SYLLABUS

OF

LECTURES ON BOTANY,

WITH AN

APPENDIX,

CONTAINING

COPIOUS DEMONSTRATIONS OF FOURTEEN COMMON PLANTS FOR THE ILLUSTRATION OF TERMS.

BY THE

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SYLLABUS.

I. STRUCTURAL BOTANY.

*External Organization.

I. PLANT: axis of Vegetation; Appendages. Organs.

1. CONSERVATIVE ORGANS.

Descending Series.

II. ROOT: Tap, fibre, fibril, spongiole.
— Neck. —

Ascending Series.

III. STEM: nodes, internodes. Branch. Buds.
(Herb, Undershrub, Shrub, Tree.)
Ærial. Definite, Indefinite. Runner, Sucker.
Subterranean (bitten). Corm, Bulb (scaly, laminated). Tuber. Rhizome (some *epigean*).

IV. LEAF: simple, compound, decompound, supradecompound. Leaflets. Petiole (general, partial), limb (base, margin, apex). Veins, ribs.
Phillode. Pitcher.
Stipules and stipels.
Vernation (folded, rolled).

2. REPRODUCTIVE ORGANS.

V. INFLORESCENCE. Peduncle, Pedicels, Bract (Spathe, Involucre), Bracteoles.
General-receptacle. Flowers.

Indefinite (axillary) or Centripetal.

Simple.	Spike (spikelet)		Compound.
	— Catkin, Spadix.		
	Raceme	Panicle, Thyrse	
	Corymb		
	Umbel (umbellule)	General Umbel	
	Head		

Definite (terminal) or Centrifugal.
Cyme. Glomerule.

Mixed.

VI. FLOWER. Floral-whorls; (complete or incomplete; each in one or more series).
Floral receptacle (Torus. Disk).
Æstivation (valvate, imbricate).
Perianth (leaves).
Calyx (sepals) } (claw, tube, } regular,
Corolla (petals) } throat, limb) } irregular.
Androecium. Stamens (Filament, Anther with Pollen)...Androphorus.
Gynœcium. Pistil (carpels). Ovary (with ovules), Style, stigma...Gynophorus.

VII. INFRUCTESCENCE (modified condition of the parts of Inflorescence), generally regarded as "compound-fruit" in Coniferæ (*Cone, Galbulus*), Fig (*Syconus*), Mulberry (*Sorosis*), &c.

VIII. FRUIT (modified condition of ovary and ovules).
Exuvies (accessory appendages).
Pericarp (cells, dissepiments, valves, placenta, funicular-chord).
Apocarpous. Achene, utricle, follicle, legume (*pod*), drupe (drupel), simple berry, &c.
Syncarpous. Capsule, pod (*siliqua*), cremocarp, nut, key (*samara*), gourd (*pepo*), berry, pome, &c.
Aggregate. Æterio.

IX. SEED (axis, base, apex).
Integument, (Testa and Tegmen), Nucleus (base and apex), hile, micropyle, raphe, chalaze.
Arillus, Arillode, Caruncula, Strophiola.
Albumen.
Embryo. Radicle, plumule, cotyledon, tigellum.

APPENDAGES (*metamorphic*) to various parts.
Armature. Thorn, Spine, Prickle.
Supports. Tendril, Claw.

***Internal Organization, and Elementary Tissues.*

Elementary Organs, of Membrane (*Cellulose*).

The CELL; usually from .05 to .01 line in diameter (also .1 to .001), cylindrically elongated, to .3 to 2.6 lines: (also to many inches). Spherical and ellipsoidal to polygonal; sometimes branched.

Cellular tissue (*parenchyma*).

Vessels—Ducts, Spiral Vessels (*Tracheæ*).

Vascular tissue. Fibrous bundles (closters and vessels).

Origin of dotted, annular, scalariform, reticulate, and spiral cells and vessels, in deposition of secondary internal layers.

Intercellular passages. Lacunæ, Receptacles, Laticiferous channels.

Organic constituents, *non-nitrogenous*, approximating to $C_{12}\ O_{10}\ H_{10}$.

Ex. gr. Starch, Dextrine, Sugar, &c.

nitrogenous, (Protein compounds) approximating to $C_{48}\ O_{14}\ H_{36}\ N_6$.

Ex. gr. Albumen, Fibrine, Caseine, Gluten, &c.

Acids, Resins, Gums, Oils, Wax, &c.

Chlorophyll, Alcaloids, &c.

Elements of Inorganic constituents, adventitious in plants, found in various combinations; viz.,

Oxygen, Carbon, Hydrogen, Nitrogen, Sulphur, Phosphorus, Chlorine, Iodine, Bromine, Fluorine, Potas-

sium, Sodium, Calcium, Magnesium, Aluminum, Silicium, Iron, Manganese.

Minute crystals (Raphides); some in Biforines.

Epidermis and Cuticle.

Stomates, 12,000 (*Iris*) 120,000 (*Lilac*) on sq. inch.

Pubescence. Hair, bristle, sting, gland.

Exogenous structure of Dicotyledons.

- Central system.
  - Pith.
  - Medullary sheath.
  - Woody layers.
    - heart-wood (*duramen*).
    - sap-wood (*alburnum*).
- Cortical system.
  - Cortical layers.
    - endophlæum (*liber*).
    - mesophlæum.
    - epiphlæum.
  - Epidermis.
- Medullary Rays (*silver grain*).

Modifications in Stems and Roots, in Herbs and Trees.

Computation of ages of Dicotyledonous Trees.

Observe, anomalous distribution of woody fibres in Bryonia, definite in Cycadeæ; disks (glandular?) on tissue of Coniferæ.

Endogenous structure of Monocotyledons.

Scattered indefinite interlacing fibro-vascular bundles in trunks of Palms; axillary buds commonly dormant.

Modifications in herbaceous and arborescent Monocotyledons.

Approximation to the ages of Monocotyledons.

Observe, Ruscus aculeatus, the only British Monocotyledonous shrub; aphyllous. Sub-exogenous structure of rhizome of Tamus communis.

Acrogenous structure of Acotyledons.

General absence of vascular tissue in the lower groups. Definite fibro-vascular bundles in the trunks of Tree-Ferns.

Fragments of fossil wood referred, by internal organization, to their Class, and some to their Order.

General anatomy of foliaceous and floral appendages.

Preparation of Skeleton Leaves.

Articulation of organs to their support, scar left by their separation.

* * * *Glossology,* (*some of the more important terms grouped for ready reference*).

A. NUMBER. Cohesion. Abortion.

	Latin.			*Greek.*		
stem, &c.	-angular.	E(x)-	0	A(n)-	-œcious (1, 2 3)	*species.*
	-lateral.	Uni-	1	Mon(o)-	-gonous	*stem*, &c.
branch, &c.	-~~cheiotomous~~.	Bi-	2	Di-	-clinous (1, 2)	*flower.*
		Tri-	3	Tri-		
	-foliate.	Quadr(i)-	4	Tetr(a)-		
	-farious.	Quinqu(e)-	5	Pent(a)-	-chlamydeous (0, 1, 2)	*perianth.*
	-lobed				-phyllous	
	-fid	Sex-	6	Hex(a)-	-merous (2, &c.)	
	-partite	Sept(em)-	7	Hept(a)-	-sepalous	*calyx.*
	-sect	Oct(o)-	8	Oct(a)-	-petalous	*corolla.*
leaf, &c.	-pinnate	Non(o)-	9	Enne(a)-	-androus	
	geminate	Dec(em)-	10	Dec(a)-	-dynamous (2, 4)	
	binate	Undec(im)-	11	Endec(a)-	-adelphous (1, 2, . . . many)	*stamens.*
	ternate	Duodec(im)-	12	Dodec(a)-		
	pectinate	Vigint(i)-	20	Icos(a)-	-gynous	*styles.*
	-digitate	Mult(i)-		Many. Poly-		
	palmate	Pauc(i)-		Few. Oligo(s)-	-spermous	*seed.*
	-nerved	Semi(i-)		Half. Hemi-	-cotyledonous (0, 1, 2. . . many)	*embryo.*
	ribbed					
leaflets	-jugate					
inflores:	-bracteate					
flower	-floral.					
	-sexual (1, 2).					
anther	-locular.					
pericarp, &c.	-valvular.					

B. MAGNITUDE. Absolute and relative, approximate (*sub-*), obsolete. Hair $\frac{1}{144}$, Line $\frac{1}{12}$, Nail $\frac{1}{2}$, Palm 3, Span 9, &c. inches. Unequal, oblique, dimidiate, &c.

C. INSERTION. *Position*, radical, cauline, rameal, epiphyllous, axillary, dorsal, lateral, marginal, apical, basilar, terminal, &c.

Attachment, sessile, stipitate, petiolate, peduncu-

late, peltate, perfoliate, adnate, decurrent, amplexicaul, sheathing; articulate, versatile, &c.

Adhesion, superior, inferior (*calyx, ovary*).

hypogynous, perigynous, epigynous (*corolla, stamens*).

adnate, decurrent.

D. ARRANGEMENT, alternate, opposite, ternate, verticillate (whorled), stellate, distichous, decussate, brachiate, secund, fascicled, squarrose, cæspitose, radiant, continuous, interrupted, &c.

Valvate, imbricate, twisted, plaited, quincunxial, regular, irregular, symmetrical, unsymmetrical.

Phyllotaxis, divergence, generating and secondary spirals.

Sexuality, hermaphrodite (*monoclinous*), male and female (*diclinous*), neuter. Monœcious, Diœcious, Triœcious.

E. DIRECTION, erect, ascending, spreading (patent), reflex, pendant, pendulous, prostrate, oblique, reclinate, resupinate, &c.

Involute, revolute, convolute, induplicate, replicate, circinate, scorpioidal, &c.

Usual relative "*inversions*" of ovule and embryo.

Ov: Orthotropous—Campylotropous—Anatropous.

Em: Antitropous—Amphitropous—Homotropous—Heterotropous.

Radicle... from, ... to, Hile indeterminate.

F. SUBSTANCE, scarious, membranaceous, chartaceous, coriaceous, crustaceous, corneous, ligneous, osseous, fleshy, tuberous, succulent, gelatinous, waxy, farinaceous, herbaceous, fibrous, fistular, &c.

Petalloid, sepaloid, foliaceous.

G. Form, (when inverted, *Ob-*).

Solid, globose, ellipsoid, ovoid, conical, cylindric (terete), angular, prismatic, clavate, fusiform, filiform, capillary, gibbous, cochleate, two-edged (*anceps*), capitate, carinate, channelled, compressed, depressed, &c.

Tubular, campanulate (bell-), infundibuliform (funnel-), hypocrateriform (salver-), rotate (wheel-), urceolate (pitcher-), cyathiform (cup-), labiate (lip), personate (mask), ringent (gape), anomalous, cucullate (hood), galeate (helmet), &c.

Plane, rounded, oval, oblong, lanceolate, linear, ligulate (strap-), ovate, cordate (heart-), reniform (kidney-), auricled, lunate, subulate (awl-), acerose (needle), spathulate (spoon), cuneate (wedge-), ensiform (sword-), deltoid, sagittate (arrow-), hastate (halberd-), &c.

Apex, acute, pungent, mucronate, setose, awned, rostrate, caudate, cirrhous, pointless (*muticus*), hooked, blunt, retuse, emarginate, truncate, præmorse, &c.

H. Division, simple, branched.

Composition, pinnate (pari-, impari-) pectinate, geminate (binate), ternate, digitate, palmate, (bi-, tri-). } (bi-,tri-,)

Incision (*marginal*), entire, repand, sinuate, curled, crenate (bi-), dentate (bi-), serrate (bi-), erose (gnawed), angular, runcinate, (*luminar*), torn, incised, cut, laciniate, lobed ($\frac{1}{3}$ to $\frac{1}{2}$), split (-fid, $\frac{1}{2}$ to $\frac{2}{3}$), divided (-partite $\frac{2}{3}$ to $\frac{3}{4}$), cleft (-sect, $\frac{3}{4}$ to 1); panduriform, lyrate, &c.

