SYLLABUS

OF

A COURSE OF LECTURES ON BOTANY,

SUGGESTING MATTER FOR A PASS-EXAMINATION

AT CAMBRIDGE IN THIS SUBJECT.

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PREFACE.

THE possibility of the Senate requiring the (so called) non-reading portion of our Undergraduates to pay some degree of attention to one or other of the subjects upon which Lectures are delivered by the University Professors, has induced me to prepare this Syllabus. It has been very hurriedly put together, the press having been kept a little in advance of my lectures, in order that my Class might receive the proof-sheets as they were proceeding. It must therefore be regarded as no more than a rough approximation to what I consider might be reasonably expected of men whose time may be pre-occupied in mastering the subjects already required for an ordinary degree. I hope to submit it, in its present form, to several persons acquainted with Botany, for the purpose of obtaining their opinion, as to whether they also consider such a course as it marks out, to be sufficient for affording

a general insight into this Science, and for preparing a student to pursue it afterwards with facility.

In so vast a subject as the "Systematic" department of Botany has now become, it is absolutely necessary that some limit should be assigned to the topics which may be required at an examination. I have therefore named a certain number of those higher groups or "families" within which our British Flora is restricted, and which are sufficient to afford a Lecturer a favourable opportunity for illustrating many of the most important modifications in the structure of plants, and for giving the student a full insight into the general principles upon which systematic Botanists are proceeding, in their attempts to complete or modify the system originally propounded by Jussieu. The several little tabular arrangements, numerical references, and explanatory notices in terminology, scattered through this part of the Syllabus, are merely intended to assist in preventing misconceptions of the Lecturer's meaning. But the questions proposed at a pass-examination need not embrace any of this sort of detail, the drift of which (though simple enough when explained) may not always be obvious without some explanation.

Perhaps it would be found sufficient to restrict the questions of a Pass-Examination to the following topics.

1. Definitions and explanations of a given number (say about 200) of the most essential technical terms—a list of which may be inserted in an Appendix.

2. Diagnoses of the British Families which have been selected under Section 2. These should be learnt by comparing plants or figures with the descriptions that are given in systematic works, and ought not merely to be got up by rote.

3. Any specimen, figure, or description of a plant belonging to one or other of these British Families, should be referred to the position it would *strictly* seem to occupy (upon inspection) in the systems of Linneus and Jussieu, so far as they are set forth in the tabular view given in this Syllabus.

4. A selection from the physiological topics discussed under Section 3.

This sketch is not to be considered as embracing all that might be required of Students who were willing to present themselves as voluntary Candidates for Honors in the proposed "Physical Tripos", if the Senate should consent to allow of its being established.

J. S. HENSLOW.

Cambridge, May 31. 1848.

SYLLABUS.

BOTANY.

I. STRUCTURAL.

Glossology, γλωσσα, lingua (*descriptive characters*).
Organography, οργανον, instrumentum (*description of parts*).
Anatomy (*microscopic dissection*).

II. SYSTEMATIC.

Phytography, φυτον, planta (*description*).
Diagnosis, διαγνωσις, discretio (*discrimination*).
Taxonomy, ταξις, ordo, ονομα, nomen (*arrangement*).
Diataxis, διαταξις, ordinatio (*method*).
Nomenclature.

III. PHYSIOLOGICAL. φυσις, natura (*vital functions*).
Epirreology, επιρρεω, influo (*external influences*).
Nosology, νοσος, morbus.

Geographical.
Oryctological, ορυκτος, fossilis.

Horticultural.
Agricultural.
Arboricultural.
Floricultural.

Medical.
Industrial.

I. Structural Botany.

**External Organization.*

Axis of vegetation—appendages.

1. Conservative Organs,

Ascending { Stem, (trunk and branches).....Leaves.

Neck.

Descending { Root, (caudex and fibres).....Spongioles.

2. Reproductive Organs,

Inflorescence,

{ peduncle and pedicel.
{ bract and involucrum.
{ receptacle and flower.

1. Floral whorls			to	2. Fruit.
Perianth. *περι*, circum. *ανθος*, flos.	Calyx (sepals). Corolla (petals).			Induvies or Exuvies.
Androecium. *ανηρ*, vir.	Stamens	filament. anther (with pollen).		
Gynœcium. *γυνη*, mulier. *οικος*, domus.	Pistil (carpels)	ovary (with ovules). style. stigma.		Pericarp (with seeds).

Modifications from

Number; Form; Cohesion; Adhesion; Degeneration; (Nectaries); Abortion (unisexual and neutral).

External Modification of Conservative Organs.

STEM—definite and indefinite. Node and internode.

