits (fingers. The skin is loose + moist - makes a bitter slim. No outer dead layer protective of skin. Must live in moist surroundings.

Skin changes colour when sur-roundings change.

A frog is a vertebrate. It is cold blooded. It is an 'amphibian' (it can live in the water + on land). It hibinates in the mud during the winter

Digestive System Rather simpler than man. - no salivary glands - bolts food - gullet very short, stomach narrower no rennin. Small intestine about 4"-5" long. no appendise. Large intestine about 1" long empties into the exterio by the cloaca.

HOW a FROG BREATHS

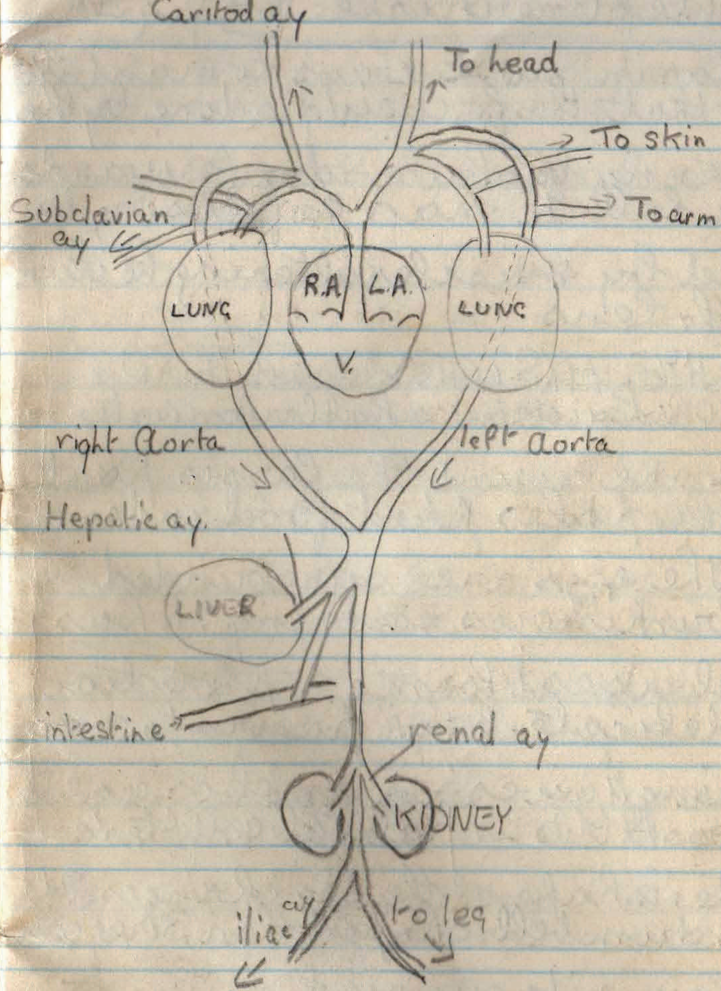
The resparatory organs of a frog a 1. lungs. 2. skin. 3. the lining of the mout

Lung Breathing. 1. When the toad lowers floor of the mouth, the glottis is close + the nostrils are opened. ∴ air flow in. The nostrils close, the glottis opens + the floor of the mouth is raised. ∴ air is forced into the lungs exchange of gasses change plac then the abdominal muscles contra + the air is forced into the mouth. The floor of the mouth + the air is forced out through the nostrils. The lungs simpler + not so efficient as man