Separation, didymous (twin), forked, stellate, articulate, septate, granular.

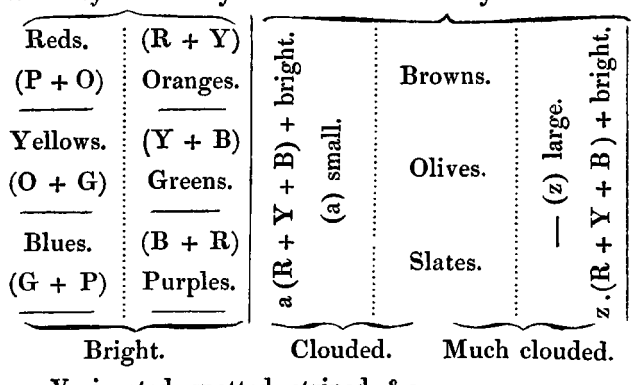
Dehiscence, indehiscent, longitudinal, transverse, irregular, loculicidal, septicidal, septifragal.

I. Surface, even, glabrous, rough, tuberculate, viscid, glaucous, pubescence (see characters of), squamose, paleaceous (chaffy), ciliate, fringed, striated, sulcate, reticulate, rugose, punctate, lacunose, alveolate.

Venation, costate (ribbed), straight, curved, parallel, convergent, divergent, reticulate.

J. Colour, White, Grey, Black (as neutral).

Nomenclature from Chromatometer.



Variegated, spotted, striped, &c.

Green (or herbaceous), as opposed to "coloured" (of any other colour).

Scent, alliaceous, hircine, &c.

K. Duration, annual, biennial, perennial, fugacious, caducous, deciduous, persistent (marcescent, accrescent).

II. SYSTEMATIC BOTANY.

Individual plants referred to sequence of natural "Groups."

1 Species, (variations, varieties, races)—Hybrid.
2 Genus, (sub-genera).
3 Order or Family, (sub-orders, tribes, sub-tribes).
4 Class, (sub-classes).

Genera grouped *artificially* under the Linnean System.

Flowers apparent (*phanerogamous*) ..... none. (*cryptogamous.*)

Hermaphrodite (*monoclinous*)..... unisexual (*diclinous.*)

Stamens.

Equality.

1 Mon-
2 Di-
3 Tri-
4 Tetr-
5 Pent-
6 Hex-
7 Hept-
8 Oct-
9 Enne-
10 Dec-
11 Dodec-
12 Icos- (*perig: epig:*)
13 Poly- (*hypog:*)

Orders.

Mono- Di- &c. Poly- } -gynia.

-andria.

Proportion.

14 Didy-

Orders.

Gymno- } -spermia.
Angio- }

15 Tetrady-

Orders.

Siliquosa }
Siliculosa }

-namia.

Combination.

16 Mon- } -adelphia. (*filaments.*)
17 Di- }
18 Poly- }

Orders.

as classes 3 to 13.

19 Syngenesia. (*anthers.*)

Orders.

Æqualis.
Superflua.
Frustranea.
Necessaria.
Segregata.

20 Gynandria. (*pistil.*)

Orders.

as classes 1 to 13.

21 Mon- } -œcia.
22 Di- }

Orders.

as previous classes.

23 Polygamia.

Orders.

Mon- } -œcia.
Di- }
Tri- }

24 Cryptogamia.

Orders.

Filices.
Musci.
Hepaticæ.
Lichenes.
Algæ.
Fungi.
(N.B. others since added.)

Genera grouped *naturally* under the Jussieuan System, modified by subsequent observation.

Subordination in the value of characters derived from the reproductive organs.

1 Embryo.
2 Pistil and Stamens.
3 Seed and Pericarp.
4 Perianth and Bracts.
5 Nectaries.

Above 80,000 species is the usual estimate for *flowering* plants, probably to be reduced one third!

Selection of Orders and a few species, chiefly British, for illustrating Structural and Systematic Botany.

Class II Dicotyledones.

Sub-class 1. Thalamifloræ (*polypet: hypog:*)

Ranunculaceæ.

Refer to Demonstration I.

Ranunculus repens. Creeping Crowfoot.

Observe, partially induplicate æstivation of Clematis.
Irregularities in perianths of several Genera.
pendulous seed of Clematis and Anemone.
follicles of Helleborus, Aquilegia, &c.
baccate pericarp of Actæa.
cohering carpels of Nigella.

PAPAVERACEÆ.

Papaver Rhæas. Common Red Poppy.

Observe, fugacious sepals, projecting parietal placentæ *apparently* opposite radiating stigmata. Corollæ in different species of Papaver tetra- to hexa-petalous.

CRUCIFERÆ.

Refer to Demonstration II.

Cheiranthus Cheiri. Wall-flower.

Observe, Spuriously lateral racemes of Senebiera. Distinction of Siliqua (*a*) and Silicula (in Capsella). Septum broad (*b*) in Lunaria, narrow (*c*) in Thlaspi. Pericarp sub-indehiscent (*d*) and one-seeded in Isatis. Spurious tranverse partitions (*septa*) (*e*) in Anastatica. Lomentaceous siliqua indehiscent (*f*) in Raphanus.

Cotyledons accumbent (1) in Cheiranthus; incumbent (2) in Sisymbrium; conduplicate (3) in Raphanus; circinate (4) in Bunias; biplicate (5) in Heliophila. Hence Sub-orders and Tribes,

Sub-orders.	Embryos.		Pericarps.	
1.	Pleurorhizeæ	0 =	Siliquosæ	*a*
2.	Notorhizeæ	0 ‖	Latiseptæ . . .	*b*
3.	Orthoploceæ	0 >>	Angustiseptæ .	*c*
4.	Spirolobeæ	0 ‖‖	Nucamentaceæ	*d*
5.	Diplecolobeæ	0 ‖‖‖	Septulatæ . . .	*e*
			Lomentaceæ. .	*f*

RESEDACEÆ.

Observe, Reseda odorata, large hypogynous disk, mutifid limb at back of claw of petals, summit of capsule gaping !

VIOLACEÆ.

Refer to Demonstration III.

Viola tricolor. Pansy Violet.

Observe, barren (irregular) and fertile (regular) states of the flowers of some species of Viola. Caulescent and acauline species.

POLYGALACEÆ.

Polygala vulgaris. Common Milkwort.

Observe, three bracts at base of pedicel; one posterior and two anterior (outermost) sepals equal, two lateral (interior) much larger and petaloid (wings). Two posterior petals, and one anterior (keel), adhering to split tube formed by cohesion of filaments; Keel crested. Stamens diadelphous, octandrous. Arillode on the seed.

Sub-class 2. Calycifloræ (*polypet: and monopet: perig: and epig:*)

LEGUMINOSÆ.

Refer to Demonstration IV.

Pisum sativum. Garden Pea.

Observe, Ulex europæus, aphyllous, bi-partite calyx, monadelphous stamens. Trifolium pratense, cohering

petals (monopetalous). Legume spirally twisted in Medicago; spuriously two-celled in Astragalus, and many celled in Cassia; drupaceous in Dipterix; lomentaceous and polyspermous in Hippocrepis, to monospermous in Onobrychis. Exostoses (*tuberous*) on roots.

British species (confined to Loteæ, Vicieæ, Hedysareæ) of sub-order I. Papilionaceæ, monadelphous and diadelphous; many exotics (in Podalyrieæ, Sophoreæ) have stamens free. Embryo straight-homotropous in sub-orders II. Cæsalpineæ (flowers irregular) and III. Mimoseæ (flowers regular).

N.B. Some species have petals and stamens sub-hypogynous or quite so.

ROSACEÆ.

Refer to Demonstration V.

Rosa canina. Common Dog-Rose.

Observe. Monœcious Inflorescence of Poterium	(Sanguisorbeæ).
Monochlamydeous Perianth of Alchemilla	(Sanguisorbeæ).
Calyculate calyx and geniculate persistent styles of Geum	Dryadeæ.
Tailed achenes of Dryas .	Dryadeæ.
Aggregated Drupels (*Etærio*) of Rubus	Dryadeæ.
Succulent torus of Fragaria	Dryadeæ.
Follicles of Spiræa . .	Spirææ.
Drupe of Prunus . . .	Amygdaleæ.
Superior calyx on Pome (with pseudo-syncarpous Follicles) of Pyrus . .	Pomeæ.

CUCURBITACEÆ.

Bryonia dioica. Common Red Bryony.

Observe, large tuberous root. Solitary stipular Tendrils (twisting dextrorse and sinistrorse). Pentandrous, flowers, triadelphous stamens. Anthers flexuose. Berry a baccate "Gourd" (*Pepo*, which *compare* with Cucumber, Melon, Gourd, &c.) trilocular, fleshy dissepiments. Seeds with watery pulp (*epidermis*), when dry adhering like an arillus.

GROSSULARIACEÆ.

Ribes rubrum. Red Currant.

Observe, palmi-lobed leaf. Inferior berry with persistent limb of calyx, unilocular, two parietal placentæ. Seeds with gelatinous testa forming the internal pulp, tegmen crustaceous. Embryo minute, homotropous, at base of horny albumen.

UMBELLIFERÆ.

Refer to Demonstration VI.

Heracleum Sphondylium. Common Cow-parsnep.

Observe, phyllodes of Bupleurum. Simple Umbels of Sanicula. Capitulum of Eryngium.

Sub-orders.

I. ORTHOSPERMEÆ, seeds plane in front (*Heracleum.*)

II. CAMPYLOSPERMEÆ, seeds furrowed in front by inflection of margins (*Chærophyllum sylvestre.*)

III. Cœlospermeæ, seeds curved in all round (*Coriandrum sativum.*)

Angelica sylvestris, primary ridges thickened (the lateral winged).

Daucus Carota, primary ridges setulose, secondary echinate.

Prangos, primary ridges winged.

Laserpitium, secondary ridges winged.

Araliaceæ.

Adoxa Moschatellina. Tuberous Moschatel.

Observe, leaves bi-ternate to ternate (*rather* ternatisect!) Corolla tetramerous in uppermost and pentamerous in four lateral flowers of the sub-cubical head. Stamens four or five accordingly, with bi-partite filaments, each branch with one cell of an anther (*apparently* octandrous and decandrous).

N.B. The next six Orders will belong to sub-class 3. Corolliflorae, if more respect is paid to the monopetalous condition of the Corolla than to its non-hypogynous insertion.

Valerianaceæ.

Centranthus ruber. Red Valerian.

Observe, dichotomous cymes. Involute and nearly obsolete limb of calyx gradually expanding into a plumose pappus. Spurred corolla. Stamens reduced to one. Capsular pericarp, with two indistinct barren cells, and one fertile. Seed inverse, exalbuminous.

Dipsaceæ.

Dipsacus sylvestris. Common Teazel.

Observe, large involucrate general receptacle of the head (*capitulum*). Flowers expanding centrifugally and centripetally from midway. Each flower furnished with a tubular involucel and paleaceous bracteole at base. Limb of calyx cuplike. Corolla quadrifid. Tetrandrous, stamens free. Utricle crowned by persistent calyx limb, and surrounded by involucel. Seed inverse, albuminous.

Compositæ.

Refer to Demonstration VII.

Senecio Jacobæa. Common Ragwort.