1. Aerial—acauline (*a, caulis*), herbaceous, suffrutescent (*sub, frutex*), woody.
   Runner (*stolo*), succor (*turio*).
2. Root stock (*rhizoma*).
   Subterranean (*creeping root!*)—bitten (*præmorsus*); corm; bulb (scaly and laminated); tuber.

Weeping trees.

Form—terete and angular.

Direction—erect to prostrate.

Climbing (sinistrorse and dextrorse).

Branches—disposition and direction.

Modifications—succulent, leafless (*a* non, *φυλλον* folium).

Armature { Thorn ..... { branch or
Spine ..... { appendage,
Prickle..... epidermal.

ROOT—Tap and fibrous. Tuberous.

LEAF—Petiole, Limb, Stipules.

Vernation (of Buds)—folded and rolled.

Nervation—parallel and ramose,
(pinnate, palmate, pedate, peltate).

Position—radical and caulinar,
(alternate, opposite, verticillate, fasciculate).

Attachment—(decurrent, sheathing, clasping, perfoliate).

Direction.

Form—solid and plane.

Incision (margin).

Surface.

Composition—simple, compound, decompound.

Leaflets—general and partial petioles.

Modifications—
spinose : tendril : phyllodium : pitcher.

External Modification of Reproductive Organs.

Inflorescence—solitary or grouped.

1. Indefinite (axillary).

   Spike—compound with Spikelets.

   Cluster (*racemus*)—compound to Panicle, and Thyrsus.

   Corymb.

   Umbel—simple and compound.

   Head (*capitulum*).

2. Definite (terminal).

   Cyme—spiked, racemose, corymbose, umbellate; scorpioidal.

3. Mixed.

Æstivation (*æstiva* summer quarters)—valvate and imbricate.

Receptacle (*torus*).

Flower—complete or incomplete.

Perianth—Dichlamydeous, Monochlamydeous, Achlamydeous.
(Χλαμυς cloak).
Claw (to tube and throat), limb.

(1.) regular. Tubular; Funnel (*infundibulum*); Salver (υπο sub, κρατηρ crater); Pitcher (*urceolus*); Bell (*campanula*); Wheel (*rota*); Star (*stella*).

(2.) irregular. Lip (*labium*); Mask (*persona*); Strap (*ligula*); Anomalous.

Androecium—single or multiple whorls.

Hypogynous (υπο sub); Perigynous (περι circum); Epigynous (επι super), (γυνη mulier).

Disk.

Gynœcium.

Gynophore (thecaphore). θηκα theca, φερω fero.

Fruit. Valve; suture; placenta; septum; cell (*loculus*).
Dehiscence, septicidal, loculicidal.

1. Simple.

Apocarpous. *απο* apart, *καρπος* fruit.

legume and follicle	see Leguminosæ.
drupe.....	Rosaceæ.
achenium	Compositæ.
caryopsis	Gramineæ.

Syncarpous. *συν* combined.

capsule, and pyxidium	Primulaceæ.
pod (*siliqua*)	Cruciferæ.
cremocarp	Umbelliferæ.
nut (*glans*).....	Cupuliferæ.
apple (*pomum*)	Rosaceæ.

key (*samara*), gourd (*pepo*), grape (*nuculanium*), berry (*bacca*).

2. Compound. Cone, Mulberry, Fig.

Seed.

Funicular chord—hilum with omphalodium (*ομφαλος* umbilicus, *ειδος* forma).

Integument—Testa and tegmen.

Raphe (*ραφη* sutura), Chalaze (*χαλαζα* tubercula), Micropyle (*μικρος* parvus, *πυλη* porta.)

Arillus and Arillode (false arillus).

Albumen, or perisperm (*περι* circum, *σπερμα* semen).

Embryo—Tigellum—Cotyledons—Radicle—Plumule (gemmule).

Position in Pericarp,

Seed—parietal (*paries* a wall), central; pendulous, horizontal, erect.

Radicle—centripetal, centrifugal: inferior, horizontal, superior.

Relative condition of seed and embryo.

Seed —Orthotropous—Campylotropous—Anatropous
(*ορθος rectus*) (*καμπυλος curvus*) (*ανα super*).

Embryo—Antitropous —Amphitropous —Homotropous
(*αντι* contra) (*αμφι* circum) (*ομος* similis).
Heterotropous (*ετερος* alter, *τρεπω* verto).

** *Internal Organization* (Anatomy).

Elementary Organs, from Membrane.

Utricles or Vesicles (cells) =,001 to ,03 inch diam.

parenchyma (παρα trans εγχυω infundo).

- spherical, to rhomboidal-dodecahedral.
- fusiform, to hexag. prisms, tetrahedral summits.
- cylindrical, to hexahedral prisms, &c., &c.

Closters—Woody-fibre, pleurenchyma (πλευρον latus)—structure of rice-paper.

Vessels—Angienchyma (αγγος vas)

Spiral (tracheæ)—dotted—annular—reticulated—scalariform (*scalaris* ladder). Laticiferous channels.