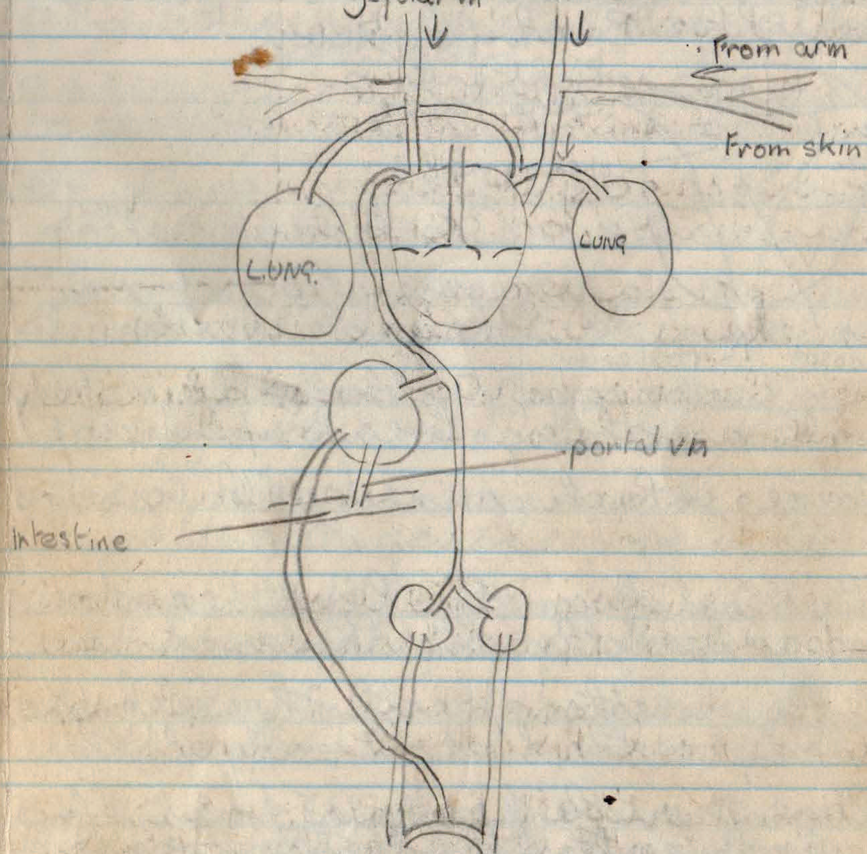
2. Mouth Breathing 2. While the air is in th mouth, it gives $O_2$ + receives $CO_2$ + $H_2$ vapour from the blood of the capil-laries in the lining of the mouth

3. Skin Breathing. The skin is richly supplied with blood capillaries + exchange of gases takes place be-tween this air + air outside. It

# ATERIAL SYSTEM



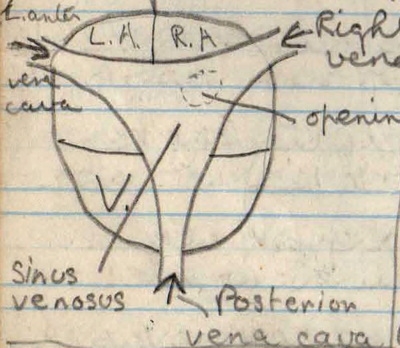

# VENOUS SYSTEM



breaths this way during hibernation.

Circulatory System.

The Heart. 2 a's + 1 v. At the back of the heart is a triangular bag called the sinus venosus which empties into the right a. Back of the Heart




The truncus arteriosus starts from the ventricle + distributes blood all over body

In all cases the a.'s break up into capillaries which connect with the veins

The blood from the hind legs does not go directly into the vena cava. It flows either directly through the kidneys or the liver. Finally all the blood from the posterior part of the body enters the bottom corner of the sinus venosus. All the blood from the head, arms + skin enters the right + left of the sinus venosus.

The sinus venosus empties into left auricle. The pulmonary v. carrying the pure blood goes straight into the left auricle.

EYE

Simalar in most ways to man (E) except that the focusing is done by the lens moving backwards + forwards in the eye ball. In man the focusing is effected by muscles altering the thickness of the lens.

THE LIFE HISTORY OF A FROG

THE SPAWN. Laid in shallow water + the eggs are round, the larger part black, the paler part food underneath. The eggs are surrounded by an albuminous covering. It has several uses. i. forms a protection for the delicate egg ii. prevents overcrowding iii gives an anchorage to the mass iv It is unpalitabe. After a week the shape of the egg changes. It becomes dumbell shaped then 3 regions can be seen + its curved owing to limited space. Hatches out after 2 weeks + wriggles out.

BLOOPY

Circulate.

How the Heart causes the Blood to
The first blood to leave the V. is mainly impure + goes to the lung + skin. The next blood is mixed and goes to the aortae to all parts of the body except to the head lungs + skin. Last comes purest blood which goes to the head.