Observe, Sub-orders. I. Tubulifloræ (*Corymbiferæ and Cynerocephalæ. Juss.*) II. Labiatifloræ. III. Ligulifloræ. (*Cichoraceæ J.*)

Capitulum.	Ex. gr. Species.	Lin. Orders.
Homogamous.		
(H–H–H) . . .	Leontodon Taraxacum	Æqualis.
——— . . .	Carduus nutans.	
Heterogamous.		
(F–H–F) . . .	Bellis perennis	Superflua.
(N–H–N) . . .	Centaurea Cyanus . .	Frustranea.
Monœcious.		
(F–M–F) . . .	Calendula officinalis . .	Necessaria.
Dicœcious.		
(M) ÷ (F) . . .	Antennaria dioica . . .	(with Superflua.)
Heterocephalous.		
(M) + (F)		*
Aggregate.		
((H) (H)) . .	Echinops sphærocephalus	Segregata.

Pappus, stipitate and pilose in Leontodon; sessile and plumose in Carduus arvensis; absent in Bellis.
Receptacle, naked in Matricaria, chaffy in Anthemis.
Order, widely diffused and species eminently endemic.

Campanulaceæ.

Observe, any Campanula in æstivation, with lines of pubescence on the style (retractile Collectors). Capsule dehiscing by pores, some opening by valves.

Jasione, with syngenesious anthers, capsule dehiscing at the summit.

Ericaceæ.

Observe, Erica Tetralix (cross-leaved Heath), marcescent corolla, anthers dehiscing by pores near the summit and aristate below. Capsule loculicidally dehiscing, with dissepiments attached to 4 valves.

Calluna vulgaris (Ling), flowers drooping, 4 coloured bracts subtending the calyx. Capsule septicidal and septifragal, the four dissepiments adhering to the axis.

Oleaceæ.

Observe, Fraxinus excelsior (Ash), polygamous and diœcious states of the trees. Capsule compressed, winged above (*Samara*), indehiscent, unilocular, and one-seeded by abortion.

Ligustrum vulgare (Privet), bilocular berry.

Sub-Class 3. Corolliflorae (*Monopet: hypog:*)

Convolvulaceæ.

Observe, Convolvulus Sepium (Great Bindweed), the dextrorse twining stem, two large bracts enclosing the calyx.

Cuscuta, (*Dodder*), any species, dextrorse twining leafless parasitic stem, with papillose suckers, coronal scales in the tube of the corolla, acotyledonous (*gamocotyledonous?*) filiform embryo, spirally convolute with thickened radicle, early decaying after germination.

Solanaceæ.

Observe, Solanum Dulcamara, corolla with plicate æstivation, anthers dehiscing by pores at the apex, bilocular berry.

Datura Stramonium, capsule bilocular, each cell divided below by an imperfect spurious dissepiment, loculicidally and septicidally quadrivalvular.

Scrophulariaceæ.

Observe, Verbascum Thapsus, unequal segments of rotate corolla (approximation to Solanaceæ), pentandrous.

Rudiment of fifth stamen in Scrophularia.

Antirrhinum majus, personate corolla, stamens didynamous. Regularity restored in Peloria forms of Antirrhinum, Linaria, and Calceolaria.

Veronica Chamædrys, quadrifid rotate corolla, diandrous.

Boraginaceæ.

Observe, the harsh pubescence and scorpioidal inflorescence (circinate cymes) of most of the species. Achenes generally resembling those of Labiatæ, but seeds pendulous. In Lithospermum officinale nutlike stony pericarps.

Labiatæ.

Refer to Demonstration VIII.

Lamium album. White Dead-nettle.

Observe Salvia; two inferior stamens only, and one cell abortive to each anther; elongated connective; some species with rudiments of two superior stamens. Rudiments of a fifth uppermost stamen in some monsters.

Primulaceæ.

Refer to Demonstration IX.

Primula vulgaris. Common Primrose.

Observe, Embryo homotropous, in Hottonia and Samolus. Capsule a pyxis, in Anagallis. Ovary half inferior, and 5 coronal scales, in Samolus.

Forms intermediate between Primrose, Cowslip, Oxlip, and Polyanthus.

Plantaginaceæ.

Observe, Plantago lanceolata. Ribwort Plantain. Calyx four-parted, imbricate. Corolla scarious. Capsule a pyxis.

Sub-Class 4. Monochlamydeæ {*achlamyd:* and *monochlamyd:* (to *dichlamyd: diclin:*) *hypog: perig: epig:*}

CHENOPODIACEÆ.

Observe, any Atriplex: polygamous flowers, females with accrescent perianth enclosing *compressed* utricle with *vertical* seed; others with *depressed* utricle and seed none (in males) or *horizontal.* Embryo amphitropous outside farinaceous albumen.

EUPHORBIACEÆ.

Refer to Demonstration X.

Euphorbia Helioscopia. Sun Spurge.

Observe, Mercurialis perennis; diœcious, bicoccous capsule; *compare* seeds with those of Ricinus communis, on larger scale. Buxus sempervirens; leaves hollow.

Phyllanthus; aphyllous species with dilated flattened and leaf-like branches floriferous on the margin.

N.B. Cassava and Tapioca obtained from highly poisonous Manihot!

CALLITRICHACEÆ.

Callitriche verna. Vernal Water-starwort.

Observe, sessile flowers in axils of leaves usually monœcious, between two bracteoles; male one stamen, female one pistil with two styles and quadrilocular ovary.

URTICACEÆ.

Observe, Urtica dioica, sometimes monœcious; charac-

ter of the stings; inflexed stamens in æstivation, separate elastically. Orthotropous ovule and antitropous embryo.

Humulus Lupulus. Common Hop. Leaves harsh, with forked bristles. Stem, sinistrorse twining. Large bracts of the conelike female catkin. N.B. urceolate perianth early adnate to the ovary, subtended by scale-like bract (perianth *auct.*) with peculiar resiniferous glands.

Observe, Amentiferous inflorescence of three following orders.

SALICACEÆ.

Observe, any Salix. Willow. Achlamydeous flowers, each subtended by a bract, with a prominent gland on other side at the base. Comose arillus surrounding the seeds.

CUPULIFERÆ.

Observe, adnate evanescent perianth; cuplike involucre to the fruit (*glans*).

	Cells to ovary.	Ovules to Cell.
Corylus (*Hazel*).....	2	2 (not 1 !)
Fagus (*Beech*)	3	1
Quercus (*Oak*)	3	2
Castanea (*Chesnut*).....	±6	1

Seeds frequently only one by abortion.

N.B. The following Order has been regarded as one of a Class apart from Dicotyledones, under the name of Gymnogenæ.

CONIFERÆ.

Observe, Leaves evergreen or deciduous (Larch), fascicled or scattered, acerose.

Female flower, (open carpellary scale)		Infructescence (cone with naked seeds).
Taxus (*Yew*) ..... Uni-	-ovuliferous	one seed.
Pinus (*Fir*) ..... Bi-	-ovuliferous	many scales (*Strobilus.*)
Juniperus (*Juniper*) Tri-	-ovuliferous	few scales...(*Galbulus*).
Cupressus (*Cypress*) Multi-	-ovuliferous	few scales...(*Galbulus*).

Fleshy cupulate arillus to seed of Taxus, and its crustaceous testa.

Fleshy baccate trifid galbulus of Juniperus.

CLASS II. MONOCOTYLEDONES.

N. B. The two following Orders have been grouped with a few others by some Botanists, as worthy of being considered a Class apart from Monocotyledones, under the name of Dictyogenæ.

TRILLIACEÆ.

Paris quadrifolia. Common Herb-Paris.

Observe, deviations from the usual quaternary arrangement of leaves and floral whorls, approximating to ternary (simply or doubly). Leaves of perianth distinguishable into sepals and petals; ovary superior.

DIOSCOREACEÆ.

Tamus communis. Common Black Bryony.

Observe, sinistrorse twining stem, diœcious flowers, petaloid perianth and inferior ovary.

ORCHIDACEÆ.

Refer to Demonstration XI.

Orchis Morio. Green-winged Orchis.

Observe, difference in specific gravity of the old and new tubercle. Numerous tropical Epiphytes. Peculiarities in Pollen characteristic of the four tribes which include British species.

1. Pollinia separable into numerous small masses of cohering grains.
   Ex. gr. Orchis and Ophrys ..... OPHRYDEÆ.
2. Pollen granular, (grains very slightly cohering).
   Ex. gr. Listera, Neottia.....NEOTTIEÆ.
3. Pollinia in definite waxy masses.
   Ex. gr. Malaxis paludosa ..... MALAXIDEÆ.
4. Two lateral Anthers perfect, intermediate one barren and petaloid (*Staminodium*).
   Ex. gr. Cypripedium Calceolus...CYPRIPEDIEÆ.

IRIDACEÆ.

Observe, any Iris, equitant ensiform leaves; petaloid stigmata.

AMARYLLIDACEÆ.

Refer to Demonstration XII.

Narcissus Pseudo-narcissus. Common Daffodil.

Observe, No crown in Galanthus.

LILIACEÆ.

Contrast, the *inferior* perianths of this order (*Tulipa, Fritillaria, &c.*) with the *superior* perianths of Amaryllidaceæ and Iridaceæ; and *compare* the petaloid character and trimerous arrangement of the three orders.

ARACEÆ.

Refer to Demonstration XIII.

Arum maculatum. Spotted Arum.

Observe, Richardia æthiopica, rudimentary stamens (staminodia) about the ovaries below; and perfect stamens covering the spadix above.

Calla palustris, flowers hermaphrodite.

Acorus Calamus, flowers monochlamydeous.

Orontium aquaticum, no spathe, and seeds exalbuminous.

LEMNACEÆ.

Observe, Lemna minor. Lesser Duckweed. Calyptrate roots, proliferous cellular *frond*. Spadix obsolete, spathe membranous investing two stamens (male flowers), which expand in succession, and one pistil (female flower.)

GRAMINEÆ (*Grasses.*)

Refer to Demonstration XIV.

Bromus mollis. Soft Brome-grass.

Observe, among British grasses,

Alopecurus pratensis, dense spike-like panicle.

Nardus stricta, glumes 0, lodiculæ 0, style 1.

Lolium perenne, glume 1.

Anthoxanthum odoratum, stamens 2; spikelets with one fertile and two barren flowers (awned scales).

Stipa pinnata, lodiculæ 3, greatly lengthened feathery kneed and twisted awn of outer pale (in the fruit.)

Among Cerealia (larger seeded grasses).

Wheat (*Triticum vulgare*), numerous varieties,

α. æstivum. *β.* hybernum.

Parentage asserted to be an Ægilops.

Spelt (*Triticum Spelta.*)

Barley (*Hordeum vulgare*), spikelets by threes, one-flowered,

{two-rowed (*H. distichum*) 2 spikelets barren,
{six-rowed (*H. hexastichum*) 3 spikelets fertile.

Oat (*avena sativa*).

Rye (*Secale cereale*).

Rice (*Oryza sativa*), glumes minute, pales rigid, stamens 6.

Maize (*Zea Mays*). Monœcious, panicle sometimes androgynous.

Millet (various species of *Panicum*, *Sorghum*, *Eleusine*, &c.)

Sugar Cane (*Saccharum officinarum*).

Job's-tears (stony involucrum of *Coix Lachryma*).

Bamboo (*Bambusa arundinacea*) arborescent to 60 feet, exudes Tabasheer in the joints of stem.

Ergot, diseased seeds of various grasses.

Viviparous state of certain grasses.

CYPERACEÆ (*Sedges.*)

Observe, Carex riparia, or C. paludosa, triangular solid stem (*culm*), sheath of leaves without a ligule, monœcious spiked flowers,

male flower, 3 stamens subtended by a bract.

female flower with urceolate perianth subtended by a bract, 3 stigmas.

embryo within the albumen.

Papyrus prepared from Cyperus Papyrus.

CLASS III. ACOTYLEDONES.

GENERAL RECOGNITION OF THE ORDERS.

FILICES (*Ferns.*)

Tree-Ferns.

Circinate vernation of Fronds.

Sorus. Indusium. Theca (*Spore-case*). Annulus. Spores.

