

A. Elisabeth Sones

City of Leeds Training College

Biology [Botany]

A. E. Sones

Leighton Hall

Biology [Plants]

Cells

Amoeba

Human Blood

Protozoans

Chlamydomonas

Algae - Spirogyra
Ulothrix
Kostoc

Plankton

Fungi Penicillium
Eurotium
Pythium

Euglena

Bacteria

Lichens

Insectivorous Plants

Thross - Datura

Fern - Aspidium

Selaginella

Pinus.

Living Matter.

Difference bet. life & dead organisms

- ① Reproduction & respiration
 - ② Growth from within - not layers
 - ③ Movement & response
- } these are characteristics of living matter.

Conditions under wh. life exists

- ① Food
- ② Air (oxygen).
- ③ Heat (32° - 104° F approx)
- ④ Space.
- ⑤ Light
- ⑥ Moisture

Diffusion

Place heavy coloured liquid by means of funnel at bottom of cylinder - liquid molecules ever in motion ∴ coloured liquid will diffuse with water.

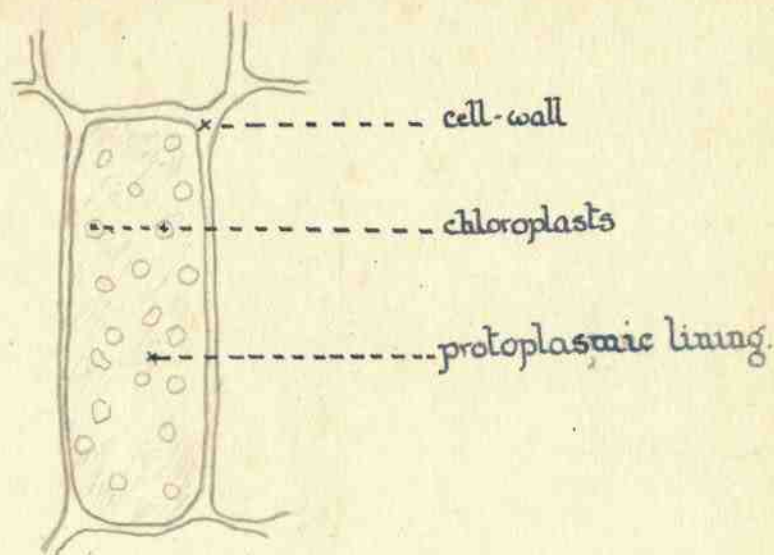
If molecules put to zero temp^r there would be no movement.

Brownian Movement - molecules moving in jerks the particles - by hitting them.

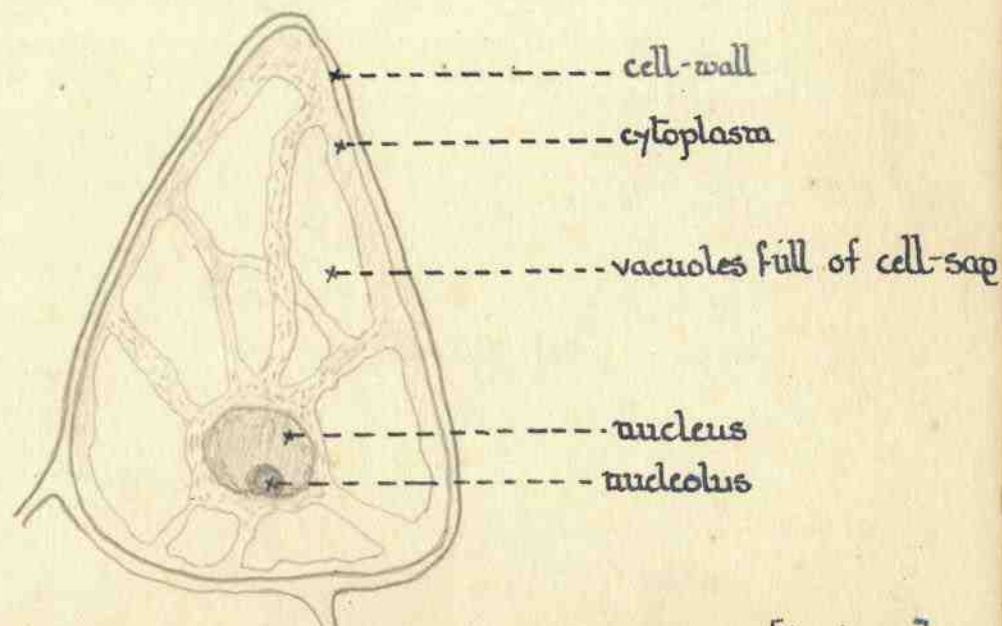
Diffusion has nothing to do with circulation of wind.

Air enters plant through stoma by diffusion

Beasts & plants can exist to height of 120° F. and as low as 32° F



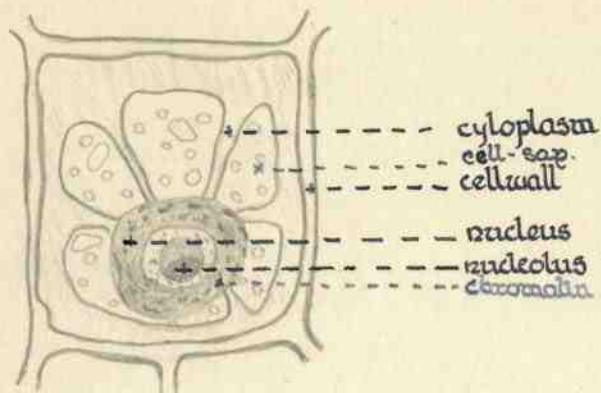
SINGLE CELL OF MOSS-LEAF.



CELLS OF HAIR ON COROLLA OF DEADNETTLE [LABIATAE]

Oct. 30th

ROOT TIP OF BEAN.



CELLS.

No life without protoplasm. Protoplasm = cytoplasm + nucleus.
Protoplasm - difficult to analyse - soon killed - little known of arrangement of atoms.

Elements which go to form protoplasm

- 1) Hydrogen
- 2) Oxygen
- 3) Carbon
- Phosphorus
- Iron
- Sulphur
- Nitrogen

Characteristic Features of Protoplasm

1. Unstable - altering positions and numbers - some continue decaying - if stable, it would not live.
2. Wasting - on meeting with oxygen the carbon + hydrogen fuel as respiration + transpiration. Must be rebuilt ∴ food to be introduced.
3. Construction

Changes which protoplasm undergoes is known as metabolism

1. destructive - katabolism
2. constructive - anabolism.

If katabolism is greater than anabolism the organism fades away. Anabolism greater than organism grows. If evenly balanced nothing happens.

How is protoplasm different from dead matter.

- | | | |
|-----------------|------------------------|-----------------------|
| 1. Movement | 3. Response to stimuli | 5. Growth from inside |
| 2. Assimilation | 4. Sustainability | 6. Respiration |
| | 7. Excretion | 8. Reproduction. |

Nucleus contains most phosphorus

Part of cell with nucleus in it can repair itself vice without nucleus can not fix itself vit disappears

Cells in rapidly growing parts are crushed spheres wh. become hexagonal.

Later in life cell wall thicker + cell larger - protoplasm has grown - nucleus at one side - cytoplasm round walls + in strands - cell sap fills in spaces.

If cells end to end adjacent walls rather + long tube left.

Plastids.

Chloroplasts - colouring matter in green leaves.
 Chloroplasts turn bluish when iodine is present.
Leucoplasts - similar colourless bodies - if leucoplast exposed to light become chloroplasts vice versa.
Chromoplasts - colouring in plant petals - tulips.

Tulip - chromoplasts in yellow part
- coloured liquid - red
- both in the orange part.

Chromatin - colourless but can be dyed certain colours.

Nature supplied it with mordant - when nucleus stain used the whole cell is stained - but after bath of alcohol only nucleus left dyed.
Chromatin so far as we know has never been found outside nucleus

All food classified :-

I. Carbohydrates - Carbon-Hydrogen-Oxygen
Carbon turns black then disappears - absolutely insoluble.
 $CH_2O = \text{carbohydrate}$ Grape sugar = $C_6H_{12}O_6$

II. Fat or Oil - Carbon Hydrogen Oxygen

Palmitin = Palm oil = $C_{51}H_{98}O_2$

III. Proteins - Carbon Hydrogen Oxygen Nitrogen Sulphur Phosphorus

I. Grape Sugar - Glucose - test is Behling's Solution (blue) turns reddish orange when heated in the presence of carbohydrates.
- sugar - grape - malt - cane does not on its own (without acid) respond to Behling's Sol. ($C_{12}H_{22}O_{11}$) - sugar not confined to fruits.
Starches - Rice - ($C_6H_{10}O_5$)_n - starch gel - test iodine sol. turns blue - starch iodide colourless when under influence of heat - will become blue again when cooled.
Glycogen - in liver of animals - in muscle as energy - v. little.
when glycogen used up - another supply from liver - animal starch
($C_6H_{10}O_5$)_n - does not turn blue with iodine - deep red not blue
Cellulose - $C_6H_{10}O_5$ - simpler molecules - in cell walls - in young cells - later some change into cork or lignin.
Used for artificial silk explosives - cotton wool - paper
Nitrogen - cellulose - gun cotton

II. Fats & oils

Tests by paper or osmic acid (turns black)
Insoluble & unmixable in water until caustic added then oils broken up & emulsion formed.
Alkaline juices in digestive

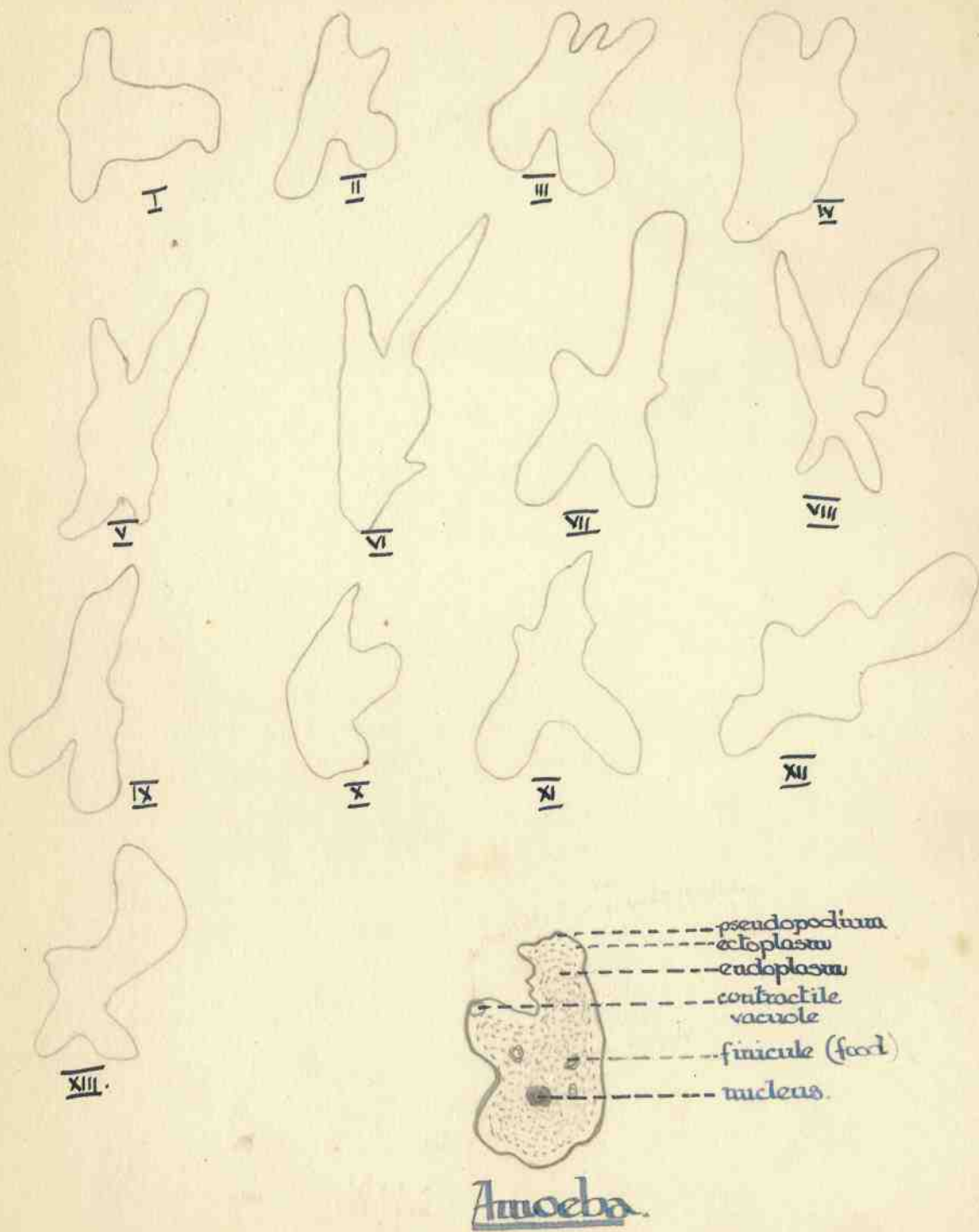
III. Proteins - coagulates in presence of heat.

Biuuret Test - add caustic to protein solution - add weak sol. of copper sulphate - solution turns blue.

Xanthoproteic Test - add equal vol. of nitric acid - heat - turns yellow - add ammonia - orange.

Milow's Reagent - add mercuric nitrate - milky - heat it then turns brick-red.

Egg albumen - Serum of Blood - red heat.



AMOEBIA - protozoa - v. primitive animals.

Microscopic - ponds & slowly moving streams

Unicellular - mass of jelly + dots in it - locomotion in most primitive form - crawling - amoeboid

Shape continually altering but volume still same

Pseudopodium - false feet - projections that can stretch out or contract - find food - when ectoplasm touches it - flows round it - wraps it in drop of water wch. is food vacuole - indigestible part the amoeba flows away & leaves it.

No mouth feeds in any part of the body.

Ingestion - digestion - egestion

Contractile vacuole - for egestion of waste fluid.

Respiration - put in water without oxygen the amoeba dies

∴ takes in oxygen & gives off CO₂

Growth - result of feeding - not growing indefinitely - law of

Response to stimuli - acid & electric shock - curl up - resumes at normal temp

ratio of volume to area ∴ amoeba divides - nucleus divides

mother cell becomes 2 daughter cells.

Death not natural in amoeba - body immortal - no old age.

Reprod.

BLOOD CELLS. (HUMAN.)

Red Corpuscles

White Corpuscles - leucocytes. } composition of blood.

Plasma (liquid)

Red Corp: - loose nucleus after early stage.