Strength of fibre. Flax: Phormium: Silk:: 1 : 2 : 3.

Intercellular spaces—Passages; Lacunæ; Receptacles.

Contained fluids—organic and inorganic compounds—raphides of oxalate of lime, &c.—Biforines (see Aroideæ).

Epidermis—Cuticle—Stomates (στομα mouth) 12000 in Iris, and 120,000 in Lilach, on 1 square inch.

Pubescence—Hair; bristle; sting; gland.

Exogenous structure (εξω extra γενναω genero) of Dicotyledons.

- Central system
  - Pith
  - Medullary sheath
  - Woody layers
    - duramen (heart)
    - alburnum

  Medullery rays

  Cambium.

- Cortical system
  - Cortical layers
    - Endophlæum (liber)
    - Mesophlæum
    - Epiphlæum

    (Silver grain.)
  - Epidermis

(ενδον intus, μεσος medius, επι super, φλοιος cortex).

Proportion of parts in herbaceous stems—Anomalous structure of Bryonia—Lace-bark.

Roots without pith or medullary sheath.

Computation of old trees—

Oak 1300; Yew 2800; Baobab 5000 years.

Imbedded materials and inscriptions.

Endogenous structure (ενδον intus) of Monocotyledons.

No concentric layers, medullary rays, or bark.

Scattered fibro-vascular bundles.

Many groups rarely branch.

Longevity of Dracæna draco, at Teneriffe.

Acrogenous structure (ακρα summitas) of Acotyledons.

Microscopic examination of fossil wood.

Anatomy of leaves.

Parenchyma between epidermis, with nerves (or veins) of vascular bundles.

Skeleton leaves, prepared by maceration.

Articulation and scar left by fall of leaf.

Dicotyledons, usually develope the Limb, and are Angulinerved;

Monocotyledons, usually develope the Petiole, and are Curve-nerved.

Anatomy of reproductive organs, referred to account of their functions.

II. Systematic Botany.

Individuals referred to

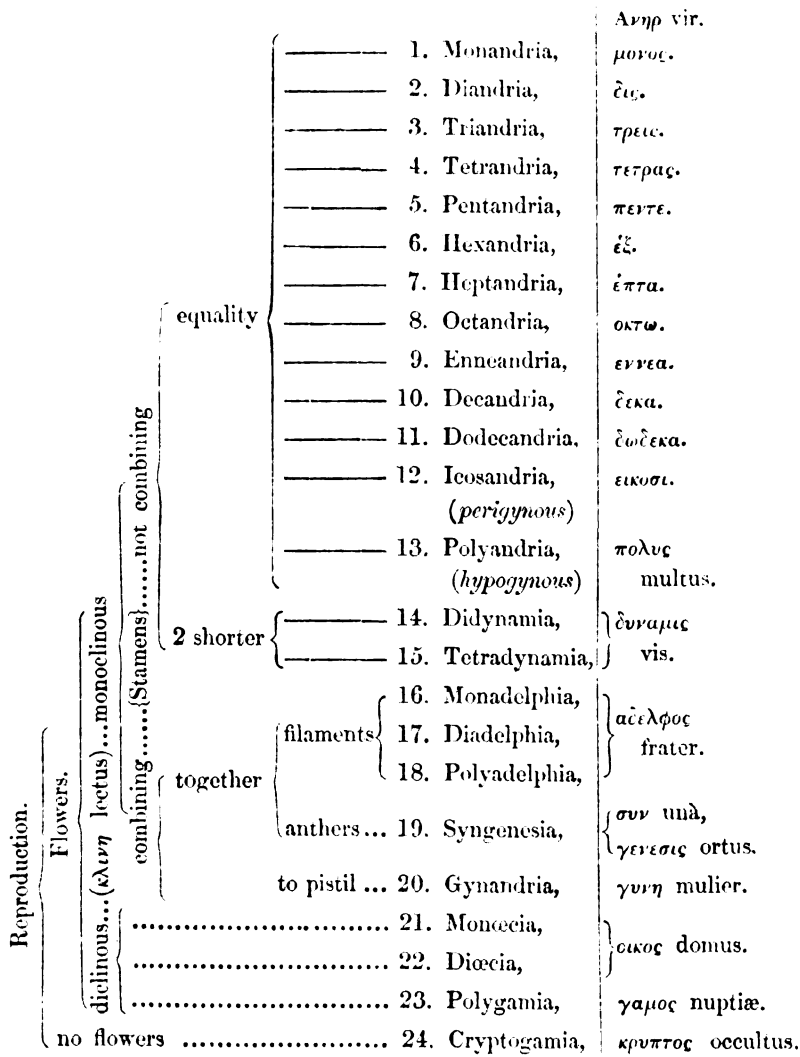
1. Species { races, varieties, variations.