Pro-embryo state, with Antheridia and Pistillidia.

LYCOPODIACEÆ (*Club-mosses.*)

EQUISETACEÆ (*Horsetails.*)

Hygrometric elaters to the spores.

MARSILÆACEÆ (*Pepperworts.*)

MUSCI (*Mosses.*)

Cauline and perichætial leaves.

Antheridia and Pistillidia.

Seta. Apophysis. Theca (*spore-case*), of Sporangium and Sporangidium. Calyptra (*veil*). Operculum (*lid*).

Peristomium (*peristome*). Dentes (*teeth* 4, 8, 16, 32, 64, ∞). Epiphragma.

HEPATICÆ (*Liverworts.*)

Spores with or without Elaters.

LICHENES (*Lichens.*)

Thallus, Apothecium (*shield*), Spores in Asci (*thecæ*), Gonidia.

ALGÆ.

FUNGI.

Mycelium (*spawn.*)

III. PHYSIOLOGICAL BOTANY.

Mineral Kingdom (*Inorganic.*) } Elements about 59. { Vegetable Kingdom (*Organic.*)

(All) (chiefly C, O, H, ± N)

Elective affinity | Crystallization | Simple minerals } from Invisible to Visible state. { Assimilation | Cell formation | Plants.

Reproductive condition of Parent Cell. Primordial Utricle.

Protoplasm among Cell-sap.

Appearance of Nucleus (*cytoblast*) ± Nucleoli.

Merismatic Cell formation, by septa from Primordial Utricle.

Free Cell formation, around aggregations of Protoplasm.

External deposition of Cellulose, as primary and secondary membrane, with organic and inorganic deposits.

Ex. gr. Siliceous skeleton of burnt cellular tissues, in glume of Oat, pubescence of Deutzia scabra, epidermis of Equisetum hyemale, lorica of Diatomaceæ.

Disappearance of Nuclei in many cells.

Vitality manifested in independent cells among simplest Plants, and in complex organs of mutually dependent cells in those more highly organized.

Stimuli affecting vital energy. Light, Heat, Moisture.

Movements depending on vitality. Sleep, Irritability.

Ex. gr. Leaves of Mimosa pudica (*Sensitive Plant*), Oxalis sensitiva, Desmodium gyrans, Dionæa muscipula, Drosera, (N.B. other fly-catching plants, Apocynum androsæmifolium, Lychnis viscosa, &c.); Stamens of Berberis, Helianthemum; Style of Stylidium.

N.B. Exclude amount of movement depending on mechanical conditions. Ex. gr. In Dehiscence of Anthers and Pericarps; turgescence and flaccidity from Endosmose and Exosmose in fruit of squirting Cucumber, and Balsams; elasticity in Stamens of Nettle and Kalmia; hygroscopicity of tissue in Mosses, Lycopodium lepidophyllum, Anastatica (*Rose of Jericho*), capsules of Mesembryanthemum, &c.

Movements of Protoplasm, ceasing in young or continued in some old cells ($\frac{1}{500}$ line per second).

Ex. gr. as observed in Caulinia; Vallisneria; and Chara (parallel to spiral rows of chlorophyll), &c.

NUTRITION OF PLANTS.

1. Absorption, into cells; at spongioles of Roots, of fluids only. Aided by Endosmose. Modified by other physical causes.

2. Diffusion, by cells (rarely by vessels). Circulation. In exogenous stems fluids *ascend* along outer

layers of central system, and *descend* along inner of the cortical.

Ex. gr. Effects of ligatures and ringing, on parts above and below the wound.

Propulsion below and *attraction* above.

Force of ascent in Vine equal 26 to 38 inches of mercury, aided by Endosmose. Bleeding of cut branches.

3. Exhalation (evaporation only?) of water at stomates in *light*, equal two thirds the absorption by spongioles.

Ex. gr. Sunflower exhales 30 oz. per diem. Drops on leaves of grasses, &c. about sunrise. Plants become dropsical in the dark.

4. Respiration, contrasted with that of animals.

Green parts in *light* absorb Carbonic acid and exhale Oxygen; in *darkness* vice versâ.

Coloured parts (not Green) constantly exhale Carbonic acid.

Assimilation of organic (organizable) compounds chiefly effected from Carbonic Acid (CO_2), Water (OH), and Ammonia (H_3N). Whether is CO_2 or OH decomposed to set O free?

5. Nutrition.

Fresh tissue only added by the vital activity of that last formed.

Conversion of starch to dextrine and sugar, in malting (by action of diastase)—in germination—in bud development, &c.

N.B. Compare nutritive properties of Potato with Flesh (Muscle), omitting inorganic compounds (,78 per cent.).

	Potato.	C	O	H	N
100,	74. water	*	65,7	8,2	*
	26. 2. protein compounds . .	1,0	0,4	0,1	0,3
	26. 16. starch . . .	10,6	11,6	1,4	*
	26. 8. cellulose . .				
	Flesh.				
100,	74. water	*	65,7	8,2	*
	26. fibrine	13,9	5,7	1,7	4,0

Blemish introduced by pruning Timber. Tree in Tree.

Grafting of allied species of Dicotyledons; rarely succeeds in Monocotyledons. Independent growth of stock and graft

Production of organs deficient in detached stem, root, or leaf. Occasional increase of detached roots.

Organic compounds are essential to the nourishment of some plants, useful to many.

Nutrition of flowering Parasites (on Stems and Roots). (1) Assimilation imperfect when no green parts present. (2) Absorption imperfect.

Ex. gr. Viscum, Myzodendron, &c. (on stems); Thesium, Rhinanthus, Melampyrum, Euphrasia, &c. (on roots) have green leaves.

Ex. gr. Orobanche, Lathræa, Monotropa, Cynomorium, (*fungus melitensis*), &c. (on roots); Cuscuta, Rafflesia, &c. (on stems) have no green leaves.

Parasitic fungi imply(?) and promote disease.

Ex. gr. Uredo caries (Bunt); U. segetum (Smut); U. rubigo (Rust) precursor to Puccinia graminis (Mildew); among Wheat, &c. Ergotetia the cause of Ergot?

Botrytis infestans the *proximate* cause of "Potato Disease."

N.B. Morbid conditions produced by attacks of Insects, &c.

Ex. gr. Numerous Galls by Cynips, &c.; Ear-cockle in Wheat by Vibrio Tritici.

Secretions, their relation to assimilated compounds.

Exhaustion of soils, and rotation of Crops.

Evolution of heat, by formation of carbonic acid, and organic compounds.

Ex. gr. By germinating seeds (raised 54^0); during fertilization of Aroideæ—in Arum maculatum (raised 27^0), in Colocasia odora (raised 50^0).

REPRODUCTION OF PLANTS.

By successive Fission of cells (into 2 or 4) indefinite, or restricted.

By production of buds (*gemmæ*) from cells, (*Musci*, &c.)

By production of buds by complex organs—some separating spontaneously.

Ex. gr. on Stems (*Lilium tigrinum*, *Dentaria bulbifera*). On Leaves (*Bryophyllum*; *Malaxis*).

Abnormal, from roots, stems, leaves, &c.

Reproduction by spores, without or by "conjugation."

Movements of Spores (*zoospores*) by ciliæ.

Reproduction by Spores in Cryptogamia with Antheridia and Pistillidia.

Reproduction by Seeds in Phanerogamia with Anthers and Pistils.

Formation and developement of the Embryo in Phanerogamia.

1. Flowering, its periodic return.

formation of pollen grains; outer and inner membranes; fovilla (*granules*).

grains exploded by moisture.

vitality of some pollen preservable for a twelvemonth.

formation of ovules; nucleus (with embryo sac) secundine, primine.

2. Fertilization.

dispersion of pollen; frequent instrumentality of Insects.

Ex. gr. economy in Orchis, Asclepias, Valisneria, Phœnix, Ficus.

growth of Pollen tubes induced and maintained by stigmatic secretion.

their extension down conducting tissue (in Cereus grandiflorus to many thousand times their diameter!)

death of stigma—collapse of grains—growth of tubes for a few hours, or for many days, to reach the ovules.

formation of "germinal vesicles" (usually 3).

pollen tube penetrates micropyle and reaches embryo sac.

developement of one (rarely more) germinal vesicle into pro-embryo, and this into "suspensor" and "embryo."

Anomalous case of Cœlebogyne.

Limitation of hybridization to allied species.

Case of a Hybrid "Cytisus purpureo-laburnum," producing buds of the two parents!

3. Maturation.

developement of embryo with modifications of its integuments into ripe seed.

Dissemination of seeds; preservation of their vitality.

Germination of seeds. *Unproved* in Mummy Wheat of Egypt; or in Tomb Maize of Peru.

BOTANICAL GEOGRAPHY.

Influence of Climate, regulated by Isothermal, Isotheral and Isochimenal lines.

Relative influences of Temperature, Humidity, Light, Altitude, Exposure, Soils, &c., in determining "stations" for Endemic species.

Effects of Spring frosts, and of cold by radiation.

Causes influencing dispersion of Sporadic species.

Preoccupation of surface by rapidly growing, and subsequent ejection by more robust and slow growing species.

APPENDIX.

DEMONSTRATIONS OF FOURTEEN COMMON PLANTS.

DICOTYLEDONES.

1. *Thalamiflorœ.*

1. Ranunculus repens. Creeping Crowfoot.
2. Cheiranthus Cheiri. Common Wall-Flower.
3. Viola tricolor. Pansy Violet.

2. *Calyciflorœ.*

4. Pisum sativum. Garden Pea.
5. Rosa canina. Common-dog Rose.
6. Heracleum Sphondylium. Common Cow-parsnep.
7. Senecio Jacobæa. Common Ragwort.

3. *Corolliflorœ.*

8. Lamium album. White Dead-nettle.
9. Primula vulgaris. Common Primrose.

4. *Monochlamydeœ.*

10. Euphorbia helioscopia. Sun Spurge.

MONOCOTYLEDONES.

11. Orchis Morio. Green-winged Orchis.
12. Narcissus Pseudo-narcissus. Common Daffodil.
13. Arum maculatum. Spotted Arum.
14. Bromus mollis. Soft Brome-grass.

FORMULA

I. PLANT: caulescence, foliation, flowering.

II. ROOT: tap, fibres.
Appendages. Tubercles, exostoses.

III. STEM and BRANCHES: aërial; epigean, hypogean.
Appendages. Armature, supports, pubescence.

IV. LEAF, LEAFLETS, STIPULES:
Petiole, limb, veins, vernation.
Appendages. Armature, supports, pubescence.

V. INFLORESCENCE: peduncle, pedicels, bracts, bracteoles, general receptacle, flowers.
Appendages. Armature, supports, pubescence.

VI. FLOWER: floral-receptacle, whorls, æstivation, perianth, (calyx, corolla), stamens (filament, anther, pollen), pistil (ovary, ovules, style, stigma).
Appendages. Nectaries, awns, pubescence.

VII. Infructescence. (See Inflorescence with fruit for flowers.)

VIII. FRUIT: Pericarp (carpels), cells, dissepiments, valves, placenta.
Appendages. Exuvies, armature, pubescence.

IX. SEED: testa, hile, raphe, chalaze.
Albumen—Embryo (cotyledon, radicle).
Appendages. Arillus, arillode, carunculus. Pubescence.

FOR DEMONSTRATIONS.

A. NUMBER. Cohesion, Abortion.

B. MAGNITUDE. Proportion, Extension, Abundance, Visibility.

C. INSERTION. Position, Attachment, Adhesion.

D. ARRANGEMENT. Symmetry, Regularity, Construction, Sexuality.

E. DIRECTION. Inversion.

F. SUBSTANCE. Structure, Strength, Solidity, Succulency, Vascularity.

G. FORM. Solid, Tubular, Plane.

H. DIVISION. Ramification, Composition, Incision, Separation, Perforation, Dehiscence.

I. SURFACE. Striation, Venation.

J. COLOR and SCENT.

K. DURATION. Periodic relations.

CLASS I. DICOTYLEDONES.