If water added - red fill up and burst

Contain haemoglobin (red colouring matter) - readily

makes compound with oxygen or CO_2
When it takes up oxygen then gives CO_2 it loses the O_2

vice versa.

Oxygen in lungs - when they come to lungs they deposit the CO_2

Haemoglobins are used often for respiration

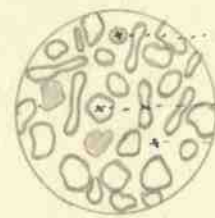
White corpuscles - defenders ag. disease

If injury - w. c. come to place & eat up the bacteria

- prevent i. c. from passing - hence inflammation.

Contain a nucleus.

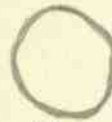
HUMAN BLOOD.



white corpuscles

red plasma

Microscopic View of Drop of Blood.

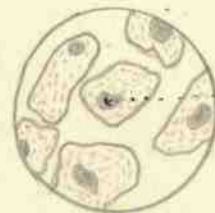


Red Corpuscles



nuclei.

White Corpuscles



nucleus

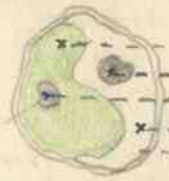
Cells of Inside of Cheek

Protococcus

Nov 12th



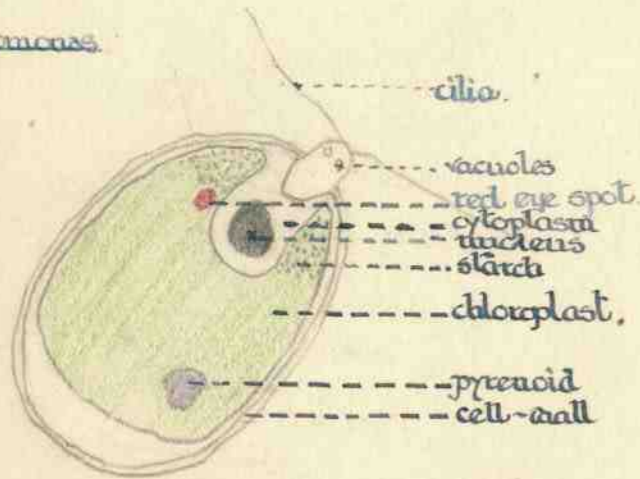
Mass of Cells



Single Cell

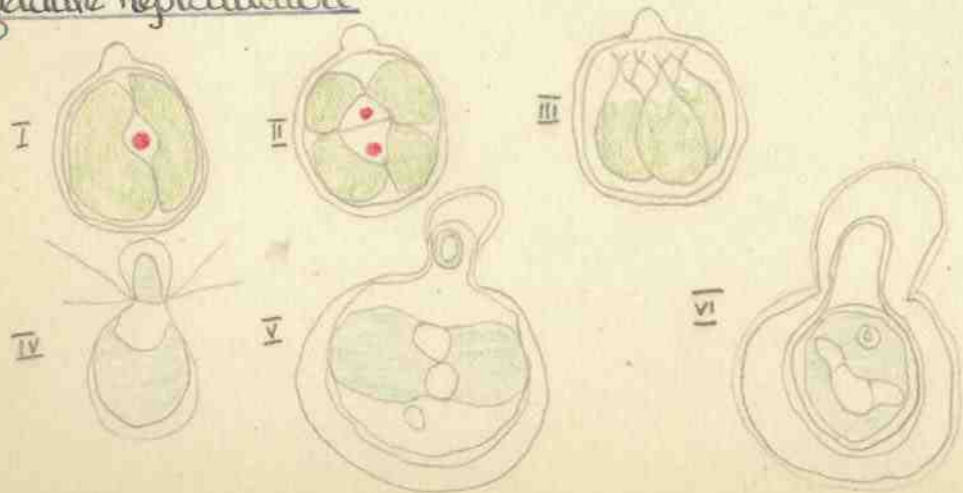
- chloroplast
- nucleus
- pyrenoid
- cytoplasm
- cell wall

Chlamydomonas



Chlamydomonas (Algae)

Vegetative Reproduction



Protococcus - green scraped from bark of tree - immotile if exposed to sunlight, pyrenoid contains starch
 Cell wall - cellulous (Schulze's solution - makes it purple)
 - no movement - ea. cell carries out life history of organism. - nucleus in cytoplasm
 - feeds on CO₂ from atmosphere, rain water, + salts
 - protococcus makes food this way provided it is given sunshine ∴ protococcus is a plant.
 if any organism can live solely on atmosphere it is a plant.
Reproduction by division - first of nucleus.
 Starch dotted over chloroplast. (iodine test.)
 Cellulous cell wall.
 groups - don't always break away.

Chlamydomonas - found in water - motile.
 starch found round the cup-like depression (iodine test.)
 - usually thought to be in pyrenoid.
 - plant - CO₂ + H₂O is food - must move to get light.
 Green edawing, moves to light - chlamydomonas swims to light - phototactic.
 Affected by heat, light & chemicals.
 Reproduction - cilia (protoplasmic) absorbed into body.
 Chloroplast divides.
 Vegetative or Asexual Reproduction - 75% increase in population.
 Sexual Reproduction - 50% " " "

Gametes - cells before fusion
 Zygotes - " after "
 Differentiation of sex.
 2 gametes leave cell walls & fuse outside cell wall
 Although unicellular - no sex differentiation

1929.

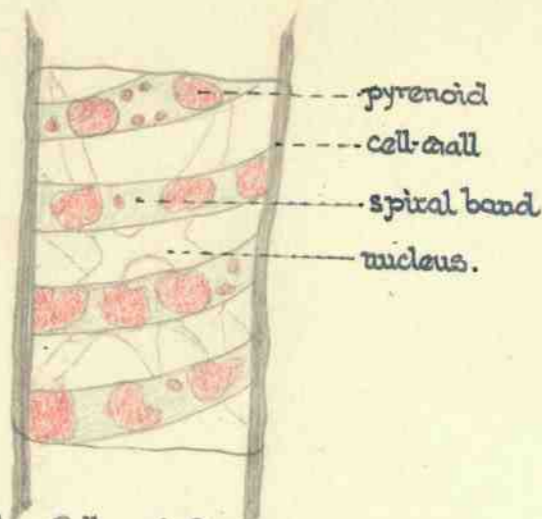
Jan 11th

SEA-WEEDS

All seaweeds can break up CO_2 for starch.
 Fish do not solely feed on sea weed.
 They live on microscopic things like chlamydomonas.
 They are unicellular floating found in sea - can be seen in Red sea etc.
 Plankton - the floating organisms
 Herrings feed on this - more food means more herring.
 If bright sunshine over N. Sea in Feb. in 3 yrs time there will be a good herring harvest - lots of sunshine means lots of food for herrings.

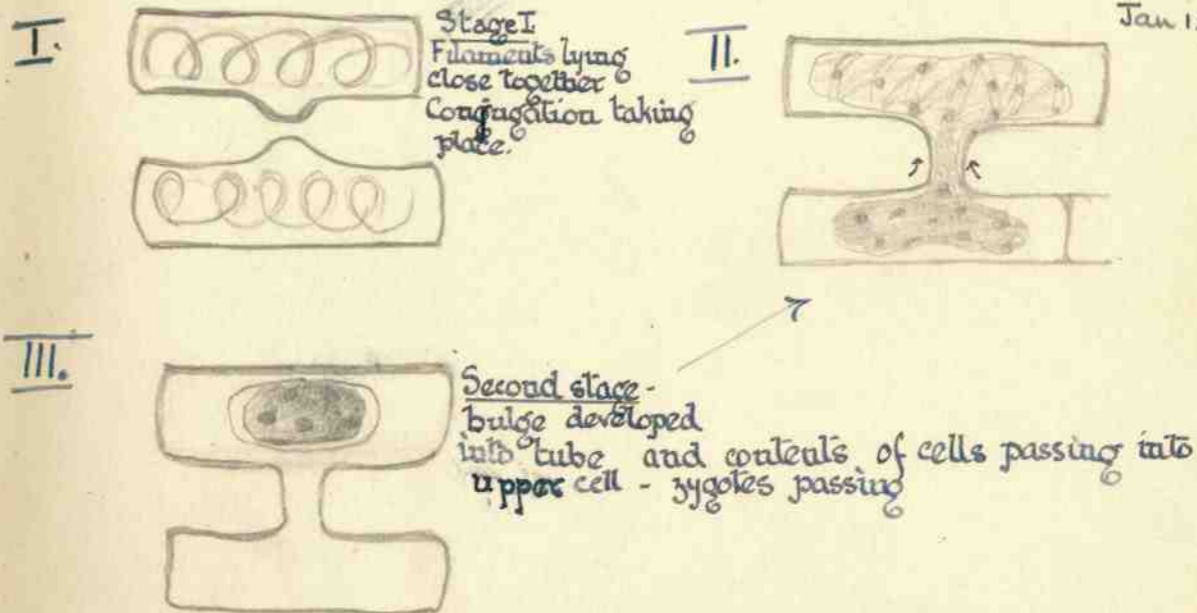
SPIROGYRA Instead of unicellular - spiral filament
 Upon the application of iodine the pyrenoids went purple - starch.
 Upon application of salt the chloroplast plasmolysed. If filaments are lying together points opposite bulge until they touch when points of contact dissolve tube is produced - zygotes are passed into 1 cell & zygospore is produced wh. can resist temp. drought. When zygospore into water it begins to form a new filament under natural conditions

250



Single Cell of Spirogyra

Reproduction of Spirogyra.



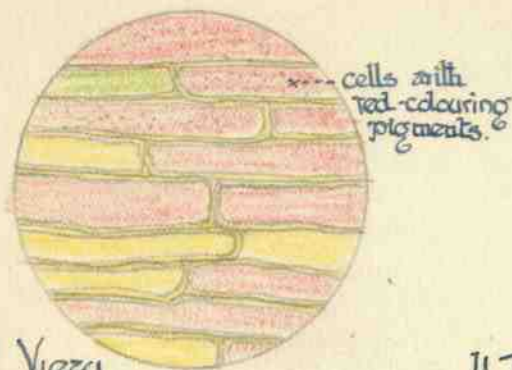
Jan 14th

Third stage - chloroplast from lower cell wholly transferred into upper cell - zygospore formed - drought resistant.

Jan 21st
1929

Epidermis of
TULIP

I.



H. P. Vierz
Mounted in Water

II.

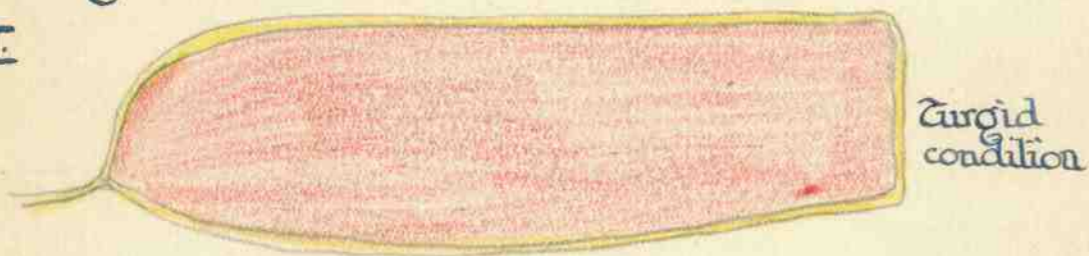


H. P. Vierz
Mounted in 10% Salt Sol.

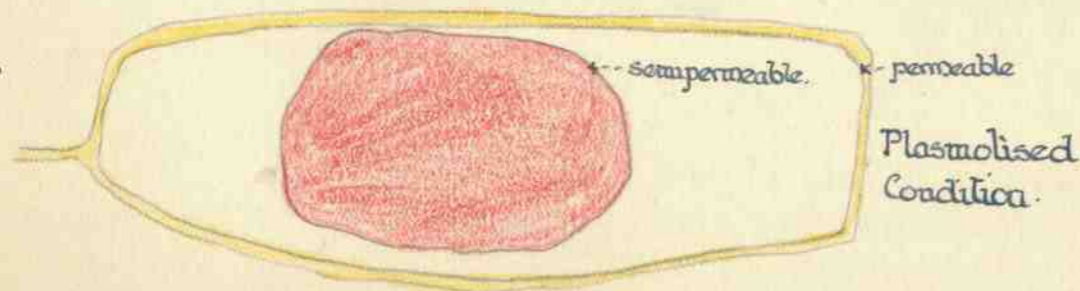
Upon washing out the salt sol: the cells return to former state.

Single Cell

I.



II.



Epidermal Cells of Tulip

Vaucheria

Found during spring in damp places water.
 Sometimes webs of fresh water algae.
 Long filaments - unid. - branches - very few transverse walls
 Dichotomous branching
 Contains no starch but drops of oil.
Nuclei - not separated by transverse walls - coenocyte
 - nuclei can not be seen except upon staining
 No. of cells same as no. of nuclei.