<u>The Blood</u>

The red corpuscles are oval with a central oval nucleus otherwise the frog's blood resembles that of mammal. Excretion. Much $CO_2 + H_2O$ are got rid of by lungs + skin.
<u>Urine is excreted by the kidneys.</u>

<u>The Tadpole</u> When hatched has no mouth – fixes itself to weed by cement gland – mouth + anus develop + alimentary canal. This is straight at first but coils as it lengthens + has thin projections on either side of head – external guilds. $O_2$ is absorbed through the thin walls. These are tempory whilst internal guilds are developing they finally wither up. The water passes over the gills + out through a small spout a small hole on the left side. It feeds vigourously + grows in size. About 7 weeks after hatching the hind legs appear as warts on on each side on the base of the tail. At the end of 8 weeks they have jointed legs. At the end of 9 weeks the toes are all visible The front legs develop at the same time but are inside their skin.

When about 2 months old it frequently comes to the surface of the water; lungs are developing + its gills are beginning to degenerate. When 12 weeks old, metamorphosis takes place – feeding ceases – it casts off its outer skin – a wide gasping mouth replaces the round one The eyes are now prominent the front legs break through the skin – the hind legs break through the spout – the tail is shortening (being absorbed) – hops on to land with a short tail. He is $\frac{3}{4}$" long mature in 3rd year.

To show that $CO_2$ is Necessary. 2 plants were put in the dark for a day + put in 2 bell jars one was fitted up as shown so that the air went into

the bell jar. The $CO_2$ was absorbed by soda lime (caustic soda + Quick lime) The $CO_2$ given out by the plant breathing is absorbed by soda lime. The second plant is allowed to have ordinary air. They were left in the light for a no: of hrs, + then a leaf from each plant was tested for starch. a leaf from the apparatus containing no $CO_2$ has no starch.

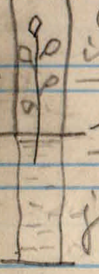
Exp. to show that $O_2$ is given off when photosynthesis takes place a plant was put under a bell-jar, a candle lit + went out. ∴ $O_2$ used up the $CO_2$ formed - apparatus left in the light for some time. a lighted taper put into the jar + candle re-lit, it burnt showing fresh supply of $O_2$ produced. Exp. repeated in dark. The taper goes out showing that no $O_2$ is produced.

Photosynthesis is one of the most important processes in nature on it animals + plants depend for food supply. Man can't make food from elements. Source of all energy for living things is the sun, but a green plant alone is capable of storing up energy which comes from the suns rays. The chlorophyll upon which this action is dependant is an enzyme it traps the kinetic energy required to bring about the following combination. $6CO_2 + 6H_2O + \text{Kinetic energy} = C_6H_{12}O_6 + 6O_2 + \text{potential energy}$

The starch + sugar

The starch + sugar formed in green plants may become fats (mostly in seeds) or proteins. Sugar made in leaves reacts with the nitrates + other salts in solution brought to them from the roots + proteins which are built up.

Transpiration (Expt I) is the process by means of which $H_2O$ vapour from the inside of a leaf escapes through the to the outside air.




a twig of leaves were set up in a jar of water the stork went through a piece of cardboard. A dry glass jar was put over the leaves. After a short time the top jar was covered with water drops

Expt II Repeat experiment in dark + result top jar remains dry

Exp. III In light torn leaves covered with vasaline, Top jar remains dry.

Exp. IV Equal amounts of water put in two test tubes - both covered with a lair of oil. Twig of leaves put in one + a twig without leaves put in the other, left in the light, water went down in test with leaves remaining the same in others ∴ leaves cause water to be drawn up the stem

to the outside air

Transpiration is the main condition determining the movement of water from the roots to the leaves

Importance of Trans.

1. It helps the plant to get rid of excess water. 2. It is a quick means of carring the salts of the soil to the leaves. 3. It tends to lower the temp. of leaves which run the risk of being overheated on a hot day.

Conditions affecting the rate of Transpiration

1. The humidity of the air. 2. The movement of the air. 3. The temp. of air. 4 The intensity of the light — causes the stomata's to open widely — it causes the temp of leaf to rise.

RESPERATION

In plants as in animals resperation is a process by which complex compounds (sugar $C_6H_{12}O_6$) are broken down into simpler ones ($CO_2 + H_2O$) + energy is set free. In plants there are no breathing movements. In darkness the $O_2$ is obtained directly from the air + the $CO_2$ passes into the air. In light the photosynthesis + resparation go on together. Photosyn takes in $CO_2$ + gives out $O_2$ — more $O_2$ is used that is required for resparation so uses some of this $O_2$.