Sub-class 1. Thalamifloræ (*polypet. hypog.*)

DEMONSTRATION I.

RANUNCULACEÆ.—Ranunculus repens. Creeping Crowfoot.

I. PLANT. Herbaceous, caulescent, leafy, with dichlamydeous, bright yellow, polyandrous flowers.

II. ROOT. G, fibrous.

III. STEM. E, erect or ascending. F, fistular. G, cylindric. H, branched. I, hairy, furrowed.

branches. A, numerous. E, upper erect, lower prostrate creeping (runners).

N.B. Some specimens entirely prostrate.

IV. LEAF. C, radical and cauline; lower petiolate, upper sessile, semi-amplexicaul. D, alternate. E, spreading. G, limb broadly cordate, petiole dilated. H, radical ternati-sect (*not* strictly compound !), cauline tripartite to trifid. I, glabrous to pubescent. J, dark green, lowest often with a black spot.

segments (not *leaflets !*). C, stalked. G, lower wedge-shaped, upper lanceolate, more or less deeply three-lobed and inciso-dentate.

V. INFLORESCENCE. C, terminal and lateral one-flowered furrowed peduncles.

VI. FLOWER.

Torus. B, large. I, hairy.

Calyx. A, pentasepalous. C, inferior.

sepals. F, spreading (patent). G, ovate-oval, concave. H, entire. I, pubescent outside. J, somewhat coloured. K, deciduous.

Corolla. A, pentapetalous.

petals. B, twice size of sepals. C, hypogynous, shortly clawed. D, alternate with sepals, æstivation imbricate. E, patent. G, ob-cordate, obtuse. I, shining. J, golden yellow with paler claw. K, deciduous.

*nectariferous pore covered by a notched scale, at the base and inside of each petal.

Stamens. A, numerous (polyandrous flower). B, half length of the petals. C, hypogynous. E, ascending.

filament. G, filiform-subulate, compressed.

anther. C, terminal, adnate. E, erect. G, linear-oblong. H, dehiscence lateral (not really extrorse!).

pollen. G, globular.

Pistils (carpels). A, numerous (polygynous flower). B, small. C, sessile. D, imbricate.

ovary. G, ovoid, compressed. H, unilocular. I, glabrous.

style. A, one. B, very short. E, reflexed. K, persistent.

Stigma. A, one. B, minute. H, simple.

ovule. A, one. C, basilar, sessile. E, erect, anatropous. G, ob-ovate.

VII. INFRUCTESCENCE, as Inflorescence, with peduncles elongated.

VIII. FRUIT. A, numerous aggregated Achenes (*Etærio*). G, globular.

Pericarp (achene). C, sessile. G, obliquely ovoid, compressed, with slightly hooked beak. H, indehiscent. I, smooth, minutely pitted. J, light brown.

IX. SEED. A, one. B, fills the cell. C, basilar. E, erect.

testa. F, membranous.

albumen. B, copious. F, horny. G, ob-ovoid.

embryo. B, very minute. C, at base of albumen, homotropous. H, dicotyledonous.

DEMONSTRATION II.

CRUCIFERÆ. Cheiranthus Cheiri. Common Wall-flower.

I. PLANT. Suffrutescent, leafy, with racemose tetramerous flowers.

II. ROOT. F, woody. H, branched.

III. STEM. E, erect. F, somewhat woody. G, te-

rete, sub-angular. H, branched. I, sub-pubescent.

branches. A, numerous. D, alternate. E, ascending.

IV. LEAF. C, cauline, sub-petiolate or sessile. D, alternate. E, patent. G, lanceolate, acute. H, simple, entire, lowermost slightly divided. I, hoary beneath.

Stipules. A, none.

*Pubescence, of hairs. E, appressed. H, bi-partite.

V. INFLORESCENCE. C, terminal. E, erect. G, raceme, at first corymbose.

pedicels. B, shorter than flowers. G, filiform.

bracts. A, none.

VI. FLOWER. A, numerous. B, conspicuous. D, scattered, regular, hermaphrodite. E, patent.

calyx. A, tetrasepalous. C, inferior.

sepals. D, cross-wise. E, erect. G, linear-lanceolate, the anterior and posterior saccate at the base. H, entire. I, smooth. J, green, tinged with purple. K, deciduous.

corolla. A, tetrapetalous. B, twice length of calyx. C, hypogynous.

petals. D, alternate with sepals, cross-wise. E, claw erect, limb patent. G, ob-ovate rounded, slightly apiculate or not, with sub-

linear claw. H, entire. I, smooth. J, yellow, to deep red-brown. K, deciduous.

stamens. A, six (hexandrous flower). B, tetradynamous. C, hypogynous. D, two shortest opposite anterior and posterior sepals; four longest in pairs opposite lateral sepals. E, erect.

filaments. B, shorter than claw of petals. G, filiform.

anther. C, terminal. D, introrse. E, erect. G, cordate-lanceolate. H, dehiscence longitudinal.

pollen. G, spherical.

Pistil. A, one (by cohesion of 2 carpels). B, length of calyx. C, superior. E, erect.

ovary. G, sub-linear, compressed. H, spuriously bi-locular.

style. A, one. B, very short. C, terminal, continuous. H, simple.

stigma. A, one (by 2 combining). C, terminal. H, two-lobed.

lobes. D, opposite placentæ. E, patent.

ovules. A, numerous. C, parietal. D, two rows in each cell, but ranging in one down the middle. E, horizontal, campylotropous.

**Appendages.* Green hypogynous glands at the base of the shorter stamens.

VII. Infructescence. G, more elongated raceme than the Inflorescence.

VIII. Fruit. A Pod. (*Siliqua*).

Pericarp. B, elongated. C, pedicellate. E, erect. G, linear compressed sub-tetragonal. H, spuriously bilocular, bivalve, valves separating from the placentas.

Placentas. A, two in each cell. C, marginal. K, remain united by the spurious dissepiment and form a "*replum.*"

IX. Seed. A, numerous. C, parietal, with short funiculus. D, one-rowed. E, pendulous. G, ovate compressed.

testa. F, membranous. J, brown.

albumen. A, none.

embryo. E, amphitropous, dicotyledonous.

cotyledons. B, large. D, accumbent. G, plano-convex.

radicle. E, ascending, slightly curved; towards hile.

plumule. B, inconspicuous.

DEMONSTRATION III.

Violaceæ. Viola tricolor. Pansy Violet.

I. Plant. Herbaceous, caulescent, leafy, with irregular resupinate flowers.

II. Root. H, branched.

III. Stem. B, span. E, decumbent or ascending, somewhat zigzag. G, angular. H, scarcely branched except below. I, downy along one side chiefly.

IV. LEAF. C, cauline, petiolate. D, alternate. E, erect. G, ovate-oblong to -lanceolate. H, simple, broadly serrato-crenate. I, smooth, or slightly downy.

STIPULES. A, in pairs. B, large. C, lateral, semi-amplexicaul. G, ovate. H, lyrate-pinnatifid, the segments linear or tongue-shaped.

V. INFLORESCENCE.

peduncle. A, solitary. B, longer than leaves. C, axillary. E, erect. G, semicylindric, channelled. H, simple.

bracts. A, two. B, minute. C, towards summit of peduncle. D, nearly opposite. G, subulate. H, simple.

VI. FLOWER. A, solitary. D, irregular, hermaphrodite. E, resupinate. H, pentamerous.

Calyx. A, pentasepalous.

sepals. C, inferior, inserted above their base, sometimes a little cohering. D, imbricate. E, erecto-patent. F, herbaceous. G, lanceolate acute, the base prolonged, dilated. H, simple. I, smooth or downy. J, dark green. K, persistent.

Corolla. A, pentapetalous. B, longer or shorter than calyx.

petals. B, unequal. C, hypogynous, clawed. D, alternate. E, spreading. G, two inferior rounded; two lateral oblong; superior (*apparently inferior*) broadly obovate-cuneate.

**spur* to superior petal. F, ascending. G, cylindrical, tubular.

Stamens. A, five (pentandrous fl.) B, equal, short. C, hypogynous. D, alternate. E, erect.

filament. B, very short.

connective. B, broad, extended beyond anthers. J, orange at the apex.

anthers. A, at first cohering (syngenesious). C, adnate. E, introrse. H, bilocular.

**spurs* to two inferior entering the spur of petal. E, reclinate. G, ligulate to subclavate. J, green.

Pistil. A, one (by cohesion of three carpels; monogynous fl.) C, superior. E, erect.

ovary. G, ovoid. H, unilocular. I, smooth. J, green.

style. A, one. C, sublateral. E, oblique. G, clavate. H, simple. K, persistent.

stigma. A, one. B, large. C, capitate. H, obliquely perforated.

placentas. A, three. C, parietal.

ovules. A, numerous. E, horizontal, anatropous.

VII. INFRUCTESCENCE. same as Inflorescence.

VIII. FRUIT. A Capsule.

Pericarp. C, sessile. F, brittle. G, ovoid subtrigonal. H, unilocular; dehiscence loculicidal, trivalve.

valves. E, at length horizontal. G, boat-shaped.

placentas. A, three. C, on the valves.

funiculus. B, very short, (obsolete).

**Exuvies* of persistent Calyx.

IX. SEED. A, numerous. C, parietal along the middle of the valves. E, horizontal. G, obovoid.

testa. F, brittle (crustaceous).

*with a slight carunculus along the course of the raphe.

albumen. B, copious. F, fleshy.

embryo. B, length of albumen. C, axile. E, straight, homotropous. H, dicotyledonous.

radicle. E, to hile.

Sub-class 2. Calycifloræ (*polypet. and monopet. perig. and epig.*)

DEMONSTRATION IV.

LEGUMINOSÆ. Pisum sativum. Garden Pea.

I. PLANT. Herbaceous, annual, with large stipules, pinnate leaves terminating in tendrils; few-flowered racemes, with rather large papilionaceous corolla.

II. ROOT. B, slender. H, branched fibres.

**Appendages.* Exostoses.

III. STEM. F, weak, hollow, climbs by tendrils. H, branched. I, smooth.

IV. LEAF. C, cauline, petiolate. D, alternate. H, impari-pinnate, but some of the terminal leaflets metamorphosed into tendrils. I, glabrous. J, glaucous.

leaflets. A, two or three pair. D, mostly opposite. G, ovate, somewhat mucronate. H, entire, sub-repand.

**Tendrils.* C, from last pair or two of leaflets and extremity of petiole. G, filiform.

STIPULES. A, two. B, large. C, lateral. F, foliaceous. G, ovate, sub-cordate. H, crenate towards the base. K, persistent.

V. INFLORESCENCE. C, axillary. D, alternate. E, patent. G, raceme.

peduncles. A, solitary. B, long.

pedicels. A, about two or three.

bracts. none.

VI. FLOWER. B, conspicuous. D, irregular, hermaphrodite. G, papilionaceous.

calyx. A, monosepalous (of 5 cohering sepals). B, 2 upper segments shortest. C, inferior. D, irregular; æstivation imbricate, odd sepal anterior. G, sub-campanulate. H, quinquefid, sub-bilabiate. K, persistent.

corolla. A, pentapetalous. C, clawed, slightly perigynous.

standard (*vexillum*). B, large. C, superior (posterior) exterior. E, reflex. G, broadly ob-cordate.

wings (*alæ*). A, two. B, shorter than standard. C, lateral. E, converging. G, roundish.

keel (*carina*). A, of two petals, cohering by outer edges. B, longer than wings. C, inferior (anterior), interior. G, lunate, compressed.

Stamens. A, ten (decandrous fl.) diadelphous, 1 free and 9 cohering. B, within the keel. C, perigynous. E, the free one superior.

filaments. G, subulate where free.

anthers. H, bilocular, dehiscing longitudinally.