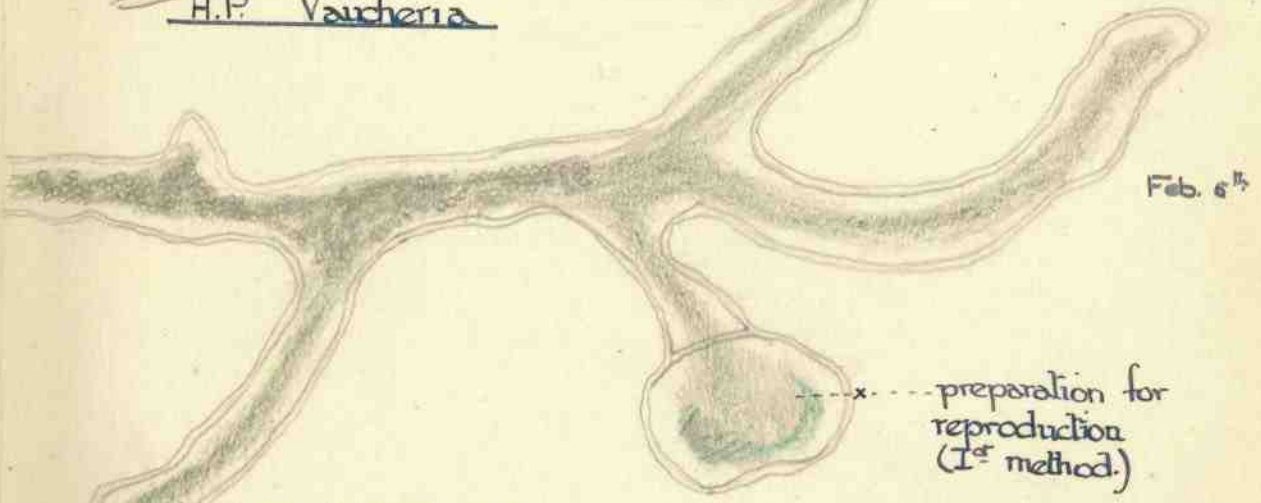
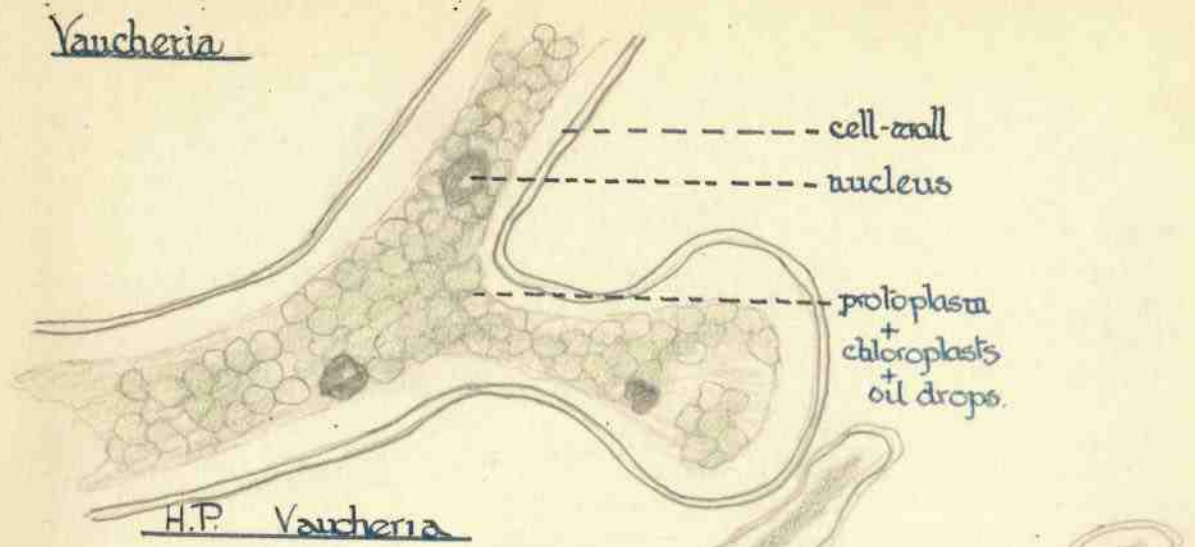
Reproduction - 2 methods

- ① Spring + early summer - rapid reproduction
 Tips of filament - darker green - transverse partition formed
 - all nuclei round margin of tip.
 In early morning - hole at end of tip - all protoplasm oozes
 out into organism - ea: nuclei develops a cilia - swims
 about for 10-15 mins - cilia disappears - cell wall forms
 - detached portion is zoogonidium.
- ② Structure growing on side of plant - hooked end dec. first
 - antheridium - antherozoids (ie nuclei + cytoplasm) swims away.
 In other side of structure oogonium - 1 nucleus + cytoplasm
 Receptive spot - antherozoids congregated there - one passes
 thru + fuses with nucleus.
 Unfertilised egg cell is oosphere
 Fertilised egg - oospore.

Chemotaxis - attraction by chemical agents

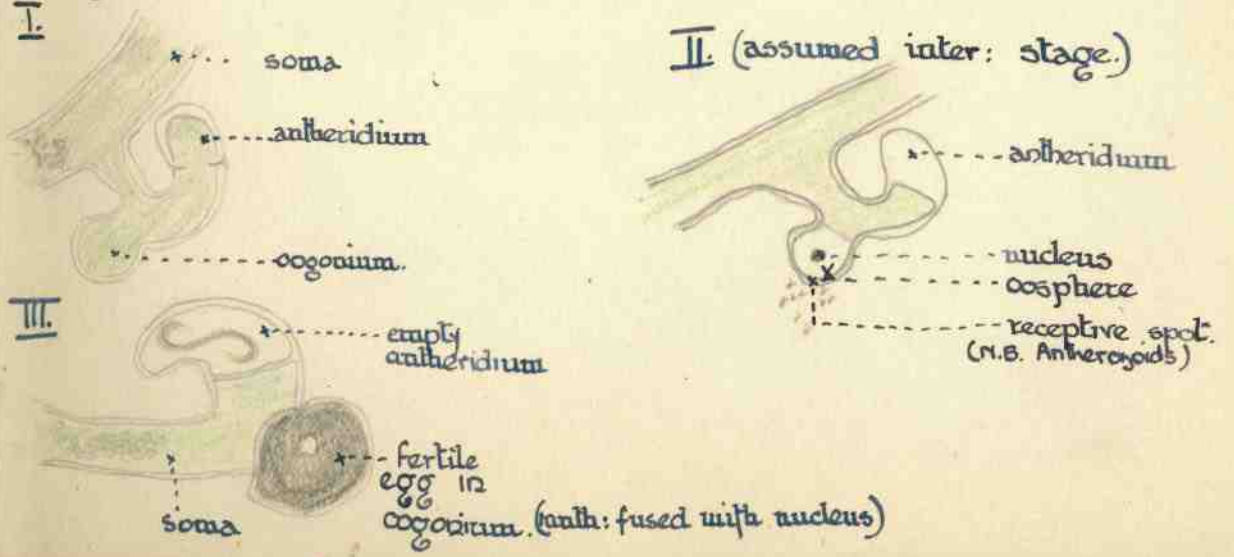
There are parts of plants wh. do not take part in reprod:
 Somatic cells - die off
 Germ cells - live.

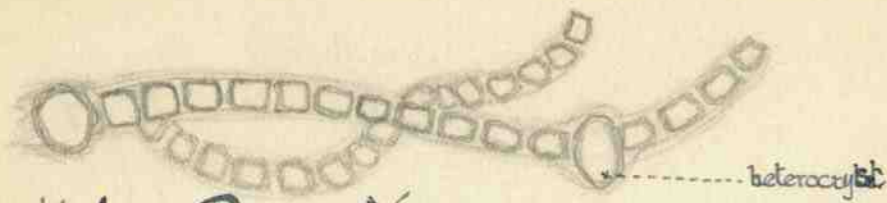
Vaucheria



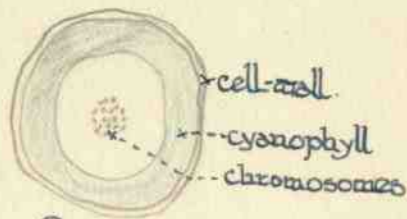
L.P. Vaucheria.

Stages in Sexual Reproduction





H Low Power View



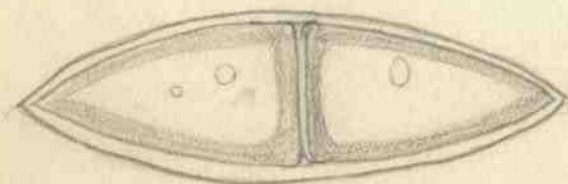
T.S. Single Cell

is nostoc animal or plant?

Chitin - animal/mata
glycogen - animals

no sexual reproduction; only vegetative

Diatoms



Pennate Diatom

Nostoc - Algae classed according to colour.

1. Chlorophyceae - green algae - *Protooccus* - *Chlamydomonas* v. high tides *Spizogrya* - *Vaucheria*
2. Cyanophyceae - blue-green algae - *Nostoc* - c
- colour due to chlorophyll + phycocyan.
3. Phaeophyceae - brown algae - *Fucus* - *Laminaria* - high tide
4. Rhophyceae - red algae - always covered with sea water.

Nostoc - occurs in streams - jelly like lumps
 Cell walls contain cellulose + chitin - chitin is not of veg. world - in insect world - outside covering of beetle + caterpillar etc.
 Within cell - layer of pigment - mixture of blue + green colouring matter
 No definite nucleus ever found in nostoc.

[Chromosomes - colour bodies - but colourless - when treated with some stains take up stains will not be washed out (staining of nucleus) - in certain stages they are very definite - numbers are constant.
 Chromosomes never found outside the nucleus.]

In middle of nostoc bodies took nucleus stains ∴ nostoc must have a nucleus but without a surrounding membrane.

If nostoc in presence of light + CO₂ it gives off O₂ but makes no starch.
 makes - glycogen - wh. is animal - cp glycogen in liver.

Reproduction - cell becomes detached - capable of div:
 some cells have spores - no sexual reproduction.

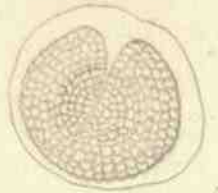
Diatoms - outside coat made of silica (flintstone) - like a box - lid comes off ∴ get smaller but conjugation takes place.

Occur extens: in sea.
Plankton - floating organisms - plant or animal - silk net with bottle attached - this is way to catch plankton.
 This plankton is eaten by copepods (crustacean) - these are

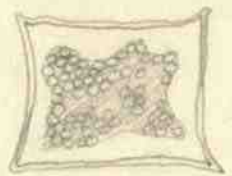
Plankton cont: eaten by larger fish etc on.
 Gt. majority of fish feed upon this plankton.
 Red Sea gets its name from plankton.
 Sunny Feb. & March means many diatoms ∴ much fishing.
Phytoplankton & Zoo-plankton.

Plankton [Marine]

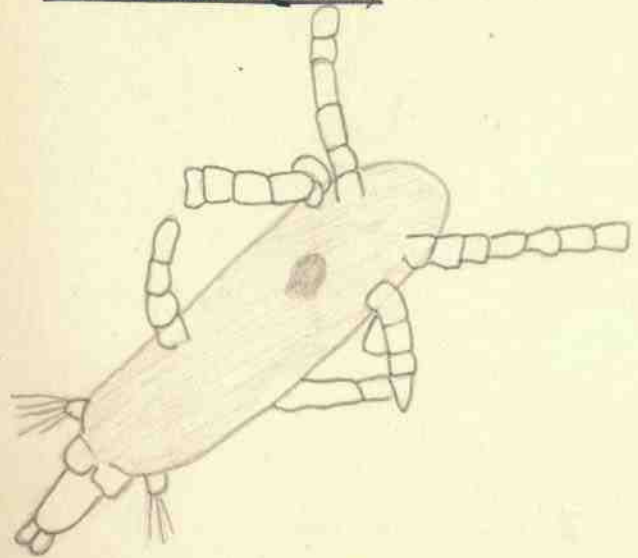
Feb 19th



Coscinodiscus (diatom)



Biddulphia (Algae)



Copepod - (zoo-plankton)



Phyto-plankton

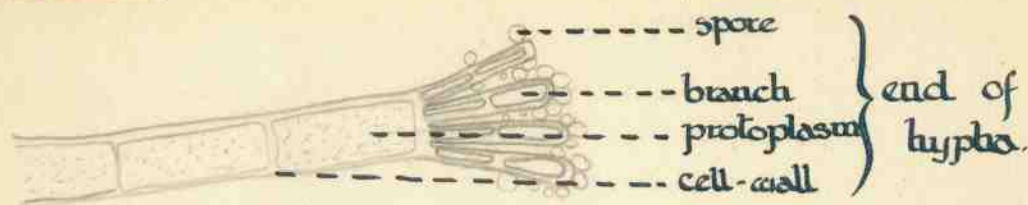
Ceratium



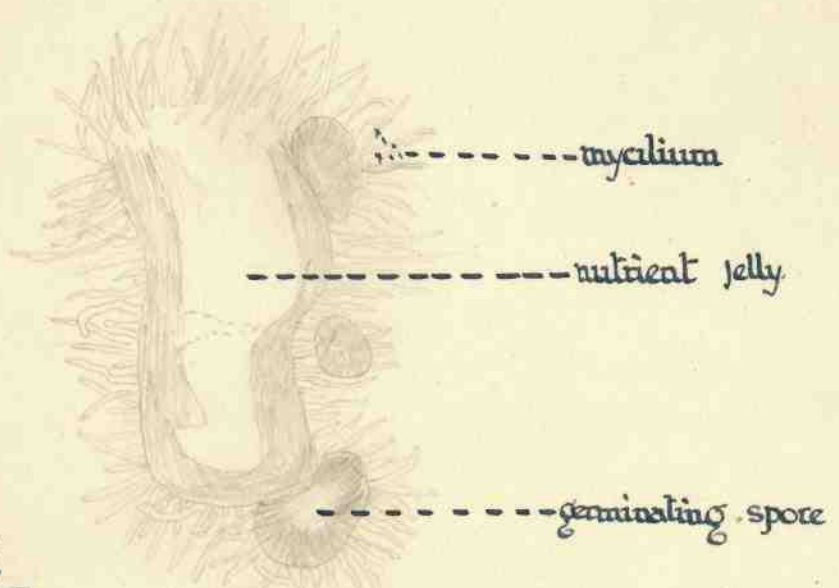
Rhizodonta

Penicillium

Feb. 26th



March 2nd



Colony of Germinating Spores of Penicillium

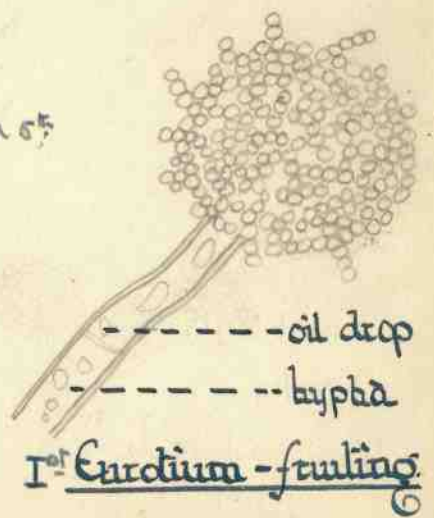
Eurotium

Mar. 2nd



Colony of Germinating Spores

Mar 5th



Ist Eurotium - fruiting

FUNGI

Moulds. I. PENICILLIUM - mould formed on bread etc:

Number of filaments with transverse walls (ie) made up of cells. Filaments end in no. of branches threads called hyphae & collection of hyphae is known as mycelium - penetrating & erect hyphae are formed. After growing for a while the branch rounds off & forms a structure - conidia which produces conidiospores.

Hyphae spread out in a ring - cells of hyphae contain enzyme wch. acts on bread - makes it soluble - passes through into cells of hyphae. ∴ penicillium said to be a saprophyte i.e. living on food produced from dead matter.

(Holophytic mode of living - c/f plant - chlorophyll must be present - (food obtained from H₂O + CO₂ etc.) If plant lives on another living organism it is said to be a parasite (dodder) - animal method of feeding is known as "holozoic" - swallowing food.)