Hybrids.

2. Genus
3. Order (Family) } with subdivisions.
4. Class

Genera grouped *artificially* under the Linnean System.

Analysis of the Linnean Classes.



Analysis of the Linnean Orders.

Cl. 1. Monandria, to Cl. 13. Polyandria.

Orders—Monogynia, Digynia, &c. to Polygynia, } free styles, γυνη.

Cl. 14. Didynamia.

Orders—Gymnospermia ..... γυμνος, nudus. } σπερμα,
Angiospermia ..... αγγος, vas. } semen.

Cl. 15. Tetradynamia.

Orders—Siliquosa, —1 : 3 } length : breadth of pericarp.
Siliculosa,—1 : 1 }

Cl. 16. Monadelphia, to Cl. 18. Polyadelphia.

Cl. 19. Syngenesia.

Orders—Polygamia.	florets. Disk.	Ray.
1. æqualis	H.	H.
2. superflua	H.	F.
3. frustranea	H.	N.
4. necessaria	M.	F.
5. segregata	all involucrate.	

Cl. 20. Gynandria.

Orders—Monandria, &c.

Cl. 21. Monœcia, and Cl. 22. Diœcia.

Orders—Monandria, &c.

Cl. 23. Polygamia.

Orders—Monœcia, Diœcia, Triœcia.

Genera grouped *naturally* under the Jussieuean System, gradually perfecting.

Method of determining affinities by a subordination in value of Organs of the same Class, viz. the reproductive—

1. Embryo.
2. Pistil and stamens.
3. Seed and pericarp.
4. Perianth and bracts.
5. Nectaries.

Relative values of structural modifications, as

Freedom—cohesion—adhesion—abortion—subdivision.

Explanation of chief Terms in the following Table.

JUSSIEU.*

I. no cotyledon.
II. one cotyledon.
III. two or more cotyledons.

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4. δις, κλινη a bed, unisexual and incomplete.
1. apet:, no corolla.
2. mon:, petals cohere.
3. pol:, free petals.

---

10. χωρις, (separation.)
11. συν, (combination).

DE CANDOLLE.

* vesicles only.
** vessels also.
III. φανερος evident.

---

4. perianth, single or none.
5. Thalamus (receptacle).

ENDLICHER.

* θαλλος frond, φυτον plant.
I. προτος primus (originating).
II. υστερος posterior (derivative).
** κορμος stalk.
III. ακρα summit, βρυω to germinate.
IV. αμφι about.
V. ακρα, αμφι, βρυω.

---

1. ανω above.

---

3. γαμος (combined).
4. διαλυω (separate).

LINDLEY.

III. ριζα root, γεννεσις origin.
V. δικτυον net.

* The words in italics are not Jussieu's.

Approximate comparison of th

JUSSIEU. 1789.				DE C
I. ACOTYLEDONES	(algæ. 2.) lichenes		* Cellulares aphylli	AC
	(fungi. 1.)			
	(musci. 4.)		foliosi	
	(hepaticæ. 3.)			
	(filices. 5.)		* * Vasculares	
			† Monocotyle	
			MON: CRY	
II. MONOCOTYLEDONES 2	*(mono)*	-hypogynæ	MON: PH	
4		-epigynæ		
3		-perigynæ		
			† † Dicotyledc	
III. DICOTYLEDONES. Diclines 4. irregulares 15		*(gymnospermæ)*	4. Monochlam	s inces)
		(angiospermæ)		
1. Apetalæ 5	epi-	*(-stamineæ)*		
6	peri-			
7	hypo-			
2. Monopetalæ 8	hypo-	*(-corollæ)*	3. Corolliflora	ious iances)
9	peri-			
10 *coris-anthera*	epi-		2. Calyciflora	us ances)
11 *synan-thera*				
3. Polypetalæ 12	epi-	*(petalæ)*	1. Thalamiflor	us anges)
14	peri-			
13	hypo-			

Review of the Diataxes *of Endlicher* (1840) *and Lindley* (1847).

Endlicher. Secondary Divisions.	Endlicher. Primary Divisions.	Endlicher.	Lindley.	Lindley. Primary Divisions.	Lindley. Secondary Divisions.
*	Regio	2	2	*	*
Cohors	. Sectio ...	5	7	. Class	*
*	.. Classis...	61	56	.. Alliance ...	*
sub-ordo . tribus .. subtribus ... divisio .... subdivisio	... Ordo ...	279	303	... Order ...	sub-order . tribe .. subtribe * *
*	.... Genus	6896	20806	.... Genus...	sub-genus
*	*		82606	..... Species	*

Selection from British Orders, for illustrating peculiar terms, and subordinate grouping.

Cl. I. Dicotyledones.