Pistil. A, one (monogynous fl.). C, superior.

ovary. G, oblong, compressed.

style. A, one. C, terminal. E, ascending. G, compressed, subfalcate, carinated. H, simple. I, villose above.

stigma. A, one. C, terminal. G, oblong. H, simple.

placenta. A, one. C, along ventral suture.

ovules. A, few. C, by short funiculus. D, in one row, but attached alternately to the opposite valves. E, horizontal; hemi-anatropous.

VII. INFRUCTESCENCE. In few-fruited racemes.

VIII. FRUIT. A Legume. A, mostly in pairs. D, unilateral. E, inclined.

pericarp. B, two inches. F, coriaceous.

G, oblong, swollen at ventral suture. H, unilocular; dehiscing along ventral and dorsal sutures, bi-valve. I, smooth.

funiculus. B, short. G, dilated (*sub-arillate*) above.

**Exuvies*, of marcescent calyx.

IX. SEED. A, about 5 to 9. C, along ventral suture. D, alternate on the valves. E, horizontal. G, globose. I, smooth.

testa. F, coriaceous. I, *hile* oblong.

albumen. A, none.

embryo. B, large. E, curved-homotropous. G, globose. H, dicotyledonous.

cotyledons. A, two. F, firm. G, plano-convex.

radicle. E, to hile. G, conical.

DEMONSTRATION V.

ROSACEÆ. Rosa canina. Common-dog Rose.

I. PLANT. Prickly sarmentose shrub, with shining impari-pinnate leaves, large showy flowers and indefinite perigynous stamens.

II. ROOT. Chiefly fibres from subterranean portions of woody suckers.

III. STEM. A, several (from suckers). B, six to eight feet. E, straggling among bushes, or trailing. F, stout, with large pith. G, terete. H, branched. I, smooth.

*armature, of Prickles. B, uniform. D, scattered. E, hooked, deflexed. F, corky inside; stout. G, dilated at the base, sharp pointed. H, simple.

IV. LEAVES. C, petiolate. D, alternate. H, impari-pinnate. K, deciduous.

leaflets. A, about seven. C, sessile. D, opposite. E, perpendicular. F, stiff. G, elliptical to sub-ovate, acute. H, serrate, or bi-serrate. I, smooth or sub-pubescent.

STIPULES. A, two. B, smaller than leaflets. C, adnate below to petiole. D, lateral. F, foliaceous. G, lanceolate, acute.

**armature,* small prickles on the petioles, and on ribs of the leaves.

V. INFLORESCENCE. C, definite. G, sub-corymbose.

pedicles. A, one to four, or more. I, smooth, or with a few gland-tipped bristles.

bracts. D, at base of pedicels (metamorphosed stipules). G, lanceolate.

VI. FLOWER. C, pedicellate. D, regular, hermaphrodite. H, pentamerous.

torus. C, spread over inside of the tube of calyx. F, fleshy. G, the *disk*, an annulus round the orifice of the tube. I, hairy inside the tube.

calyx. A, monosepalous (5 cohering sepals).

C, inferior. D, imbricate æstivation, odd sepal posterior. E, limb spreading. G, tube urceolate, contracted at the throat, segments ovate lanceolate, pointed, concave. H, limb quinque-partite, segments pinnati-sect. I, smooth. K, tube persistent, limb deciduous.

corolla. A, pentapetalous. C, on throat of the calyx, perigynous.

petals. B, equal. D, alternate with segments of the calyx. E, spreading and slightly incurved. F, delicately membranous. G, ob-cordate, broadly unguiculate. H, entire. K, deciduous.

stamens. A, indefinite (icosandrous fl.). B, shorter than petals. C, perigynous. E, incurved in æstivation.

filament. G, capillary.

anther. C, terminal, attached by base. D, introrse. G, rounded-oval. H, bilocular, dehiscing longitudinally.

Pistils (*carpels*). A, numerous, C, on lower part of the torus (within the tube); slightly stipitate. D, scattered. E, erect.

ovary. G, ovate-oblong. H, unilocular. I, smooth.

style. A, one (to each pistil). B, slightly exserted. C, lateral. E, straight. G, filiform. H, simple. I, hairy above. K, marcescent.

stigma. A, one. B, thickened. H, entire.

ovule. A, one. C, apical. E, pendulous; anatropous. G, ob-ovoid.

VII. INFRUCTESCENCE, solitary or corymbose, like the Inflorescence, but ebracteate.

VIII. FRUIT. A Hip, with numerous Achenes.

torus. E, succulent. J, red-orange.

pericarp. C, sub-stipitate. D, scattered within and towards base of calyx tube. E, erect. F, bony, with stipes fleshy, like the torus. G, ovate. H, unilocular; indehiscent. I, comose on side opposite the style (back).

**appendages.* Baccate tube of calyx adhering to the torus. Marcescent stamens, and sub-clavate mass of sub-cohering styles.

IX. SEED. A, one. C, apical. D, pendulous (inverse). G, ob-ovoid.

testa. F, membranous.

raphe and chalaze. G, conspicuous.

albumen. A, none.

embryo. D, straight, homotropal. H, dicotyledonous.

cotyledons. B, large. F, fleshy. G, plano-convex.

radicle. B, small. C, superior. E, towards the hilum.

DEMONSTRATION VI.

UMBELLIFERÆ. Heracleum Sphondylium. Common Cow-parsnep.

I. PLANT, herbaceous, perennial, caulescent, leafy; with small pentamerous flowers in compound umbels.

II. ROOT. F, somewhat fleshy. G, tap.

III. STEM. E, erect. F, fistular, with solid nodes. G, terete. H, branched. I, furrowed, rough with spreading hair.

IV. LEAF. C, radical and cauline, petiolate, broadly sheathing. D, alternate. G, cordate. H, considered as impari-pinnate (but only spuriously compound!) to ternate.

leaflets. A, two pair. C, sub-petiolate. D, opposite. G, broadly cordate. H, variously pinnatifid cut and serrate. I, downy beneath, veiny. J, paler beneath.

petiole. B, large in the lower leaves, ribbed; in the upper sheathing, the limb becoming much diminished.

V. INFLORESCENCE. C, terminal to stem and axillary branches. G, compound Umbel. H, many rayed.

pedicels (in the Umbellules). G, angular. I, downy on one side.

bracts (in general involucre). A, few or none.

F, membranous. G, lanceolate, acute. I, ciliate at edges. K, early deciduous.

bracteoles (in partial involucres). A, several. G, lanceolate acute.

VI. Flower. A, numerous. D, hermaphrodite.

calyx. A, monosepalous (by cohesion of 5 sepals). C, inferior. H, limb minutely five-toothed.

corolla. A, pentapetalous.

petals. B, unequal, the outer largest, radiant. C, surrounding an epigynous disk. G, obcordate, with inflexed apex. I, white to reddish. K, deciduous.

stamens. A, five (pentandrous fl.). C, epigynous. D, alternate with the petals.

filament. B, short. G, filiform.

anther. D, introrse. G, ovate, sub-didymous. H, bilocular, dehiscing longitudinally.

Pistil. A, one (of 2 cohering carpels), often abortive in the middle flowers of the umbel.

ovary. C, inferior. H, bilocular.

styles. A, two (digynous fl.). C, terminal.

stigma. C, terminal.

ovules. A, one in each cell. C, apical. E, pendulous; anatropous.

**appendage*, Epigynous Disk (*stylopodium*).

VII. Infructescence. Ebracteate compound Umbel, reduced from the state of the Inflo-

rescence by abortion of some of the middle flowers.

VIII. Fruit, a Cremocarp.

floral axis (*Column*). B, length of the cremocarp. C, between the carpels. F, slender. G, filiform. H, bi-partite.

pericarp. A, of two cohering carpels (*mericarps*). C, suspended at summit of column. G, round, depressed, discoid, margins dilated (winged). H, emarginate, dehiscence septicidal (along *Commissure*), but the carpels indehiscent.

ridges. A, primary 10, secondary none. C, 3 dorsal approximate, 2 lateral distant and close to margin. G, very slender.

vittæ. A, solitary in the interstices, twin on the commissure. B, shorter than the carpels. G. sub-clavate. J, dark brown.

appendages, divergent persistent styles.

IX. Seed. A, one in each carpel. C, apical. E. pendulous.

testa. C, appressed to pericarp.

albumen. B, copious. E, straight. F, sub-corneous. G, sub-plano-convex.

embryo. B, small. C, in the base (uppermost part) of albumen. E, straight; homotropous. H, dicotyledonous.

cotyledons. B, somewhat unequal. G, oblong.

radicle. C, superior. E, towards hile.

DEMONSTRATION VII.

COMPOSITÆ. Senecio Jacobæa. Common Ragwort.

I. PLANT. Herbaceous, perennial, branched, with furrowed stems, doubly pinnatifid leaves, and heads of yellow florets.

II. ROOT. Fibres from a somewhat fleshy rhizome.

III. STEM.

subterranean rhizome. C, at base of aerial portion. G, somewhat fleshy, præmorse.

aerial. A, one. E, erect. G, terete. H, branched. I, smooth furrowed.

IV. LEAF. C, cauline, lower petiolate, upper semi-amplexicaul. D, alternate. G, ob-ovate-oblong, sub-lyrate, segments oblong. H, pinnatifid, the segments pinnatifid and variously notched and toothed. I, smooth (glabrous).

stipules. A, none.

V. INFLORESCENCE. A, Head (*Capitulum*). C, terminal. D, corymbose. G, heterogamous (sometimes homogamous.)

peduncles. B, longer than heads. E, erect. I, cottony.

involucrum. G, sub-hemispherical.

bracts (*phyllaries*). D, two-rowed.

innermost. A, numerous. B, equal. D, contiguous. E, parallel. G, linear. J, tipped with black.

outermost. A, fewer. B, minute. D, lax.

general receptacle. G, flat, or somewhat convex. I, naked.

VI. FLOWER (*floret*). A, numerous. D, capitate. G, ligulate in the ray, tubular in the disk.

calyx. C, superior, *tube* adnate. G, *limb* pappose.

pappus. B, length of tube of corolla. C, sessile. D, many rowed. H, pilose. I, scarcely toothed. K, persistent.

corolla. A, monopetalous (by cohesion of 5 sepals). C, epigynous. J, golden-yellow.

—(*disk florets*). G, tubular, funnel-shaped (infundibuliform). H, 5-toothed.

—(*ray florets*). E, spreading, at length recurved. G, ligulate, linear-oblong. H, 3-toothed.

N. B. Ray florets sometimes wanting.

stamens (in *disk florets*). A, five (pentandrous fl.). B, exserted. C, on tube of corolla. D, alternate with teeth of corolla. E, erect.

—— (in *ray florets*). A, none.

filaments. B, short. G, filiform-clavate.

anthers. A, cohering (syngenesious). C, terminal. G, linear. H, bilocular; dehiscing longitudinally.

pollen. G, spherical. I, echinulate.

Pistil. A, one.

ovary. C, inferior. G, ob-ovately sub-cylindric. I, rough.

style. A, one (monogynous fl.). B, slightly exserted. C, articulate to summit of ovary. E, erect. G, filiform. H, bifid at summit. I, collectors at the apices of the branches.

stigmas. A, two. C, along upper (inner) surface of the branches of the style.

placenta. C, basilary.

ovule. A, one. E, erect; anatropous.

VII. INFRUCTESCENCE, corymbose Heads, as in Inflorescence.

VIII. FRUIT. An inferior Achene.

Pericarp. C, articulate to the general receptacle. E, chartaceous, brittle. G, ob-ovately sub-cylindrical. H, unilocular; indehiscent. I, in the disk hairy or silky, in the ray smooth.

funiculus. B, very short.