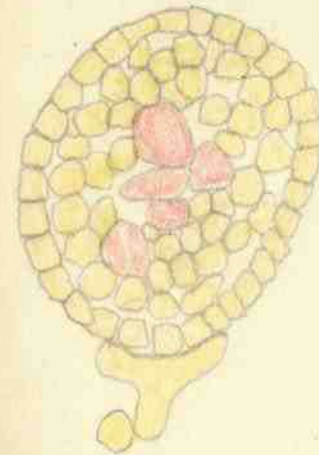
Structure of Cells

Cells contain protoplasm & nucleus (visible only if stained). Cell-walls do not stain blue with Schult's Sol. ∴ are not formed from the usual type of cellulose but of fungal cellulose. No chloroplasts - can not decompose CO₂ & water for food - blue green pigments - nothing to do with chloro.

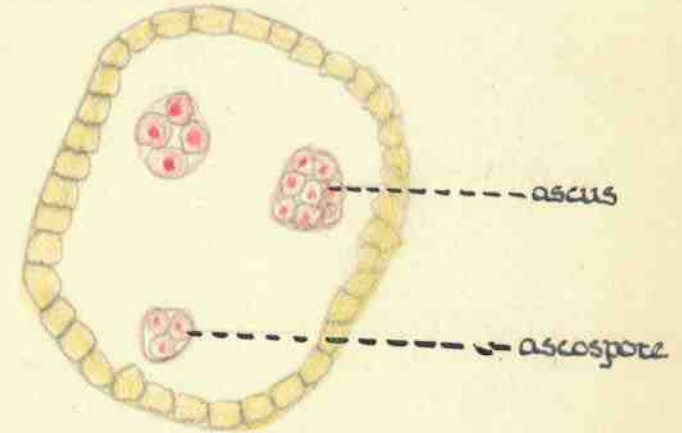
II. Eurotium - blue mould - cheese jam. No branching for spores - head at end of hyphae - pimples all round head - these produce the spores - formed from cytoplasm & nucleus. Spores of both penicillium and eurotium were set up as cultures on nutrient jelly - Feb 26th. H.B. diagrams showing results on March 2nd & 5th.

II - Fruitification of Eurotium

After Eurotium has formed the head of spores it begins to bring about another fructification. The diagrams opposite (taken from black board) show the stages. Archicarpus grows from the apex of a branch



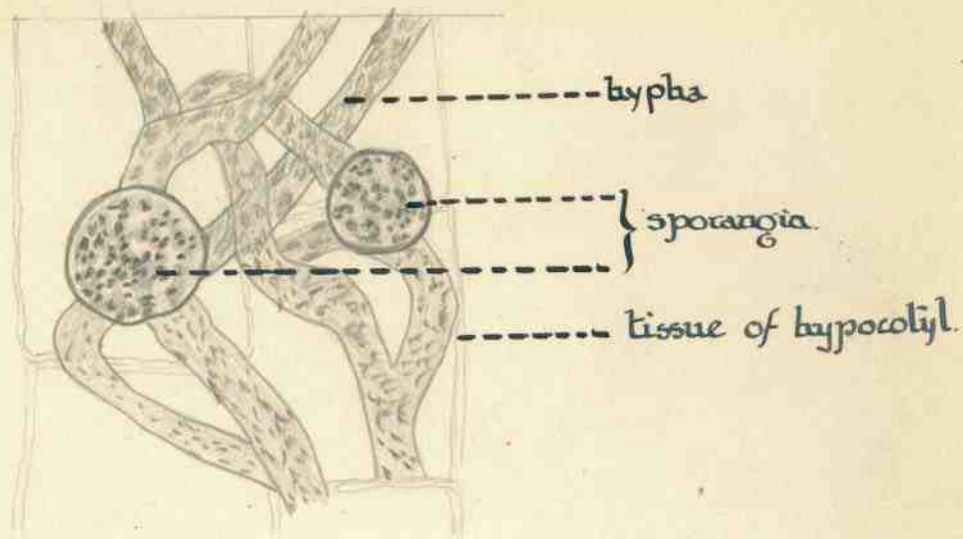
Perithecium



Single ascospore

Pythium

Mar 7



Asexual Reprod.



Sexual Reproduction



Pythium (no transverse walls in hyphae - a coenocyte.)

If cress seeds sown very close together & kept in very damp the phenomena known as "damping" has set in and pythium has attacked the plant - parasitic - live wholly on plant - kills it & lives on the corpse - cress attacked near the base of the hypocotyl (@ transition bet root & stem)
 The hypocotyl is weakened by the attack of the fungus & falls over. The fungus' hyphae enter the tissues of the hypocotyl - by means of an enzyme - usually through a stoma

Parasitic fungus - attacks cress.

Spores from air; soil; surface of seeds -
 Hyphae - granular protoplasm; oil drops; no chlorophyll.
 Enters plant thro' stomatal pore - grows & filaments pass along hypocotyl into stem; leaves; root -
 Goes along intracellular spaces & can even penetrate cell walls by pressure.

Reproduction I Asexual Reproduction - hyphae out of stem into air - aerial hyphae produce conidia at end - dep: upon humidity of air, etc:

- ⊙ damp air - forms new mycelium wh: penetrates hosts
- ⊙ in water - puts out little tube & spherical body is formed - protoplasm into this & divides to form zoospores - ea. having 2 cilia - swim about & germinate & form a new mycelium

II Sexual Reproduction - unfavourable conditions - sexual organs are formed - oogonium & antheridium. - oogonium - cell contents to centre - tip of antheridium enters oogonium & empties contents into it - oospore is formed which

- ⊙ grows into new mycelium
- ⊙ contents divide into number of zoospores - swim & germinate
- ⊙ contents of zoospore into delicate walled cell & then divides into zoospores.

Parasite - living on host to detriment of host.

- Dodder - Toothwort - no chlorophyll.

Semi-parasite - mistletoe (chlorophyll \therefore makes carb-hyd.)
Yellow rattle - eyebright - binds nest orchid.

Pythium kills host & lives on corpse (ie) passes
from a parasite to a saprophyte

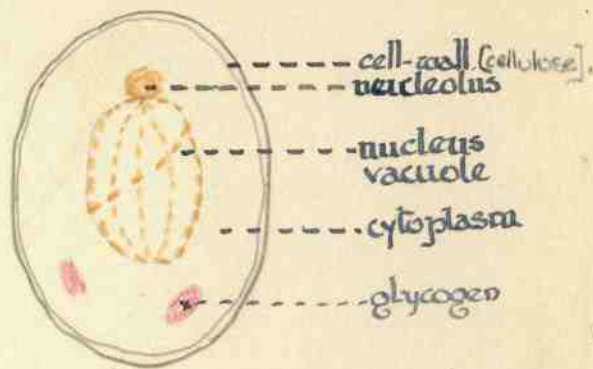
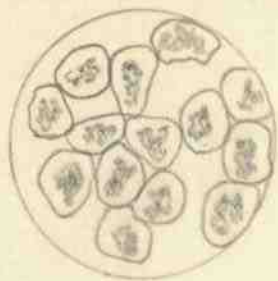
Pythium and Vaucheria.

- ① Coenocyte - no transverse walls.
- ② Secretes food as oil - pythium no chlorophyll.
- ③ 2 methods of reproduction - vaucheria forms spermat:
instead of whole cell contents pairing into oogonium
from antheridium.

Pythium

Yeast

Apr. 23.



Yeast (Saccharomyces)

Grows readily in sugar solution - unicellular - no chlorophyll

Structure of Yeast-cell

Definite cell wall of cellulose - enclosing protoplasm & a vacuole containing liquid - Water at last found a nucleus by trying to stain chromosomes - glycogen in cytoplasm (cf. nostoc re chromosomes & glycogen)

Experiment (for apparatus see diagram).

* Yeast in sugar solution - ferments - gives off CO_2
 $\text{C}_6\text{H}_{12}\text{O}_6$ (grape sugar) ferments & forms $2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2$
 Ethyl alcohol + Carbon dioxide

Physiology

Yeast thus obtains energy from fermentation. But some molecules do not break up as the others & yeast takes its food from this source

* Solution was really so Ammonium tartrate } this provides all
 10 Potassium phosphate } the necessary parts
 1 Calcium phosphate } for food - nuclei
 1 Magnesium sulphate. } etc.

The breaking down is done by enzyme brymase - a ferment. This action is an early form of respiration (ie) formation of alcohol - anaerobic respiration. Those which need gaseous air for breathing are 'aerobic'.

Uses of Yeast

- ① Baking bread - flour sugar water yeast
- ② Beer making - barley in germination (ie) malt.
- ③ Whiskey making - after fermenting alcohol into still & temp. raised - crude spirit.
 - fusil-oil - v. poisonous - absorbed by cloths - not left in alcohol.
- ④ Wine production - sugar directly from grapes - ferments without addⁿ of yeast - wild yeast does the work. - will not ferment without presence of air - yeast cells in bloom of grapes

Reproduction - by budding or spores formed inside cell

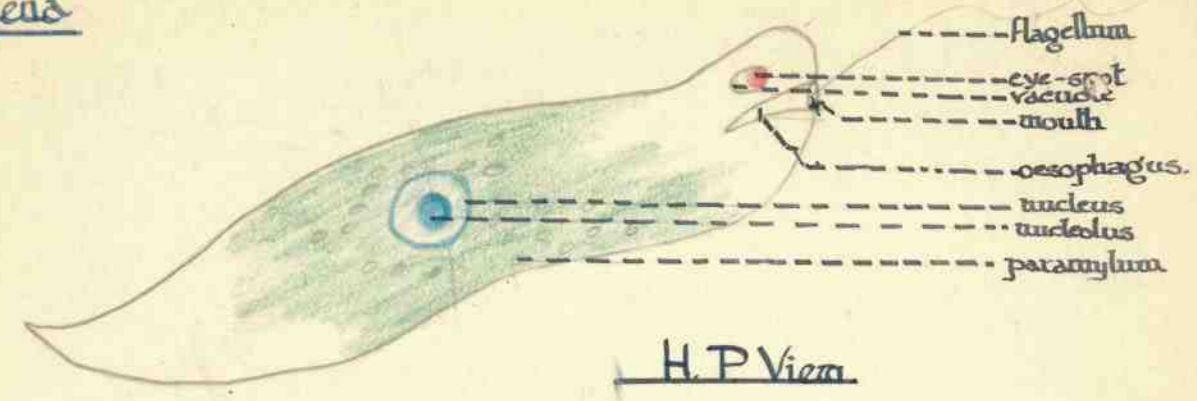
Wild Yeast - on sap of trees - v. Californian Bees

April 30th

Euglena

EUGLENA - on pools + on drainage from manures - go green in warm temperature.
 - movement is euglenoid - changes shape - shorter + thicker - propelled by flagellum wh arises from base of depression
 vacuole containing bright eye-spot
 Changes shape ∴ no cell wall - contains chlorophyll
 - no starch but paramylum
 Takes in food by mouth + oesophagus but can also make food in the light by the chlorophyll (gives off O₂ + makes a starchy food known as paramylum)
 Holozoic + Holophytic (ie) feeds as animal + plant.
 Belongs to family of flagellates

REPRODUCTION - Euglena into cystic condition - divides into 4 - cellulose wall ∴ plantlike



May 1st




Reproduction of Euglena.

Protozoa - v. important group of organism.



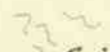

- ① Rhizopoda - Amoeba - Globigerina ooze
 Amoeba wh. is parasitic on man - dysentery
 - swallow the blood from intestine walls.
- Malarial parasite - rather like amoeba - eats into red corpuscles - often caused death of patient.
 - research re malaria done by Sir Ronald Ross
 - suspected mosquito bites - parasite into salivary gland of mosquito - transmitted thus to humans.
- ② Flagellata - Euglena - one of the flagellates causes sleeping sickness - Central Africa - from insect bite - Tse-tse fly
 - in blood of malaria - large number of animals had germ in blood - organism called trypanosoma.
 - if to be exterminated would mean extermination of fauna of district

Bacteria

May 7th


Bacteria off Soup

May 28th

 Bacilli  Cocci  Spirilla  Vibrios

BACTERIA

17 - Dutchman found organisms of bacteria by means of a new microscope.

Early knowledge only based upon authority.

Louis Pasteur - early experimentist - chemist - interested in chemical industries (fermentation)

Action of air causes putrefaction if there is still bacteria in air.

Cotton wool plugs allow air to enter flasks but withholds the bacteria - no putrefaction.

Experiment - to prove that putrefaction is the result of living organisms & not to a chemical reaction

Two test-tubes containing a little soup - one T.T. was sterilised the other one was not - cotton wool plug put into each T.T. to allow in filtered air (cotton wool acts as the filter).

May 14th A week later the sterilised soup was found to be unchanged in appearance whilst the unsterilised soup was cloudy & of a disagreeable odour. Some were covered with a mould.

Observations from microscope - some bacteria move in definite way (motile bacteria) others just bumped about in any direction in jerks (immotile bacteria)

May 29th Types of bacteria
 ① Bacilli ② Spirilla
 ③ Cocci ④ Vibrios

Plants - relatives of blue-green algae.

(Cocci = $\frac{1}{1000}$ mm diam (ie) 1/4)

- very little visible structure - no nucleus or cell-wall
 - mobility by cilia at one extremity - grow in culture by absorption of food (saprophytic) - produces chemical reaction

Reproduction by division (in 20 hrs) & by spores
 As T° rises to human body heat they are most active - as T° rises to boiling pt. of water the bacteria are killed.
 - killed by certain poisons as well as heat.

Iodine - one of the deadliest to bacteria

Poisons set up in food by action of bacteria are known

as ptomaines - can not be injured by heat (they are not living organisms)
Some meats give rise to more deadly ptomaines (shellfish)
- others do no harm at all (game)

Action of Bacteria on living organisms.

Antibodies neutralise the effect of bacteria
(eg) white corpuscles in blood
chemical substance in serum cause the bacteria to clot then dissolve (agglutinins)

Diphtheria - deadly bacteria ∴ inject antibodies -
Serum treatment (horse serum - prepared [Louis Pasteur]).
Lister & Pasteur institutes.

To be immuned - vaccines of enteric - paratyphoid etc:

Cellulose unable to be digested by ^{gastric juice} bacteria - cows eat much
in grass - bacteria in alimentary canal digest it.