Sub-Cl. 1. Thalamifloræ (*thalamus, flos*).

Ranunculaceæ (*Polyp*: *hypog*:)

Comparison of four common British Species—

	Calyx.	Stem.
1. acris	patent	*
2. repens		. scions.
3. bulbosus ...	reflexed	. bulbous.
4. hirsutus ...		*

Sub-division of Gen. Ranunculus D. C. 1824.

Sect.		Brit.	Carpels.	Fruit.	Root.
1.	Sp. 3	5	transv: wrinkled	*	*
2.	... 25	0	smooth	spiked	grumose
3.	... 4	0	smooth	globose	grumose
Ficaria	2	1	smooth	globose	fibrous
4.	... 103	10	smooth	globose	fibrous
5.	... 14	3	tubercul:	*	*
?	... 10	0	*	*	*
	161	19			

Induplicate æstivation of Clematis—many petaloid sepals—variously deformed perianths—frequency of double flowers (*flores pleni*)—tailed Achenia (*a non, χαινω dehisco*) and follicles.

Baccate carpel of Actea.

Tribe.	Gen.	Brit.	Anther.	Carpel.	Seed.	Æstiv.
1. Clematideæ ...	1.		extrorse	monosperm:	pendulous	valvate
2. Anemoneæ	9.		extrorse	monosperm:	pendulous	imbricate
3. Ranunculeæ ...	20.		extrorse	monosperm:	erect	*
4. Helleboreæ ...	9.		extrorse	polysp:	*	*
5. Paonieæ	2.		introrse	*	*	*

PAPAVERACEÆ (*Polyp*: *hypog*:)

Frequent quaternary arrangement among the floral whorls.

CRUCIFERÆ (*crux, fero*) (*Polyp*: *Hypog*:)

Racemoso-corymbose inflorescence, sometimes opposite the leaves—symmetrical but irregular flower—Tetradynamia of Linnæus—spuriously 2-celled pericarp (*siliqua* and *silicula*); accumbent, lying on edges, and incumbent, on back, of cotyledons.

British Gen. in Sub. Orders.	Siliquosæ.	Latisepte.	Angustisepte.	Nucamentaceæ.	Septulatæ.	Lomentaceæ.
1. Pleurorhizeæ	8	5	4	.	.	1
2. Notorhizeæ	4	1	2	1	0	.
3. Orthoploceæ	4	1	.	.	0	2
4. Spirolobeæ	0	0	0	.	0	.
5. Diplecolobeæ	.	2	.	0	0	0

1. πλευρα latus, ριζα radix.—2. νωτον tergum.—3. ορθος rectus, πλεκω plico.—4. σπειρα spira, λοβος lobus.—5. δις bis, πλεκω, λοβος.

Siliqua pod; Latus broad, septum partition; Angustus narrow; Nucamentum nut; Septa transverse; Lomentum, articulate legume.

RESEDACEÆ (*Polyp*: *hypog*:)

Uncertainty of dodecandrous character—lacerated limbs of petals—largely developed disk—anomalous state of capsule.

VIOLACEÆ (*Polyp*: *hypog*:)

Foliaceous stipules—resupinate flower—barren and fertile states—monogamous stamens, with nectariferous spurs and prolonged connectives—loculicidal capsule, with parietal placentæ.

POLYGALACEÆ (*Polyp*: *hygog*:)

Pseudo-papilionaceous appearance of the flower.

HYPERICINEÆ (*Polyp*: *hypog*:)

Polyadelphous arrangement of the stamens—pellucid glandular dots in the leaves.

GERANIACEÆ (*Polyp*: *hypog*:)

Monadelphous arrangement of the stamens—elongated torus—aristate styles.

Sub-Cl. 2. Calycifloræ (*calyx*, *flos*).

LEGUMINOSÆ (*Polyp*: *perig*:)

Sub-Orders.	Tribes.	Sp.	British.
1. Papilionaceæ	1. Podalyrieæ.....	350	0
	2. Loteæ	3000	48
	with Vicieæ	.....	23
	3. Hedysareæ	500	4
	4. Phaseoleæ	650	0
	5. Dalbergieæ ...	250	0
	6. Sophoreæ	50	0
2. Cæsalpineæ		700	0
3. Mimoseæ		1000	0
		6500	75

Papilionaceous Flower { Standard ..... *vexillum*. Wings ..... *alæ*. Keel..... *carina*.

Diadelphous, Monadelphous, or Free stamens.

Legume (*lego* to gather)—valvular, twisted, spuriously celled, indehiscent (drupaceous), monospermous, lomentaceous; Hypogean.

Stipules to spines and tendrils—Phyllodia of Acacia.

ROSACEÆ (*Polyp*: *perig*:)

British Tribes.	Fruit.
1. Amygdaleæ.....	Drupe { epicarp. mesocarp (sarcocarp). endocarp (*pyrena*, or *putamen*).