**Appendage,* the pappus enlarged. D, many-rowed. G, pilose. K, of *ray* deciduous.

IX. SEED. A, one. C, basilary; sessile. E, erect. G, cylindric ob-conical.

albumen. A, none.

embryo. E, straight, homotropous. H, dicotyledonous.

cotyledons. G, flat.

radicle. B, short. E, to the hile.

plumule. B, inconspicuous.

Sub-class 3. Corolliflorae (*monopet. hypog.*)

DEMONSTRATION VIII.

LABIATÆ. Lamium album. White Dead-nettle.

I. PLANT. Herbaceous, perennial, with quadrangular stems, opposite exstipulate leaves, bilabiate flowers disposed in axillary dichotomous cymes.

II. Root. C, fibrous, from the nodes of subterranean rhizomes.

III. Stem. A, several. C, subterranean (rhizomes) and aërial. E, rhizomes creeping; aërial erect, or ascending. F, fistular, solid at the nodes. G, quadrangular. H, simple (the branches being accounted as stems!). I, slighty pubescent.

IV. Leaf. C, radical and cauline; lowest petiolate, uppermost nearly sessile. D, opposite and decussate. E, horizontal. G, rounded-cordate, acuminate. H, simple, strongly but unequally serrate. I, rugose, subhirsute; venation pinnate, reticulate.

Stipules. A, none.

V. Inflorescence. C, axillary. D, forming Verticillasters. G, Cyme. H, dichotomous.

peduncle and pedicels. B, very short.

bracts. A, one to each flower. B, very minute (bracteole). C, close to calyx. G, linear-subulate.

VI. Flower. A, about ten to a cyme. D, crowded, hermaphrodite. G, irregular.

calyx. A, monosepalous (by cohesion of five sepals). C, inferior. D, somewhat irregular. G, tubular, campanulate, dilated upwards, with ten obscure angles. H, five-cleft. K, persistent.

calyx-teeth. B, nearly equal. D, upper one

apart. E, spreading. G, subulate.

corolla. A, monopetalous (by cohesion of 5 petals). B, twice length of calyx. C, hypogynous. G, irregular, bilabiate, ringent. *Throat* inflated, compressed, gibbous. *Upper lip* galeate. H, *Lower lip* trifid; *middle lobe* large, obcordate, and contracted at the base; *lateral lobes* acute.

**Ring* (*annulus*) of hair inside the tube and near the base. E, oblique.

stamens. A, four (tetandrous fl.). B, two inferior (anterior) longest (didynamous). C, on the tube of corolla. E, ascending.

filaments. G, subulate. I, villose towards summit.

anthers. C, attached at back. D, approach by pairs. E, incumbent, cells at length divaricate. G, oblong. H, cells dehiscing longitudinally in continuous line through divaricate cells. I, hairy. K, blackish purple.

pollen. G, ovate-globose when moist, ellipsoidal dry. I, dry, three-striated. J, yellow.

Pistil. A, one (by cohesion of two or four carpels?) C, somewhat stipitate (by gynophorus).

**Gynophorus.* F, fleshy, sub-glandular. G, annular. H, four lobes alternating with the lobes of the ovary.

ovary. H, quadri-partite, divisions (lobes) truncate.

style. A, one (monogynous fl.). B, length of

stamens. C, in the middle from between the lobes of the ovary. G, filiform. H, apex bifid, divisions nearly equal.

stigmas. A, two. G, on the summits of the segments of the style.

ovules. A, one in each cell. C, basilar. E, ascending: anatropous.

VII. INFRUCTESCENCE. In crowded Verticillasters, from axillary dichotomous cymes.

VIII. FRUIT. Four sub-cohering Achenes (by subdivision of ovary).

pericarp. G, acutely triquetrous, convex on one side, obliquely truncate. H, indehiscent.

**Exuvies*, of persistent (scarcely accrescent) calyx.

IX. SEED. A, one. C, basilar. E, erect.

albumen. B, extremely slight or none (exalbuminous seed).

embryo. E, homotropous. H, dicotyledonous.

cotyledons. A, two. B, large. E, straight.

radicle. C, inferior. E, to the hile.

DEMONSTRATION IX.

PRIMULACEÆ. Primula vulgaris. Common Primrose.

I. PLANT. Herbaceous, perennial, acauline, large simple leaves, single-flowered scapes or umbels of showy monopetalous flowers.

II. Root. B, stout fibres. C, from under side of subterranean rhizome.

III. Stem. C, subterranean rhizome. E, oblique. F, fleshy. G, præmorse. H, simple. I, scaly from persistent bases of old leaves. J, reddish.

IV. Leaf. C, radical, sub-petiolate, semi-amplexicaul. D, crowded. E, spreading. G, obovate-oblong, tapering at base. H, simple, unequally crenate-dentate. I, rugose, somewhat downy; venation reticulate.

Stipules. A, none.

V. Inflorescence. C, radicle (Scape). E, erect. G, simple umbel, or usually many single flowers (from contracted peduncle leaving only pedicels apparent).

bracts. A, one, at base of each pedicel. B, small. E, erect. G, subulate. H, simple.

VI. Flower. D, regular, hermaphrodite. E, erect. H, pentamerous.

Calyx. A, monosepalous (by cohesion of 5 sepals). C, inferior. D, æstivation valvate. E, erect. G, prismatic, 5-angular, subinflated. H, quinquefid. K, persistent.

Corolla. A, monopetalous (by cohesion of 5 petals). B, tube longer than calyx. C, hypogynous. D, lobes alternate with teeth of calyx; æstivation imbricate.

E, limb spreading. G, salver-shaped (hypocrateriform,) throat dilated. H, limb five-lobed, lobes ob-cordate. J, sulphur yellow, with darker spot in the middle. K, marcescent.

Stamens. A, five (pentandrous fl.). B, included. C, inserted at top of the tube of corolla (*base* of throat). D, opposite the lobes of corolla. F, erect.

filament. B, short. G, filiform.

anther. C, cells parallel, introrse, attached at back above the base. E, erect, converging. G, oblong, pointed. H, bilocular, dehiscing longitudinally. J, yellow.

pollen. G, globose when moist, angular when dry.

Pistil. A, one (by cohesion of 5 carpels). C, superior. E, erect.

ovary. G, globose. H, unilocular.

style. A, one (monogynous fl.). B, long as tube of corolla. C, terminal. E, erect. G, filiform. H, simple.

stigma. A, one. G, capitate. H, simple.

placenta. A, one. B, large. C, central. G, globose.

ovules. A, numerous. C, peltate. E, semi-anatropous? G, plano-convex.

VII. INFRUCTESCENCE, as Inflorescence.

VIII. FRUIT. A Capsule.

Pericarp. F, chartaceous. G, ovate-cylin-

drical. H, dehiscing longitudinally at apex into 5 to 10 teeth. J, brown.

**Exuvies,* an accrescent calyx. B, as long as the capsule.

IX. SEED. A, numerous. C, sessile, peltate. G, plano-convex, angular. I, testa punctate-rugose.

albumen. B, copious. F, fleshy to horny.

embryo. B, small. C, in axis of albumen. E, straight, heterotropous (transverse or parallel to hile). G, sub-cylindric. H, di-cotyledonous.

cotyledons. B, short.

radicle. E, indeterminate.

Sub-Class 4. Monochlamydeæ {*achlamyd.* and *monochlamyd.* (to *dichlamyd. diclin.*) *hypog. perig. epig.*}

DEMONSTRATION X.

EUPHORBIACEÆ. Euphorbia helioscopia. Sun Spurge.

I. PLANT, herbaceous, annual, foliaceous, smooth, lactescent; small heads of one female and several male incomplete flowers in calyciform involucres (resembling monochlamydeous hermaphrodite flowers).

II. ROOT. B, slender. H, branched fibres.

III. STEM. A, solitary. E, erect. G, terete. H, branched.

branches. D, alternate below, umbellate above. H, bi-tri-chotomous.

IV. Leaf. B, uppermost largest. C, cauline, sessile. D, alternate. E, patent. G, ob-ovate-cuneate. H, simple; serrated towards the apex. I, smooth. J, full grass green.

Stipules. A, none.

V. Inflorescence. C, terminal. D, on five di- to tri-chotomous branches umbellately disposed. G, small head (*Glomerule*) in calyciform involucre.

pedicel. B, of the female longer than of the males.

bracts. C, on and below umbellate branches. D, involucrate. F, leaflike. G, ob-ovate, cuneate. H, serrated towards apex.

involucre (*Anthodium*). A, monophyllous. F, calyciform. G, campanulate-turbinate. H, quadrifid.

(its *laciniæ*). F, membranous. H, ciliately cut.

**Appendages.* Glands on involucre. A, four. B, large. C, outside near the summit, peltate. D, alternate with the lacineæ. F, fleshy. G, roundish. H, entire. I, shining. J, yellow green.

bracteoles. A, numerous within the involucre. B, very small. C, at base of the pedicels. H, ciliato-lacerate.

VI. Flower. D, diclinous (and monœcious), achlamydeous.

Males. A, about 12. B, very small. C, pedicellate.

stamen. A, one (monandrous fl.).

filament. B, thick as pedicel. C, articulated to pedicel.

anther. C, terminal. G, cells globose. H, bilocular, didymous.

pollen. G, globose. I, smooth.

Female. A, one. B, at length exserted. C, pedicellate. D, central. E, at length deflexed.

pistil. A, one (three cohering carpels). C, sessile.

ovary. G, sub-globose. H, three-lobed, trilocular.

styles. A, three, slightly cohering (monogynous fl.) at base. C, terminal. E, spreading. H, bifid. K, persistent.

stigmas. A, six (or three bifid ?) G, obtuse.

ovules. A, one in each cell. C, apical. E, anatropous.

VII. Infructescence. A, solitary.

VIII. Fruit, a Capsule (*Regma*).

Pericarp. G, globular. H, three-lobed, tricoccous, dehiscence septicidal and separating from a central receptacle; and the carpels (cocci) elastically bivalve.

IX. Seed. A, one in each carpel. C, apical. E, pendulous. G, ellipsoidal.

testa. F, crustaceous. I, reticulate, pitted.

**Appendage.* A fleshy arillode near the hile.

tegmen. F, membranous.

chalaze. B, distinct. C, opposite the hile.

raphe. B, distinct.

albumen. B, copious. F, fleshy and oily.

embryo. B, length of albumen. C, axile. E, straight, homotropous. H, dicotyledonous.

cotyledons. B, very thin. F, leaf-like. G, flat, oval.

radicle. C, superior. E, towards hile.

CLASS II. MONOCOTYLEDONES.

DEMONSTRATION XI.

ORCHIDACEÆ. Orchis Morio. Green-winged Orchis.

I. PLANT, herbaceous, perennial, with leafy scape-like stem, terminating in spike of irregular purple flowers.

II. ROOT, of fibres and tubercles (*tuberous fibres*).

fibres. F, fleshy. H, simple.

tubercles. A, two. B, size of hazel-nut. F, fleshy. G, ob-ovoid to globose. H, simple. K, annual.

III. STEM. E, erect. G, terete.

IV. LEAF. C, cauline, sheathing. D, alternate. E, lower spreading, upper erect. G, linear-

lanceolate. H, simple, entire. I, glabrous, venation parallel. J, paler beneath.

STIPULES. A, none.

V. INFLORESCENCE. C, terminal. G, a lax spike.

bracts. A, one subtending each flower. B, long as ovary. E, erect. F, membranous. G, lanceolate. H, simple. I, greenish-purple. K, persistent.

VI. FLOWER. A, four to ten. D, normal position reversed, rather lax, irregular, hermaphrodite, gynandrous.

perianth. C, superior. D, leaves (*rather*, segments!) in two rows. G, ringent. J, all coloured.

outer row (*sepals*). A, three. B, equal. D, anterior uppermost. E, converging. G, lanceolate. I, many green ribs.

inner row (*petals*). A, three. B, two equal, the third (*Lip*) in front larger. D, alternate with the 3 outer.