Bacteria & decay. - v. important process

- decaying leaves form humus - part of soil
to replace nitrates in soil - farmyard manure - acted upon by bacteria - ammonification
brought about by several kinds of bacteria

this is nitrification

amino acids
↓
ammonia
↓
nitrites - prod. by nitrosomonas
↓
nitrates ∴ nitro bacter

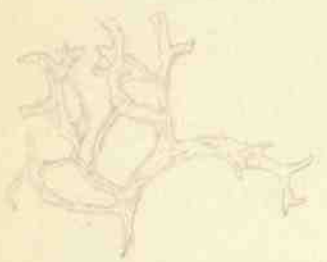
Lichens



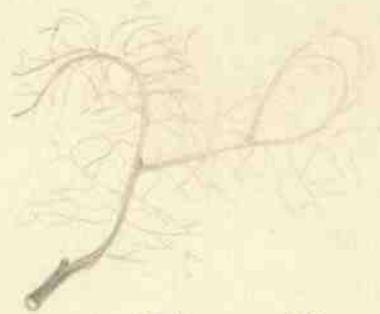
Dog's Tooth



Lecidia Geographa



Reindeer Moss



Beard Moss



Scripture-wort



Cup-moss



Parmelia



Section of Parmelia

June 11th

LICHENS

- will grow where most other things will not grow - 1st colonists of new land. - endure desiccation
Lichens can not endure a polluted atmosphere.

Parmelia - reindeer moss - cup moss - beard lichen
- scripturewort

Dual organism - algae in middle & fungus on outer part -

Thallus of Parmelia (T. Section)

Green cells to centre (chlorophyll) - algal cells

Benefits of this symbiosis of the plant. Green algae part of plant forms carbohydrates for the feeding of the plant.

Fungus part - attaching organism to substratum - absorbs the moisture from air etc. - mineral salts - protects the vital organs ag. drought

This living together for general good of both - known as Symbiosis. (not parasitic living.)

June 12th

Reproduction of lichen.

Lichen { Fungus Apothecia - containing sacs of spores (ie) ascis of ascospores)
- hairs in between (paraphyses)
Subhymenial + gonidial layers.
(Some fungi - arranged like this - called ascomycetes)

Alga Chlorella - cf. protococci - unicellular - chlorophyll - nucleus
- fungus part can grow without alga & vice versa.
- brought fungus & alga together - result was a lichen.

Upper cortical layer come away + gonidial layer as soredia are blown about - begins to grow + form new lichen

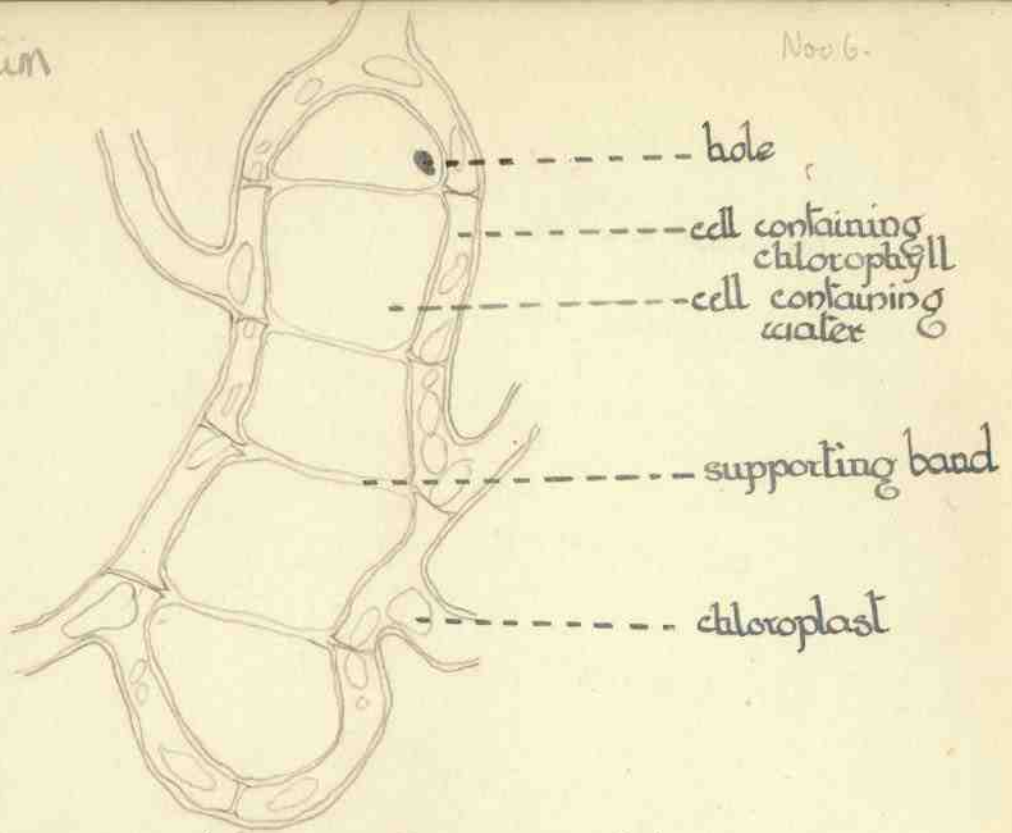
Examples of Symbiosis

- ① Modules of leguminous roots
- ② Mycorrhiza (fungus roots) - root hairs on tree roots. - transmits mineral salts etc. to roots in place of root hairs (beech) - cf. feather + mycorrhiza - orchids
- ③ lichens - seeds would not germinate except when mycorrhiza is first developed - symbiosis results probably in tubers of potatoes - will not produce tubers from seeds.

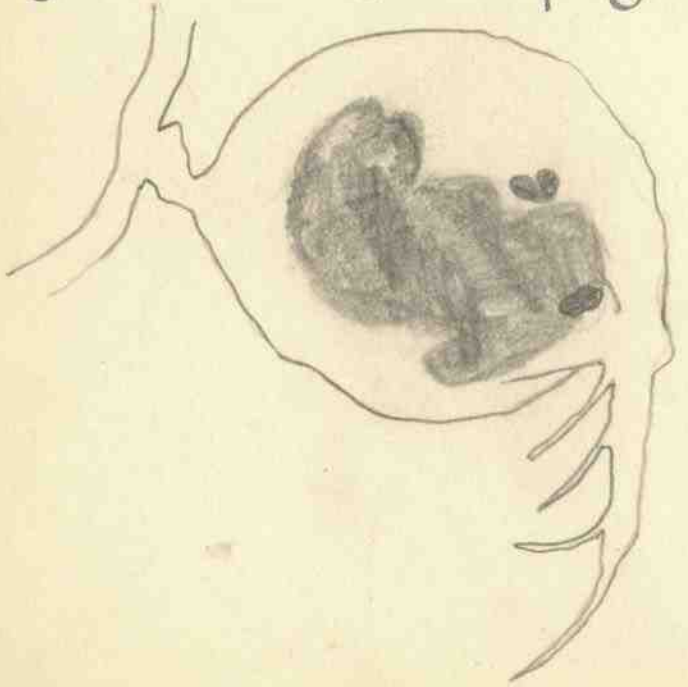
Symbiosis denotes a condition of conjoint life bet.
different organisms that in a varying degree are
benefitted by the partnership

Sphagnum

Nov 6.



Single Cell from Leaf of Sphagnum Moss



Bladderwort

Sphagnum Moss.

found on bogs - holds much water
 Acts on the principle of a sponge - sundew
 often grows on this using the moisture.

INSECTIVOROUS PLANTS.

Sundew - contains digestive juices - tentacles move.

Butterwort - " " " - leaf curls.

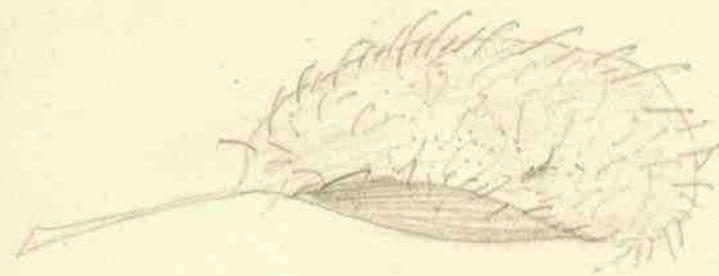
Bladderwort - trap door opens & closes - no digestive juices
 - products of decay absorbed.

Pitcher Plant - no movement - only juice - prod; absorbed

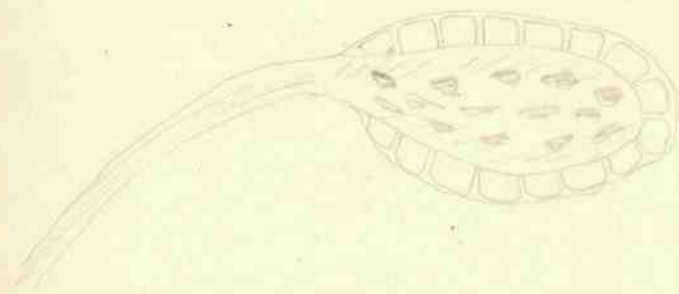
Sarracenia - " " " no juice - absorption.

Sundew

Nov 6



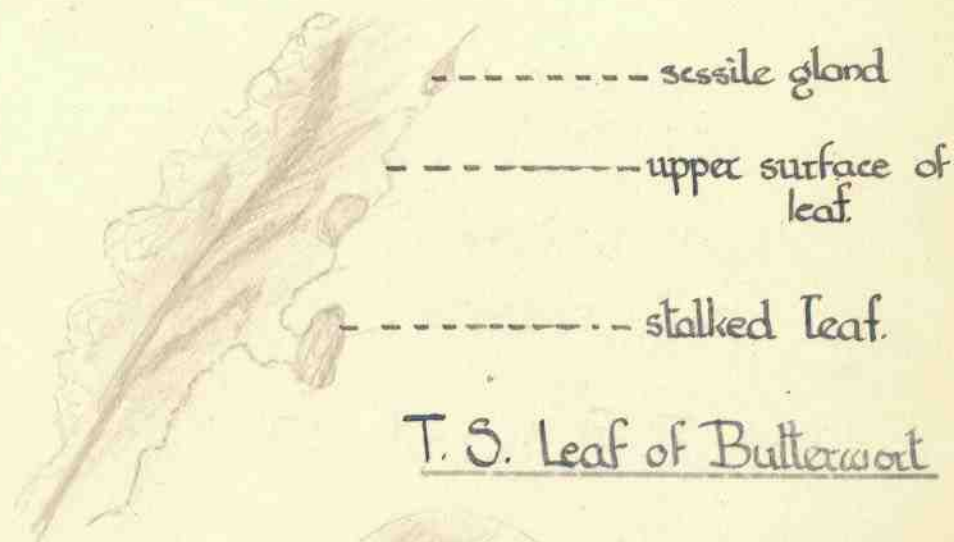
Leaf of Sundew



Butterwort - numerous species -

Leaves covered with glands - enclose protein bodies
- secrete digested fluid - sticky - glands sessile & stalked
when insect falls on leaf - edges of leaf curl over
- sessile glands give out digestive juice -
protein of insect is absorbed - leaf then uncurls.

Pitcher plant - pitcher formed from modified apex of leaf
- at entrance - honey glands - lid on the top
- waxy scales & spines wh. prevent exit of insects
- liquid in bottom - decay in this



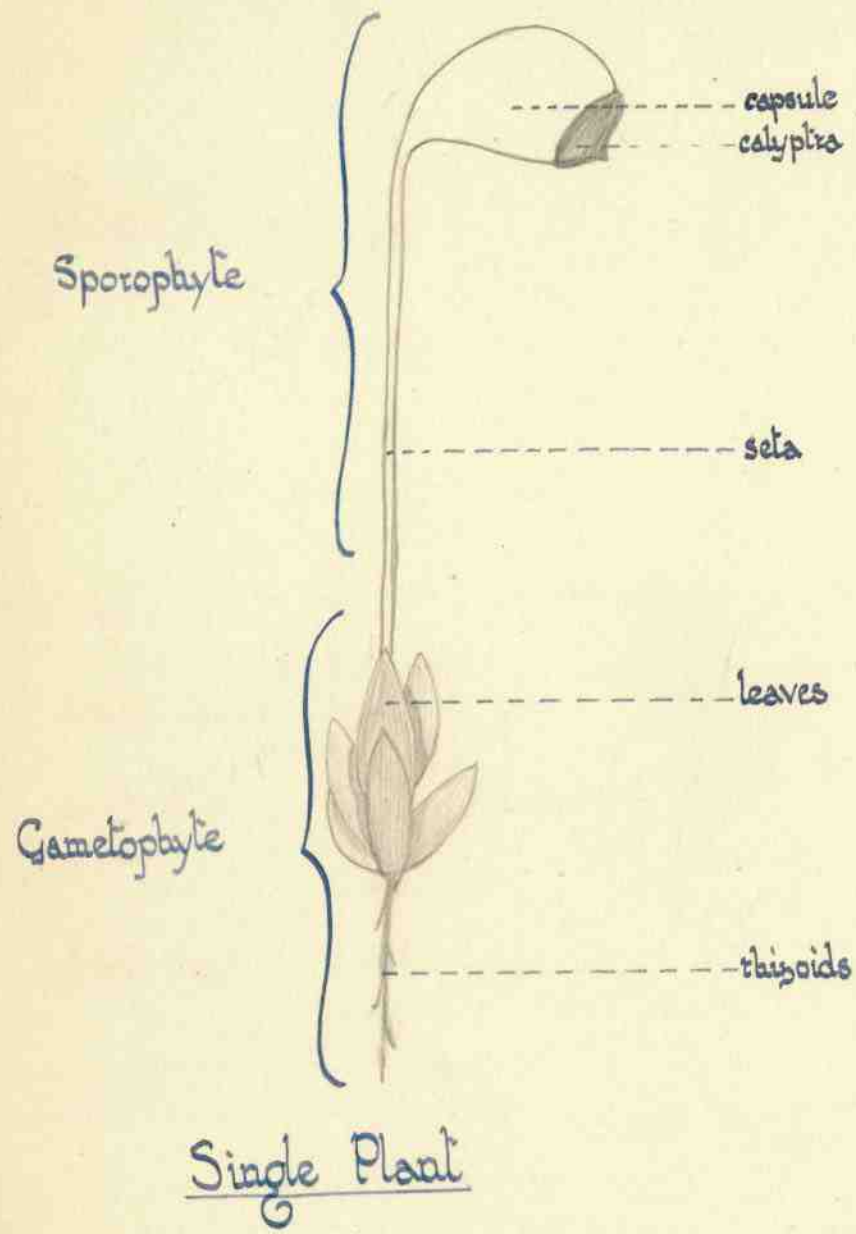
T. S. Leaf of Butterwort



H. P. Stalked Gland

Funaria

15/11/17



MOSSES.