επι super, μεσος medius, σαρξ caro, ενδον intus; καρπος fructus.

2. Spirææ ..... Follicles.
3. Dryadeæ..... Æterio (with achenia or drupellæ).
4. Roseæ ..... Hip.
5. Pomeæ ..... Pomum.

CUCURBITACEÆ (*Monop*: *epig*:) (*Dicl*: *irreg*: *J*.)
Stipular (?) tendrils.

UMBELLIFERÆ (*Polyp*: *epig*:)
Epigynous flowers with fleshy stylopodia, (στυλος, the style, πους foot).
Umbella and umbellula—Involucrum and involucellum.
Carpophorus (καρπος fructus, φερω fero).
Cremocarp (κρεμαω, suspendo) of 2 Mericarps (μεριζ, portio).
Commissure (commissus, joined).

Ridges (Jugæ): 10. primary { 5. carinal { 6. dorsal. / 5. sutural { 4. lateral. }
8. secondary ..... { 4. dorsal. / 4. lateral. }

Interstices (valleculæ).
Vittæ (oil channels).

Sub-Orders.

	Albumen.	Umbels.	Ridges.	Tribes.	British.
1.	Orthospermæ (ορθος rectus, σπερμα semen)	simple	.....	3	2
		compound	few (*prim.*)	5	5
			many (*pr.* and *sec.*)...	4	1
2.	Campylospermæ καμπυλος curvus (*margins*)	.....	many	2	1
			few.....	2	2
3.	Cœlospermæ κοιλος concavus (*ends*)	.....	.....	1	1

COMPOSITÆ (*Monop*: *epig*: *Syn*:)
About $\frac{1}{10}$th of known species, at different periods.

A. D.	Author.	Compositæ.	Known Sp.
.	Bauhin,	548	
.	Linnæus,	785	
1809.	.	2800	27000
1830.	.	5247	
1838.	De Candolle,	8421	85000
1846.	.	9500?	95000?

In Geographic distribution of 8400 species, only 8 *eminently* sporadic out of 500 sporadic (σποραδικος vagabundus).

Reduction of calyx limb to pappus—stipitate or sessile—pilose or plumose—scarious, &c.

Peculiar nervation of corolla of Compositæ—style of Compositæ furnished with Collectors.

Compositions of Capitula—Disk and Ray.

	Jussieu.	Decandolle.
(*l* . *f* . *l*)	Corymbiferæ, (*corymbus, fero*)	Tubulifloræ. I.
(*f* . *f* . *f*)	Cynerocephalæ, (*cynara, artichoke*)	
(*l* . *l* . *l*)	Cichoraceæ, (*cichorium, succory*)	Ligulifloræ. III.
* *	*	Labiatifloræ. II.

	Capitulum.	Linnean Orders.
(H . H . H)	Homogamum (ὁμος similis)	æqualis.
(F . H . F) (N . H . N)	Heterogamum (ἑτερος diversus, γαμος connubium)	superflua. frustranea.
(F . M . F)	Monoicum	necessaria.
{(H)}		segregata.
(M) - (F)	Dioicum	*
{(M) (F)}	Heterocephalum (κεφαλη caput)	*

Explanation of above references.—*l.* ligulate; *f.* floscular; H. hermaphrodite; F. female; N. neuter; M. male.

Passage from homogamous to heterogamous in Bidens, Senecio, &c.

Passage from tubuliflorous to ligulate state in Dahlia, Helianthus, Aster, Anthemis, &c. (*capitula plena*).

Tendency to abortion of stigma towards axis, and anther towards circumference of capitulum—*Ex. gr.*

Dioecious tendency in group Petasiteæ.

Homogyne (F . H . F) } ..... Tussilago {F . (H - σ) . F} }

Nardosma (F . H . F) } ..... Petasites {F . (H - α - σ) . F} }

Example of Synonymes in Linnean Genus Leontodon.

Jussieu.	Linnæus	Lessing	Tribes.
	Leontodon.		
Taraxacum dens-leonis	1. taraxacum	L. tarax:	Lactuceæ
L. hisp:	2. hispidum	Apargia hispida	Scorzonereæ

Affinity between four Orders, as a group—"Aggregatæ."

		Anthers	Pericarp.	Seed.
ex-al:	1. Compositæ	synantherous	1-celled	erect.
alb:	2. Calycereæ	synantherous	1-celled	pendulous.
alb:	3. Dipsaceæ	corisantherous	3-celled	pendulous.
ex-al:	4. Valerianeæ	corisantherous	3-celled	pendulous.

Involucellate flowers, and albuminous seeds of Dipsaceæ.

Suppression of parts in the Andrœcium of some groups.