—(*two upper* do.) E, connivent, forming a *galea* with uppermost one of outer row. G, lanceolate. I, three green ribs.

—(*Lip.*) E, pendulous. C, adhering to base of the column. G, ob-cordate. H, with 3 unequal lobes, the midde truncate, emarginate, the lateral largest, more or less notched and irregularly crenate.

**Appendage,* a spur behind. B, shorter than

ovary. E, ascending. G, conical, obtuse, sub-clavate.

Central-Column. D, gynandrous. F, fleshy.

anther. A, one (monandrous fl.). C, terminal, sessile, adnate. D, cells parallel. E, erect. G, ob-ovate. H, bilocular, dehiscing longitudinally.

**staminodia.* A, two. C, on either side the fertile anther. G, bluntly conical.

pollen-masses (*pollinia*). A, two. C, each with a gland (*retinaculum*) at extremity of its stalk (*caudicula*), terminating within one pouch (*bursicula*). G, clavate. H, easily separable into numerous small masses of cohering grains.

ovary. C, inferior. E, twisted, patent. G, sub-cylindric. H, unilocular.

style. C, forming a projection (*rostellum*) from its summit between the base of the anther lobes.

stigma. A, one (monogynous fl.). B, dilated. C, top of the column. E, oblique. G, concave. I, mucilaginous (viscid).

ovules. A, very numerous. B, very minute. C, to short funicular-chords, parietal. E, anatropous?

VII. INFRUCTESCENCE, a spike of capsules.

VIII. FRUIT, a Capsule.

pericarp. F, membranous. G, ellipsoidal. H, unilocular, trivalve, valves dehiscing,

from intermediate ribs, but cohering at base and apex.

placentas parietal. A, three. C, on the valves.

IX. SEEDS. A, numerous. B, very minute. C, parietal.

testa. C, loose. G, attenuated at each extremity. I, reticulate.

albumen. A, none.

embryo. F, fleshy, solid. H, monocotyledonous.

DEMONSTRATION XII.

AMARYLLIDACEÆ. Narcissus Pseudo-narcissus. Common Daffodil.

I. PLANT. Bulbous, perennial, linear radical leaves; scape bearing a single showy flower with 6-partite perianth and large bell-shaped crown.

II. ROOT. A, many fibres. D, round margin of a circular disk at base of the bulb. G, cylindric. H, simple. J, white. K, annual.

III. STEM. A, *aërial* none (acauline plant); *subterranean* within a bulb.

BULB. D, tunicated. F, fleshy, with outer coat scarious. G, sub-globose. J, blackish-brown.

IV. LEAF. A, about four. B, long as the scape. C, radicle, sheathing. D, crowded. E, erect.

F, slightly succulent. G, linear, obtuse. H, simple, very entire. I, smooth, striated, venation parallel. J, slightly glaucous.

V. INFLORESCENCE. A, solitary. C, radicle.

peduncle (scape). E, erect. G, bluntly two-edged.

bract (spathe). A, one. B, investing flower in æstivation, afterwards one-third its length. C, at base of ovary, sheathing. F, membranous. G, ovate, concave, acute. H, entire. I, pale green. K, persistent.

VI. FLOWER. A, solitary. B, large. D, regular, hermaphrodite. E, slightly inclined, (subcernuous). G, hexamerous.

Perianth. A, single (by cohesion of six leaves). C, superior, segments alternating in inner and outer series of three each. E, limb erect, patent. F, petaloid, somewhat succulent. G, somewhat funnel-shaped (subinfundibuliform), segments lanceolate, or ovate-lanceolate, equal. H, sex-partite. I, smooth. J, pale yellow. K, marcescent.

**Crown* (corona). A, one (by cohesion of abortive stamens ?). B, rather longer than perianth. C, on mouth of tube. E, erect. F, petaloid. G. bell-shaped (campanulate), the mouth expanding. H, crenate, crisped.

Stamens. A, six (hexandrous fl.). B, alternately shorter, included. C, at base of the

crown. D, alternating in two series, with segments of perianth. E, erect.

filament. C, very slight adhesion with tube of perianth. G, subulate.

anther. C, terminal, attached below middle of the back. D, introrse. E, incumbent, converging. G, linear. H, two-lobed, dehiscence longitudinal on the edges.

pollen. G, ovoid when moist, to elliptic when dry.

Pistil. A, one (by cohesion of three carpels). E, erect.

ovary. C, inferior. D, carpels alternate with inner series of stamens, i.e. are opposite outer segments of perianth. G, sub-globose, obtusely trigonous and three-furrowed. H, trilocular.

placenta. D, axile in each cell.

ovules. A, numerous. C, axile. D, linear. E, horizontal, anatropal.

style. A, one (monogynous fl.). B, included. C, terminal. E, erect. G, somewhat triangular, slender. H, simple.

stigma. A, one. C, terminal. G, obtuse. H, somewhat three-lobed.

VII. Infructescence. Solitary, with scarious spathe.

VIII. Fruit. A Capsule.

Pericarp. C, shortly pedicellate. E, inclining. F, membranous. G, ovoid, obtusely trigonous. H, trilocular; dehiscence loculi-

cidal, trivalve, with the dissepiments in the middle of the valves.

SEED. A, numerous. C, sessile. D, two-rowed. E, horizontal, anatropous. G, sub-globose.

testa. I, rugose. J, black.

albumen. B, copious. F, fleshy.

embryo. B, more than half length of seed. C, axile, and toward the base. E, homotropous, slightly curved. G, sub-cylindric. H, monocotyledonous.

radicle. E, to the hile; centripetal.

DEMONSTRATION XIII.

ARACEÆ. Arum maculatum. Spotted Arum.

I. PLANT. Herbaceous, perennial, tuberous, with shining hastate radicle leaves, and large convolute spathe investing a spadix of monœcious aggregate achlamydeous flowers.

II. ROOT. C, fibres, from and above a tuber. H, simple.

III. STEM. C, subterranean tuber. E, horizontal. F, fleshy and full of starch. G, irregularly ovoid, præmorse. H, simple. I, scarred. J, brown.

IV. LEAF. A, two or three. B, large. C, radicle petiolate, sheathing the scape. D, alternate. F, erect. G, broadly sagittate

to hastate, acute; petiole channelled. H, simple, entire, wavy. I, glossy, strongly and palmately veined. J, dark green, often spotted with black.

V. Inflorescence. A, solitary. E, erect. H, simple.

peduncle (a Spadix), the summit of a radicle branch (scape). F, fleshy. G, clavate. I, naked above. J, yellow turning to purple. K, summit deciduous.

involucre (a Spathe). B, very large. C, sessile. D, convolute. F, foliaceous. G, oblong, narrowed above, and contracted below the middle. H, entire. J, pale green, often spotted with black outside, coloured within. K, marcescent.

VI. Flower. A, numerous. B, small. C, sessile, below the fusiform summit of the spadix. D, monœcious, grouped round the spadix, the females lowest.

males. C, sessile. D, aggregate.

Perianth. A, none (achlamydeous fl.).

stamen. A, one (monandrous fl.). B, very short.

anther. E, lobes diverging. H, bilocular, dehiscing towards the summit.

pollen. G, globose.

females. C, sessile. D, aggregate.

perianth. A, none (achlamydeous fl.).

pistil. A, one (monogynous fl.).

ovary. G, ovate. H, unilocular.

style. A, none.

stigma. C, sessile, capitate, sub-lateral. G, hemispherical, depressed.

ovules. A, few. C, parietal. D, superimposed. E, erect; orthotropous.

**Appendages,* incomplete flowers of both sexes resembling each other. A, numerous. D, whorled. G, ovate and tapering at the summit.

—*staminodia* (abortive stamens). C, aggregate above the male flowers.

—*pistillidia* (abortive pistils). C, aggregate above the female flowers.

VII. INFRUCTESCENCE. C, terminal. G, spiked berries, the summit of the spadix with the male flowers having fallen.

**spathe* marcescent.

VIII. FRUIT. A Berry.

pericarp. C, sessile. F, fleshy. G, ovate. H, unilocular; indehiscent. I, smooth. J, scarlet.

IX. SEEDS. A, few. C, parietal. G, sub-globose.

testa. F, sub-coriaceous, thickened at the hile.

hile. B, broad.

albumen. F, farinaceous.

embryo. C, axile, towards the summit. E,

nearly straight; antitropous. G, subclavate. H, monocotyledonous.

radicle. E, from the hile. G, obtuse.

plumule. C, somewhat denuded.

DEMONSTRATION XIV.

GRAMINEÆ. Bromus mollis. Soft Brome-grass.

I. PLANT. Annual, erect with soft pubescence, panicle erect, rather close.

II. ROOT. G, fibrous.

III. STEM (*Culm*). A, one. B, two feet or more. E, erect. F, fistular. G, cylindrical (terete), swollen at the joints. H, simple. I, smooth or slightly hairy, the joints densely so.

IV. LEAF. C, cauline, sheathing. D, distichously alternate. G, linear. H, simple. I, nervation parallel, densely hairy.

Ligule (axillary stipule ?) B, short. G, blunt.

V. INFLORESCENCE. B, about 8 inches. D, close, or slightly spreading. E, erect. G, a Panicle. H, branched simply above, compound below.

branches. D, half-whorled. G, angular. I, downy.

spikelets. A, numerous. C, pedicellate. E,

nearly erect. G, ovate-oblong, acute, rather tumid. H, many flowered.

glumes. A, two. B, unequal, nearly as long as the pales. G, elliptic, acute. I, downy, except at the base, (sometimes smooth). J, *inferior* 5-nerved; *superior* 7-nerved, the margins diaphanous.

VI. Flower. A, 7 to 10 in a spikelet. D, closely imbricate, distichous, hermaphrodite. G, broadly elliptic, concave-depressed, the margins obtuse-angled.

Pale, outer or inferior. F, herbaceous, diaphanous at the margins. G, convex at the back, blunt. H, deeply cloven at the apex. I, downy (sometimes smooth), with 7 to 9 strong green ribs; awned below the summit.

Awn to outer pale. B, length of pale. C, a little below its summit. E, straight. F, stout. I, rough.

Pale, inner or superior. B, shorter than outer. E, membranous with green border. G, obovate, bicarinate. H, entire. I, pectinately ciliate at the edges.

Squamules (*lodiculæ*). A, two. B, minute, little longer than the ovary. C, hypogynous. D, collateral. E, erect. F, succulent, transparent. G, cultriform, somewhat obtuse. H, entire.

Stamens. A, three (triandrous flower). B, sub-equal. C, hypogynous. D, one anterior and two lateral.

filaments. G, filiform.

anthers. E, incumbent. G, linear, blunt. H, bilocular, and bilobed on each side, dehiscing longitudinally.

pollen. G, sub-globose. I, smooth.

Pistil. A, one (by suppression of 2 carpels ?). C, superior sessile, or very slightly stipitate.

ovary. H, unilocular. I, smooth, hairy on the summit.

styles. A, two (digynous fl.). B, very short. C, sub-lateral, distant.

stigmas. A, two. C, sub-sessile. H, plumose with simple hyaline spreading hair.

ovule. A, one. E, anatropous.

VII. Infructescence. Contracted panicle, with spikelets articulate.

VIII. Fruit. A Caryopsis.

pericarp. C, adnate to testa. F, thin-chartaceous. G, plano-convex. I, apex villose.

**Exuvies*, the two pales.

IX. Seed. A, one.

integument (*testa*). A, one.

albumen. B, copious. F, farinaceous.

embryo. C, near the base on the anterior surface of the albumen. G, cylindric. H, monocotyledonous.

cotyledon. F, fleshy. G, scutelliform with a furrow (sulcus) in front.

radicle. G, blunt.