I Funaria hygrometrica

Alternation of generations

- ① gametophyte - from the protonema - has gametes or sexual organs.
- ② sporophyte - from gametophyte with sexual organs - capsule - spores wh. germinate

and form Gametophyte generation.

Funaria

Stem

- little structure - no vascular bundles
- cells - not highly differentiated - cells on outside have thicker walls

Leaf

→ cell thick

Roots

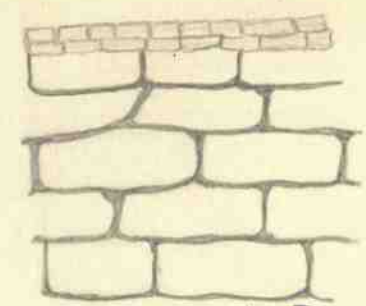
Rhizoids or multicellular hairs

Reproduction - Antheridia & ^{archi}ogonia on different stems
Antheridia & paraphyses on one branch
Single anteridium - sac bounded by cells containing tissues.
As anteridium ripens - spermatogoids ripe - antheridia burst & sperm swim about in drops of water or dew.

Archigonium - few collected with paraphyses at top of stem
Spermatogoids in water drop on its lower branches - fall on archigonia - go down neck canal of archigonium - mucilage contains cane sugar
chemotaxis - attracts spermatogoids

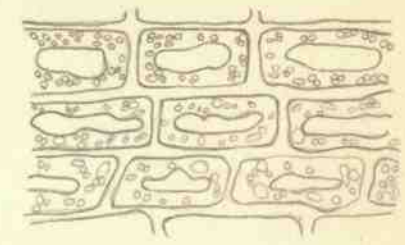
After fertilisation - cell division takes place & Seta + Capsule is produced - not at all like parent never detached from parent plant

Capsule or Sporangium - Columella & sporogenous tissue - air spaces
Apophysis - lower part of capsule - contains stoma.

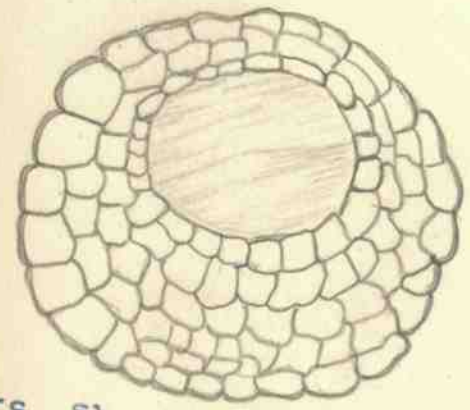


Low Power

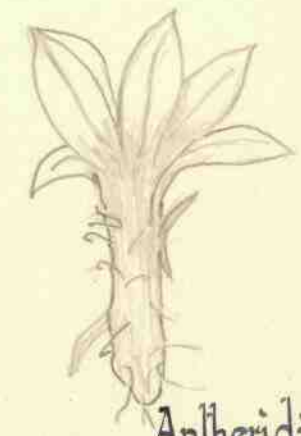
Leaf



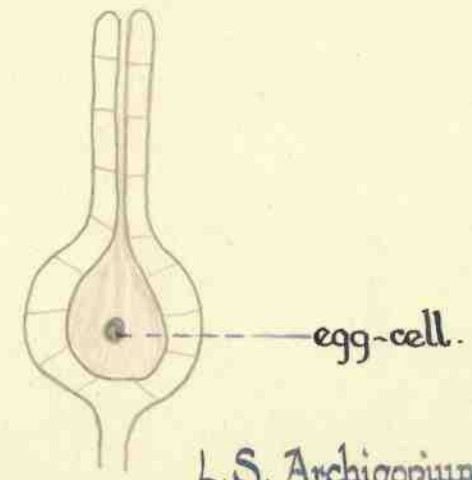
High Power



T.S. Stem.



Antheridial Branch

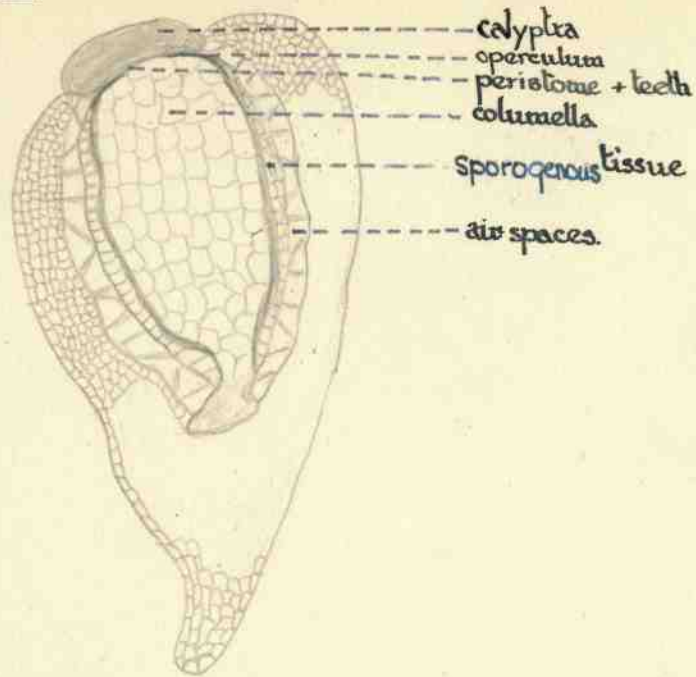


egg-cell.

L.S. Archigonium

Funaria.

Jan 27



V.S. Capsule.

Jan 28

Life History of Funaria.

From fertilised egg-cell of archigonium grows the sporophyte part of the moss-plant - sporophyte is called capsule after fertilisation.

When spore shaken out - begins to grow - puts forward filament (branched) - protonema - transverse cell walls are not at right angles - in apex of branches grows up the new moss plant.

Structure of Capsule

Central cells form columella - surrounded by spongy tissue wh. produces the spores - sporogenous tissue.

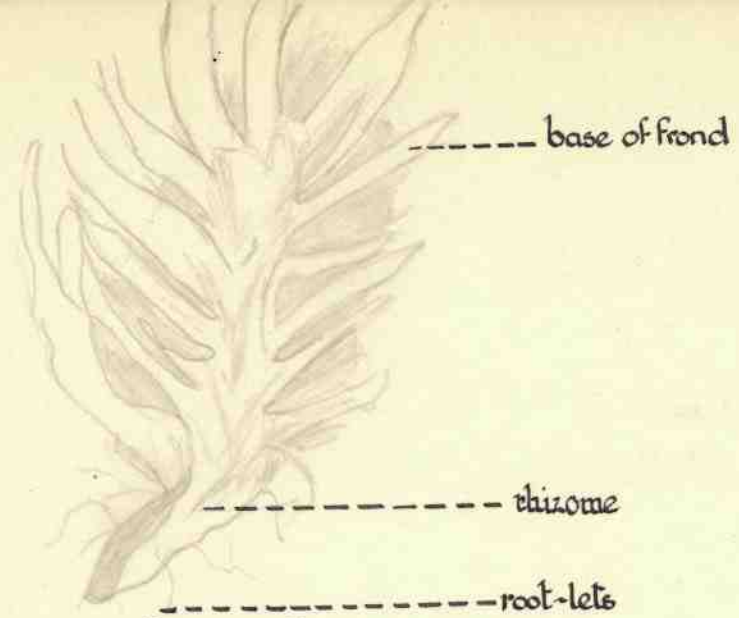
This surrounded by air spaces.

Apophysis contains stomata.

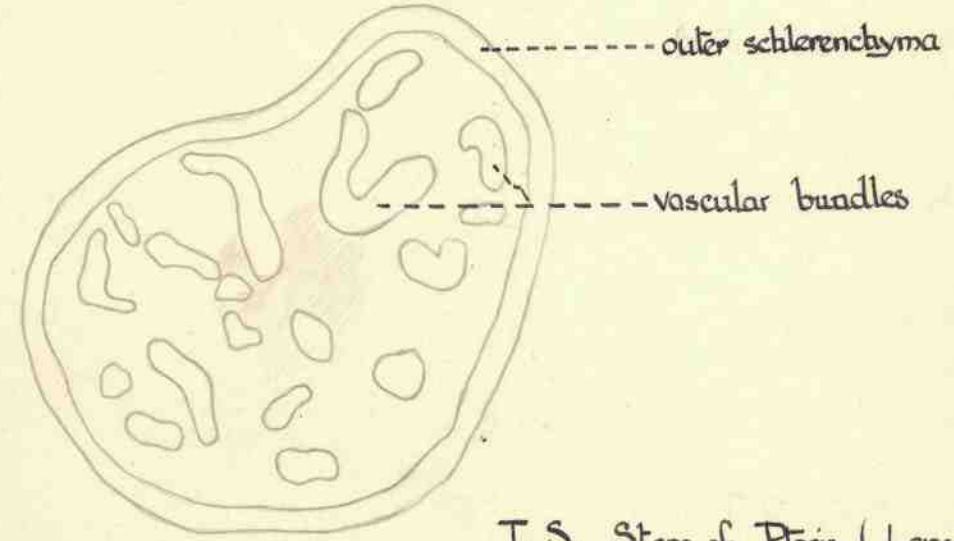
Calyptra or cap falls off - peristome teeth in dry weather open & spores escape through operculum. Closed in damp weather ∴ no waste of spores.

FERN.

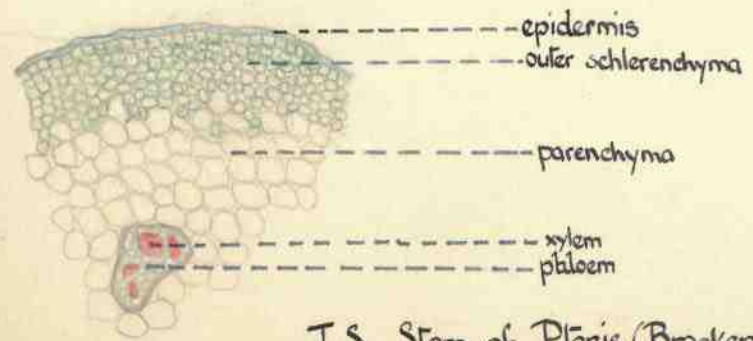
Rhizome which gives off roots & shoots
Lowest example of vascular plants



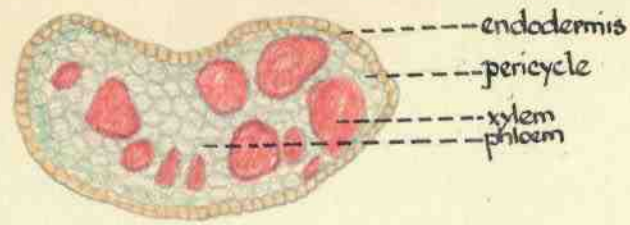
L.S. Root of Aspidium [Male Fern]



T.S. Stem of Pteris (Lens)



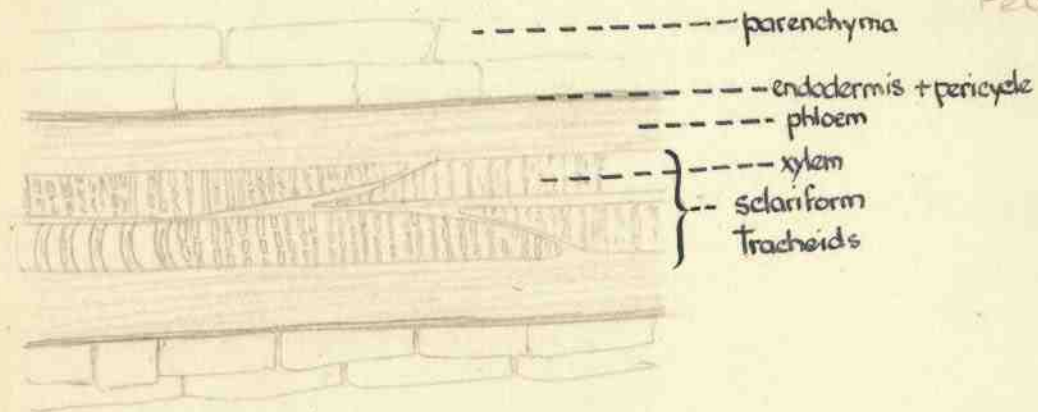
T.S. Stem of Pteris (Bracken) Microscopic.



-----endodermis
 -----pericycle
 -----xylem
 -----phloem

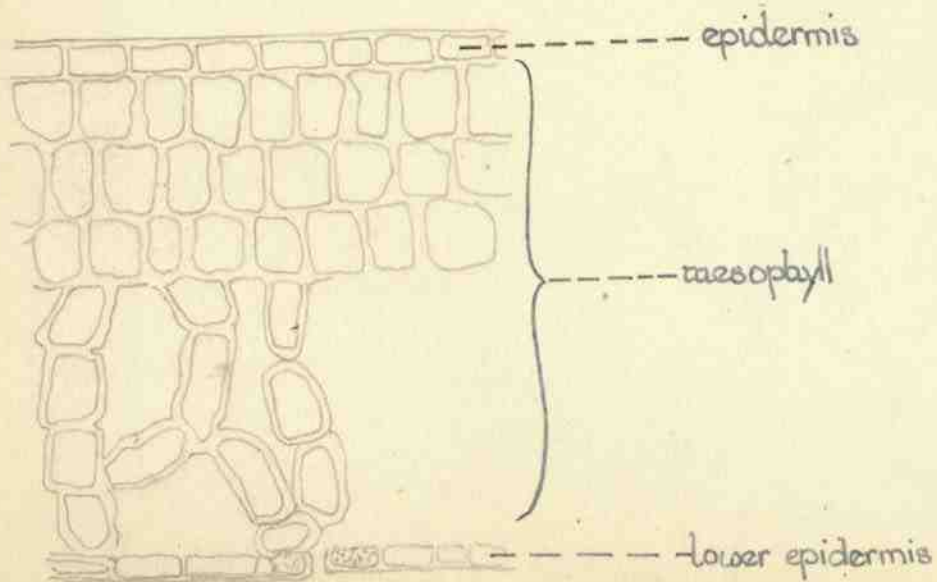
T.S. Vascular Bundle (Pteris)

Feb 5



-----parenchyma
 -----endodermis + pericycle
 -----phloem
 -----xylem
 -----scalariform
 -----tracheids

L.S. Vascular Bundle (Pteris)

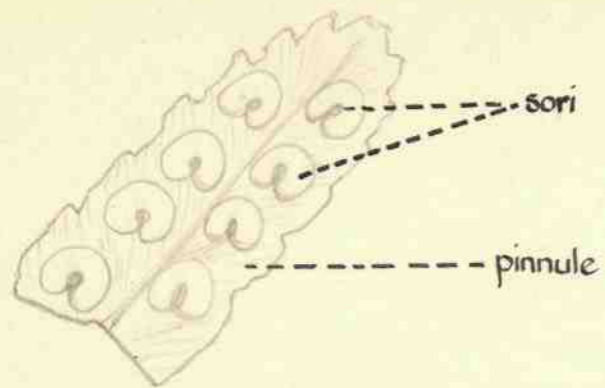


-----epidermis
 -----mesophyll
 -----lower epidermis

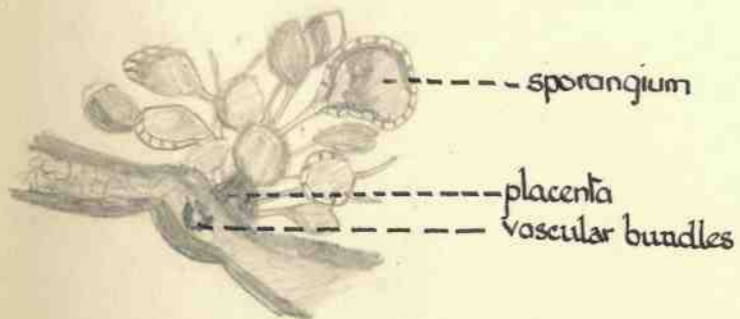
Section of Leaf

Aspidium.