CAMPANULACEÆ (*Monopet: peri:-epig:*)

Occasionally monogamous—Retractile collectors on the style—Valvular dehiscence of some capsules.

ERICACEÆ (*Monopet: Hypog:*)

Loculicidal and Septicidal dehiscence of capsules—Etærio-like berry of Arbutus—pore dehiscence of some anthers.

Comparison between a Polypetalous hypogynous group and a Monopetalous epigynous one,

	Corolla.		Stamens.
Humiriaceæ	Hypog:	polypet:	monadelp:
Monotropaceæ		½ monop:	free
Ericaceæ		monop:	
Vacciniaceæ	Epig:		

Sub-Cl. 3. Corollifloræ.

CONVOLVULACEÆ (*Monopet*: *Hypog*:)

Gamo-colyledonous (?) embryo of Cuscuta—its germination, parasitism, and coronal scales.

BORAGINACEÆ (*Monopet*: *Hypog*:)

Frequency of harsh pubescence (Asperifoliæ)—scorpioidal (gyrate) inflorescence—slight tendency to produce irregular flowers—pseudo-gymnospermous appearance of the fruit—stony nuts of Lithospermum—occasional presence of nitre in herbage.

SOLANACEÆ (*Monopet*: *Hypog*:)

Imbricate (and plaited) æstivation—capsular and baccate fruits—strongly narcotic properties of some species.

SCROPHULARIACEÆ (*Monop*: *hypog*:)

Personate (*persona* mask) or ringent (*ringo* to grin) character of some flowers—return to regularity in Peloria (πελωρ monster)—spurred and pouched corollæ.

Reduction of 5 stamens to 4 (didynamous) and to 2, by abortion.

LABIATÆ (*Monop*: *hypog*:)

Mixed inflorescence—verticillastrum or false whorl.

Bi-labiate (*bis* twice, *labium* lip) corolla, from 2 petals in upper and 3 in lower lip.

Reduction of stamens, as in Scrophulariaceæ.

Pseudo-gymnospermous ovarium, as in Boraginaceæ.

Spiral cells in testa of Salvia, &c.

Abundance of oil reservoirs in the herbage.

PRIMULACEÆ (*Monop*: *hypog*:)

Limitation of the group amid many dissimilarities.

Ex. gr. Primula.....scapes to umbels.
Cyclamen .....reflex corolla.
Pellitiera .....tripetalous condition.
Centunculus....quaternary.
Trientalis .....septenary division.
Glaux.....no corolla.
Lysimachia ...coronal scales.
Hottonia .....homotropous embryo.
Samolus.....semi-superior calyx.

Sub.-Cl. 4. Monochlamydeæ.

PLANTAGINACEÆ (*Apet*: *hypog*:) or (*Monop*: *hypog*:)

CHENOPODIACEÆ (*Apet*: *hypo-perig*:)

Polygamous flowers of Atriplex.

THYMELACEÆ (*Apet*: *perig*:)

ARISTOLOCHIACEÆ (*Apet*: *epig*:)

Ternary divisions of the flower—Gynandrous column.

EUPHORBIACEÆ (*Diclin*: *irreg*: *Ang*:)

Calyciform involucrum, with peltate glands, and achlamydeous flowers, of Euphorbia.

Septicidal dehiscence of bi-tri-multi-coccous capsules.

URTICACEÆ (*Diclin*: *irreg*: *Ang*:)

Stings of Urtica, &c.

---

composite fruit of Morus.

receptacle expanded in Dorstenia.

————closed in Ficus.

AMENTACEÆ (*Diclin*: *irreg*: *Ang*:)

Several groups with male and female Catkins.

Salicaceæ—Downy arillus.

Cupuliferæ—Perianth adhering to ovary.

abortions in bi-tri-multi-locular ovaries, to monospermous coriaceous (Quercus) or osseous (Corylus) nuts (glandes).

CONIFERÆ (*Diclin: irreg: Gymn:*)

Evergreen (or deciduous) fascicled acerose leaves.
Circular disks on woody tissue.
Deciduous staminiferous Catkins (amentum)
Bi-multi-ovulate carpellary scales.
Gymnospermous Fruit,

Strobilus, ...(Pinus) ..... Abietineæ
Galbulus, ...(Juniperus)..... Cupressineæ
(Taxus) .....Taxineæ
(with crustaceous testa and arilliform disk.)

Cl. II. Monocotyledones.

Grouping of 9 British (*Perig: and Epig:*) Genera.

	Jussieu.	Endlicher.	Lindley.	
Agraphis, Scilla	Asphodeli			IV. ENDOGENS.
Tulipa, Fritillaria	Lilia	Liliaceæ	Liliaceæ	
Asparagus, Convallaria, Ruscus, (*Smilax*), Paris, Tamus	Asparagi	Smilaceæ	Smilaceæ	V. DICTYOGENS.
			Trilliaceæ	
		Dioscoreæ	Dioscoreaceæ	

JUNCACEÆ (*Hypo-perig:*)
glumaceous sepals of Juncus and Luzula.