Feb. 5th

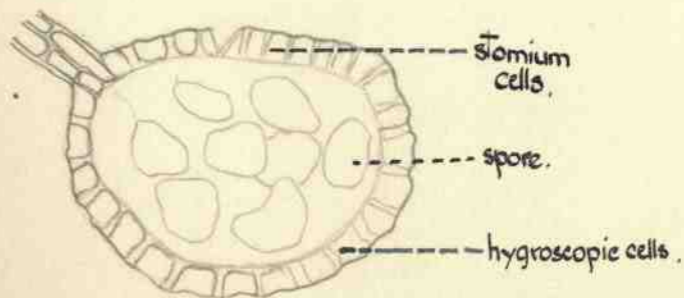


Pinnule - Underside



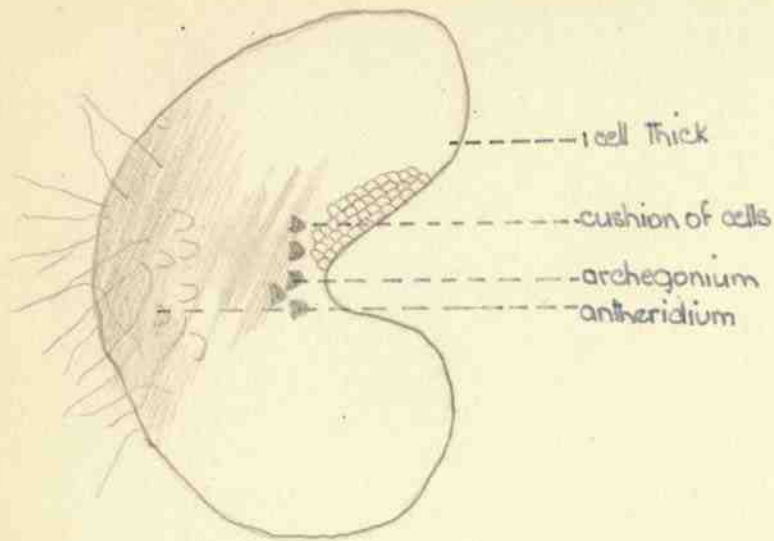
Part of Section through Sorus

Feb. 12th

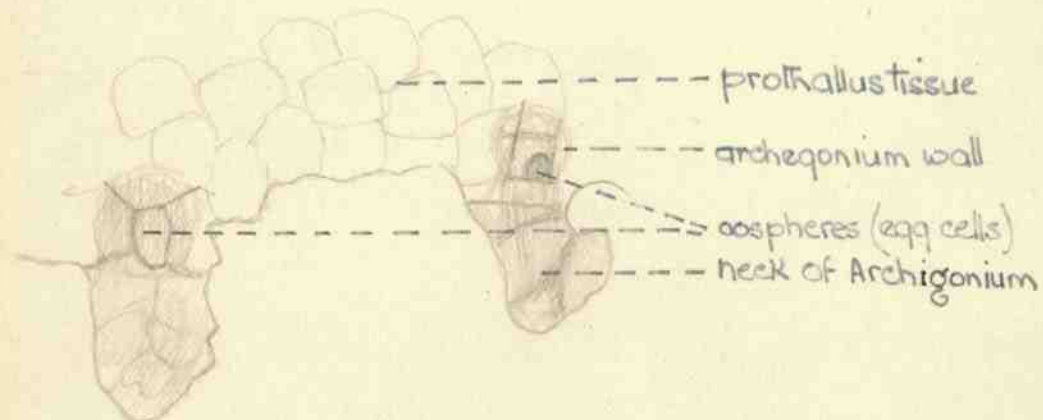


Section of Sporangium

Feb. 19th



Prothallus of Fern.



Section of Prothallus showing archegonia

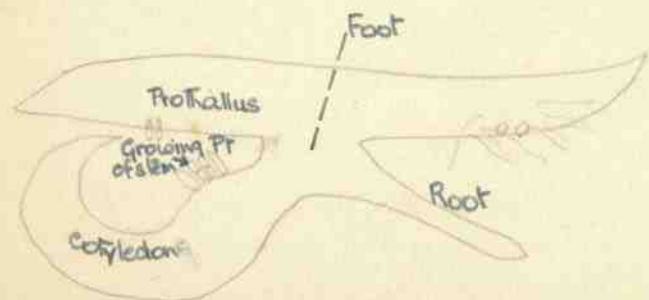


Diagram of T.S. Young Fern Plant

Feb. 19th

Prothallus - grows from spore - kidney shaped -
 1 cell thick on outside & cushion of cells in centre
 - has rhizoids - archegonia & antheridia on underside.

Archegonia hold oospheres - when these are fertilised these young moss plants begin to grow from the division of cell - resulting in something like diagram at foot of page.

SELAGINELLA

Really a type of fern - found in greenhouses growing on pots.

Real point of interest is the spores

Adder's tongue fern - difference between spore bearing & non spore bearing fronds - modification of spore bearing fronds.

Modification of selaginella - looks as tho' fronds are not there - cone like structures are the outcome of the modification

Section of cone like structure - there is sporangium with @ on one side 4 spores - macrospores
⊙ " other " many " - microspores
Vessels containing spores are called macrosporangium or the microsporangium

Each prothallus bears only 1 gamete - not two as in aspidium (ie) Selaginella is homaphrodite
Prothallus grows in spore with ~~antheridia~~ or archegonia on top; where spore has burst.
This is the macrospore.

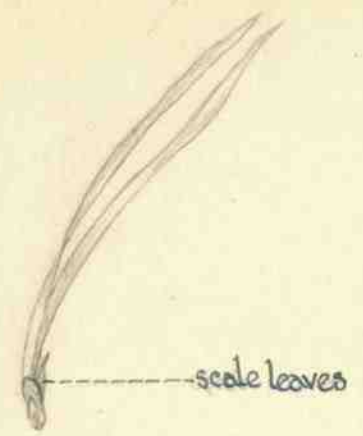
Microspore contains antheridia - when ripe the microspore bursts - ripe antheridia set free & swim in moisture of soil to the archegonia.

In coal measures - many fossilised plant forms - these are strong ancestors of Selaginella - become weaker
Ancestors of Horsetail are found also
In shale below coal - coal balls were found - full of vegetable remains with perfect cells ∴ structures of ancestors of many plants are found.
Flora of Coal Measures.

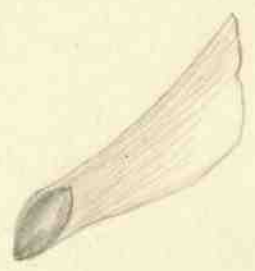
no flowering plants - only spore bearing plants
These have come from aquatic plant - Selaginella is beginning to live on land & water is necess. for fertil:
Pinus more elaborate modified structures for life on earth → pollen grain.

PINUS

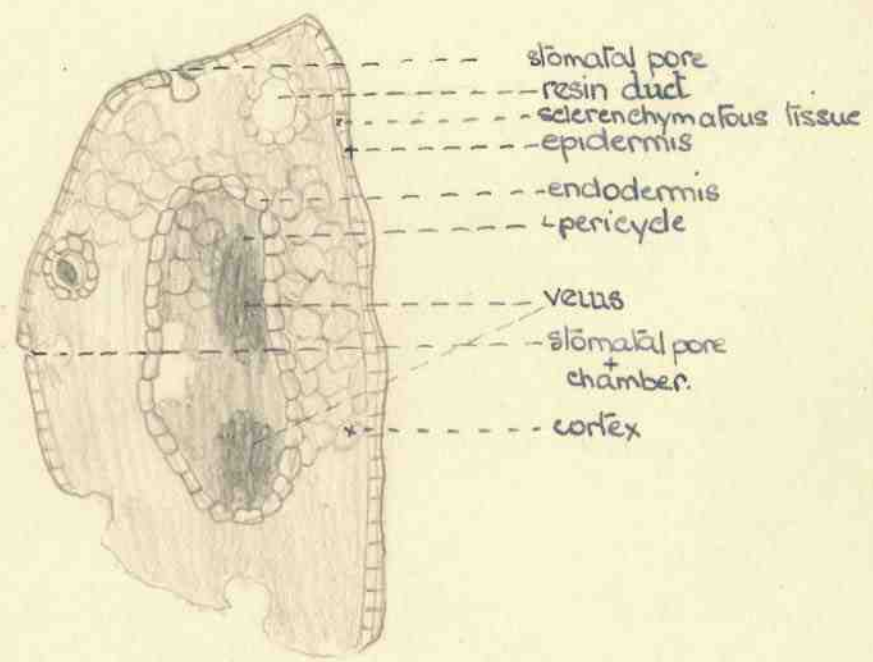
May 1st



Leaves of Pinus



Winged Seed (syris to form in cone)



T.S. Leaf of Pinus

PINUS

Indigenons of n. European forests

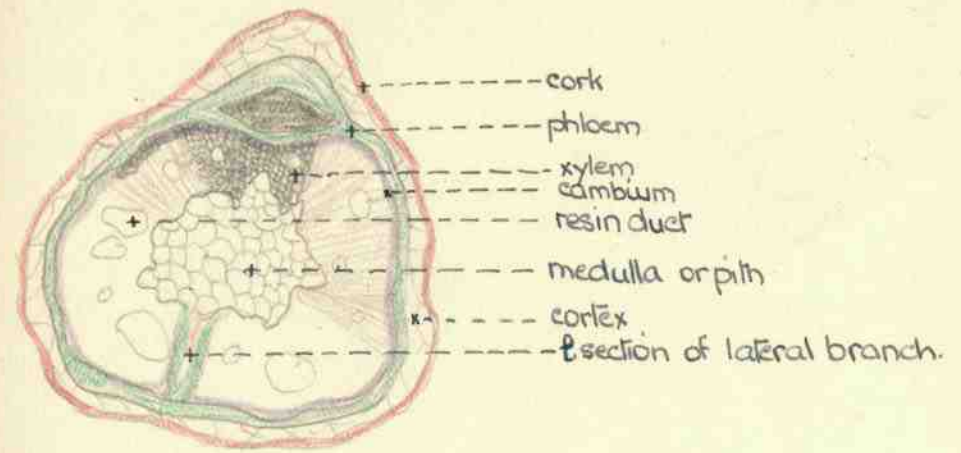
Leaves.

- needle shaped - rigid in texture - in pairs in scaly sheaths - concave or grooved on inner side - slightly twisted
Bluish-green in colour.
Leaf is of strongly marked xerophytic type

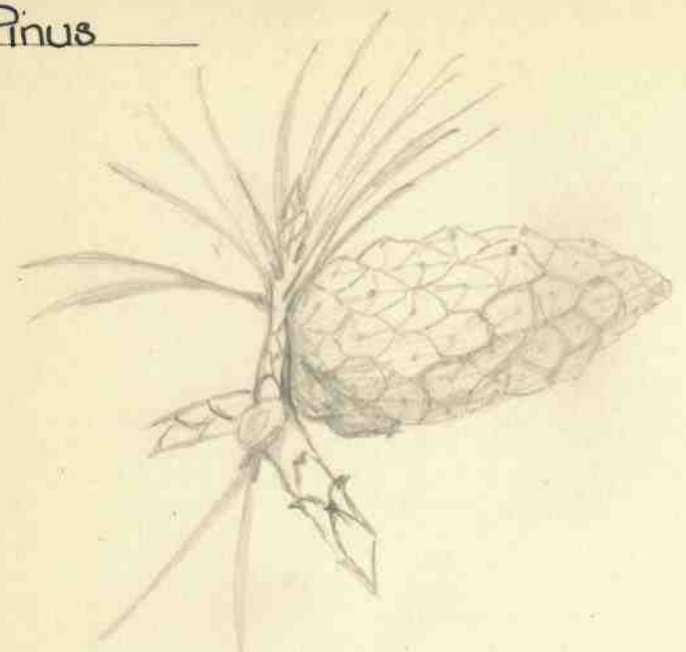
- ① epidermis - strongly cuticularised - sunken stomata
- ② under epidermis except in region of stomata layers of sclerenchymatous tissue occurs
- ③ v. reduced air spaces in parenchyma + resin ducts
- ④ well marked endodermis
- ⑤ Pericycle has 4 types of cells.
 - ⓐ thin walled - albuminous cells wh. contain oils proteins + starches
 - ⓑ tracheidal cells - pitted
 - ⓒ fibres round v. bundles
 - ⓓ thin walled parenchyma cells.

Pinus

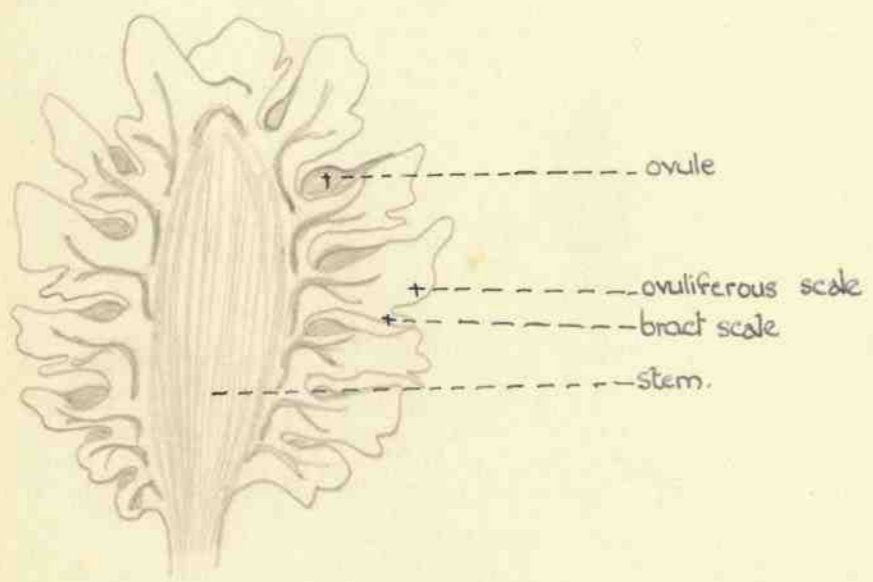
May 5th



T.S. Stem of Pinus



Cone + leaves + stem of Pinus.



L.S. Ovule-bearing Cone

Carpellary or Ovule bearing Cone.

Cone consists of
 (i) axis
 (ii) spirally arranged macrosporophylls
 (iii) carpellary leaves except at the base where there are a few sterile scales

At the time of pollination the cones are erect & scales slightly opened out - the scales of the cone are double.

At the base is a small fringed portion - bract scale and a larger thicker portion which can be regarded as a placenta for it bears on the upper surface 2 macrosporangia ∴ it is called the placental scale. Macrosporangia are better known as ovules

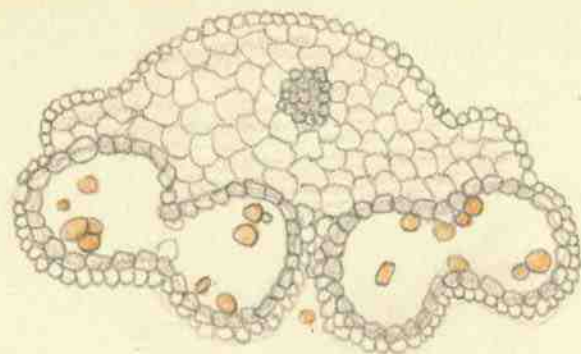
After pollination placental scales increase in size

The exposed surface of each scale forms a rhomboidal thickened area known as the apophysis (cf. lower portion of moss capsule)

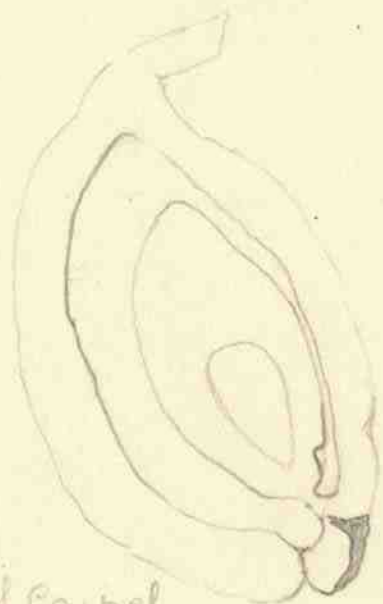
CLASSIFICATION OF PLANTS.

Phanerogamia } Angiosperms { dicotyledons
(Seed-bearing) } Gymnosperms - Pine, Fir, Yew.

Cryptogamia.
(Spore-bearing)

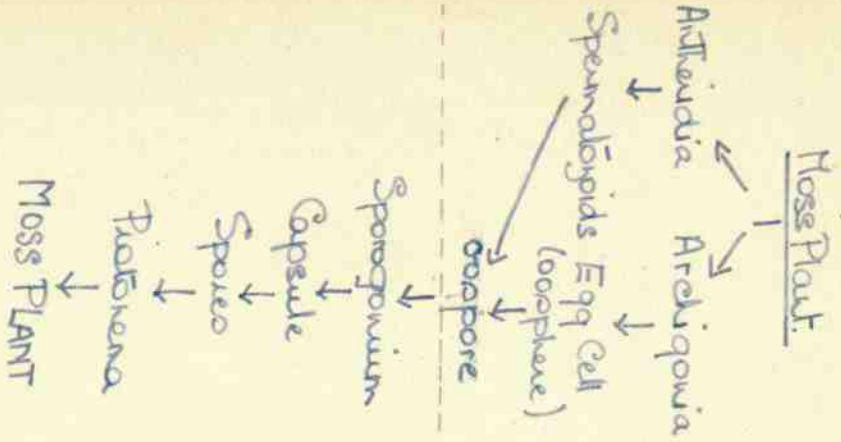


Section of anther



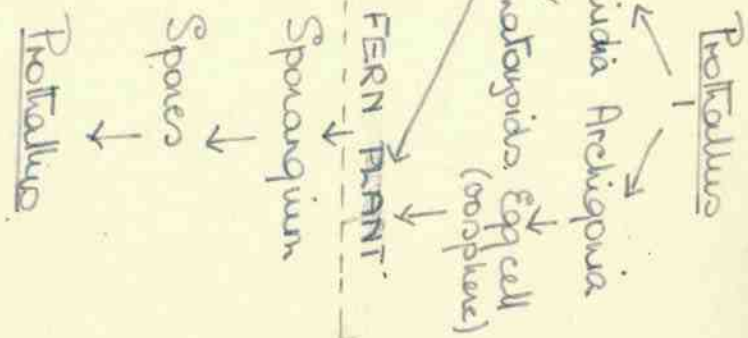
Section of Carpel

Moss:

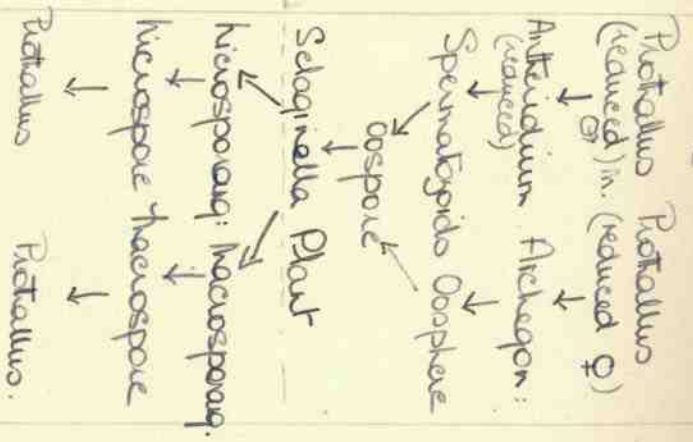


SPERMATOPHYTES

Fern:



Selaginella



Rhizom:

Uses of Food.

Growth - repair - energy.

Energy is liberated from food by oxidation (i.e.) slow burning - little used for repair for food used before it becomes part of muscles etc.

Breathing is for the releasing of energy.

More active the more breathing

It difference bet. combustion & respiration - oxidation is necessary for both.

Each substance in food gives off definite amount of heat - measured in calories (heat necess. to raise 1 gr. of water thro' 1°C.)

Constituents necessary for growth

Calcium phosphate make bone - humans are 60% water

Soluble salts

Water

Vitamins - Beri-beri - symptoms - lower limbs swell + no feeling - nervous system attacked - people who ate polished rice suffered

5 distinct vitamins A, B, C, D, E.

Some in milk.

Too much is harmful - easily destroyed by heat

Vitamin A - green leaves - natural fats oils - if this is omitted growth is harmed - eye trouble - sol. in oil.

Vitamin B - sol. in water - yeast - cereals - absence interferes with growth - nerves attacked

Vitamin C - sol. in water - fruit - leaves - lemons - absence causes scurvy - not contained in lines.

Vitamin D - sol. in oil - absence leads to rickets + bad teeth. - cholesterol - in eggs + cells of body - when exposed to light it becomes Vit. D - ultra-violet light changes cholesterol to Vit. D - too much " " " is very dangerous.

Vitamin E - sol. in oil - in embryo of wheat - absence of it causes sterility (in rats as experiment)

We set up a number of experiments to see if albumen would pass through a membrane. Contrary to expectation the albumen (protein) did pass through.

1. Test with caustic soda weak copper sulphate. the mixture becomes heliochrome.
2. Test with millon's reagent - white precipitate wh. becomes red on heating.

To test whether ① diastase turns starch into sugar
 ② remains unchanged.

1. Starch in parchment boat + diastase in saucer of water. - test in boat

Effect of heat on enzymes. - starch jelly + enzyme diastase in 4 T.T.

I Starch jelly A.	} Place all near heat N.B. Diastase in ca. T.T Test for sugar with Yehling's Solution.
II Starch jelly boiled B.	
III " + acid C.	
IV " + alkali D.	

Enzymes will only do their own work

Results.

I

Colloids

- ① not pass through membrane
- ② never formed crystals - often glue like

Examples

- ① starch
- ② glue
- ③ gum

Crystalloid

- ① Will pass through membrane
- ② often form crystals

Examples

- ① Sugar
- ② Salt
- ③ Copper Sulphate

Plant stores up excess material as starch - secure in cell - sugar is a crystalloid
 little diff. in comp. bet starch & sugar
 $\left. \begin{array}{l} \text{Starch } (C_6 H_{10} O_5) \\ \text{Sugar } (C_6 H_{12} O_6) \end{array} \right\} \therefore \text{water is needed to make starch into sugar.}$
 starch + saliva (containing enzyme ptyalin)
 Enzyme diastase - in plants
 Reaction on starch
 Enzyme pepsin

We dissolved the shell off an egg & found that the albumen passed through the membrane.
 The test-books say that albumen does not pass through a membrane.

Osmosis.

Cane sugar - osmosis takes place quickly

Starch - will not go thro' membrane

Salt solution - very slow osmosis.

If denser liquid were outside exosmosis would take place

Use made of plants of osmosis

Root hair - in soil - soil surrounded by water -

- full of cell sap (sugar solution) - no cell sap comes out but water goes in - protoplasm determines what shall go in & what out.

If salts in soil water are stronger than cell sap

exosmosis takes place - plant dies of drought.

Diffusion of contents of adjacent cells.

Experiments - set up in parchment containers with
Glucose, Starch, Albumen, peptone & Copper Sulphate.

Tests

Seltingold - Iodine - Millon's reagent
- white precipitate
- brick red on heat

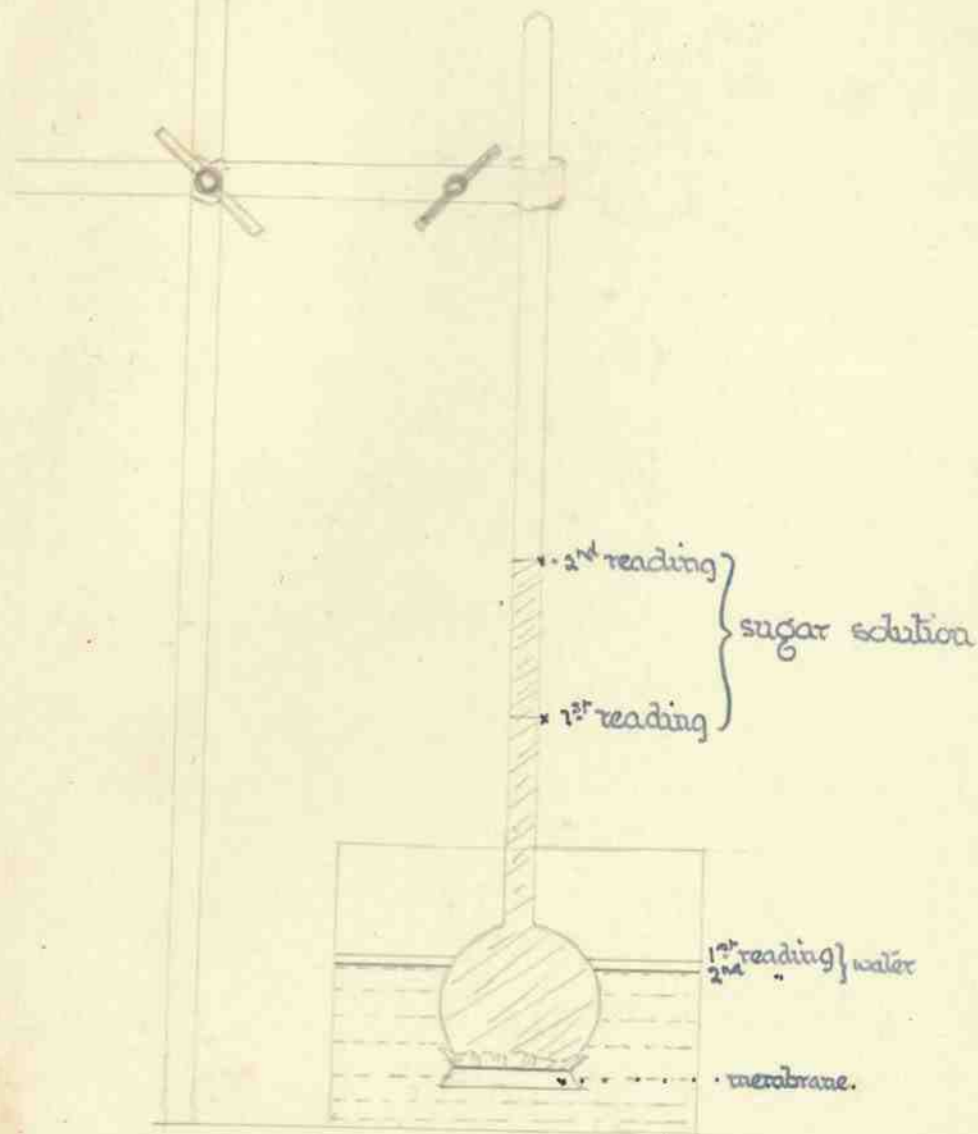
Results. Glucose - passed through the membrane

Starch - no starch passed through the membrane

Albumen - some had passed
although test books state to the contrary
- which is in error?

Peptone - passed through the membrane

Copper Sulphate - passed through the membrane.





Suggestions for Special Topics for Thesis work

Plant - Animal life in fields - habits - special adaptations.

Intensive study of plant structure - functions

Intensive study of animal structure

Classification of Br. plants - aid of Fla.

Study of hedgerows + meadows

Sea-shore - water plants

Moorland - Woodland

Natural Order - grasses - leguminosae - rosaceae - compositae -
- siphonocarpitae - stices - ferns - mosses - liverworts -
fungi - bacteria - seaweeds - fresh water algae.

Leaves & their modifications

Stems - fruits - seeds - food stores

Physiology - carbon assim. - respir. - transp. -
absorption of water

Parasites - Insectivorous plants

Seedlings - Plant Galls.

Animal Group.

Animals - birds - dogs - cats - fish - marine life
pond life - insects - shells etc. - spiders - earth worms
- animal locomotion