IRIDACEÆ (*Epi-perig:*)
petaloid stigmata of Iris.

ORCHIDACEÆ (*Epig:*)

Epigean and Epiphytic (Air-plants) species.
Lips anterior arrangement of posterior seg: of perianth.
Gynandrous column, Gynostemium (γυνη and στημων).
Clinandrium (κλινη, ανηρ) with Anther.
Gynizus (γυνη) with Rostellum; and Bursicula (*bursa* purse) with Retinaculum.
Pollen, in grains, or in masses, "Pollinia," with caudicula (*cauda* tail).
Staminodium (barren stamen) of Cypripedium.

ARACEÆ (*Hypog:*)

Achlamydeous flowers of Arum, on Spadix with a Spathe.
Biforines in tissue of Caladium.

PISTIACEÆ.

Lenticular frond of Lemna, without vessels.

GRAMINACEÆ (*Hypog:*)...3800 Sp.

Culm; Sheath; Ligula.
Stony involucrum of Coix.
Spike and Panicle.
Spikelet (spicula) uni-multi-floral.
Gluma, Palea v. glumella } awned (aristata) or awnless (mutica)
Lodicula v. squamula v. glumellula.
Stamens 2 (Anthoxanthum), 3 (generally), 6 (Oryza).
Paniceæ, two flowered, tendency to abortion outwards }
Poaceæ, one to many-flowered..... upwards }
Farinaceous albumen in large cariopses of Cerialia.
One million bushels of Wheat daily consumed in Britain.
Limits to the successful cultivation of the Cerialia.
Barley—Oats—Rye—Wheat—Spelt—Rice—Maize—Millet.

		Winter.	Summer.	Annual.	
62½°	Feroe	39°	51°	45°	
70	Lapland	22	46	33	Barley.
67½	Russia	9	46	32	
57½	Siberia	0	60	32	
58	Scotland	36	57	46	
64	Norway	23	59	39	
62	Sweden	23	59	39	
60½	Russia	15	60	37	
30	Cairo	57	88	72	Wheat.
22	Macao	64	82	73	
22	Rio Jan.	68	78	74	
23	Havannah	71	82	77	
21	Bourbon	71	80	77	

Viviparous Grasses.

CYPERACEÆ (*Hypog:*)

Class 3. Acotyledones.

A general recognition of the principal groups.

Propagation by spores.

FILICES.

Rhizome creeping; or erect in Tree Ferns.

Circinate vernation of dorsiferous Ferns.

Sorus: Indusium: Theca: Annulus.

LYCOPODIACEÆ.

MARSILEACEÆ.

EQUISETACEÆ.

MUSCI.

Caulinar and perichætial leaves.

Antheridia: Pistillidia: paraphyses.

Seta: Apophysis.

Sporangium (capsule) with

Calyptra (veil), Operculum (lid), Stoma (mouth), Peristomum (περι around, στομα) (of Epiphragma, or teeth, 4, 8, 16, 32, 64, &c.)

HEPATICÆ.

Elateres.

LICHENES.

Thallus (θαλλος green leaf) with Gonidia (γονη generation, ειδος resemblance), Spores in Asci. Apothecium (shield).

ALGÆ.

FUNGI.

Mycelium (μυκης fungus); Hymenium (ὑμην membrane): Sterigma (στηριγμα prop).

III. PHYSIOLOGICAL BOTANY.

Formation of Inorganic and Organic Compounds.

(all).....Elements.....(C. O. H ± N)

Elective affinity	Invisible	Assimilation
Crystalline aggregation	to	Cellular development
Simple Minerals	Visible	Vegetable structures

Properties of elementary tissues.

1. Chemical.

   Non-Nitrogenous; approach $C_{12}O_{10}H_{10}$
   (Cellulose, Starch, Gum, Sugar, &c.)

   Nitrogenous; approach $C_{18}O_{14}H_{36}N_6$
   (Albumen, Fibrine, Caseine.)

2. Mechanical.

   Hygroscopicity—exhibited in Lycopodium pallens, fruit of Mesembryanthemum, Anastatica, &c.

   Endosmose, (ενδον within, ωσμος impulse), producing turgescence—stamens of Nettle—fruit of Impatiens.

3. Vital—subservient to stimuli (Light, Heat, Moisture).
   Appreciation of vital energy.
   Vegetable irritability—Sleep of leaves—Mimosa pudica, Oxalis sensitiva, Desmodium gyrans, Dionæa muscipula—stamens of Berberis—style of Stylidium.
   Fly-catching plants—Apocynum, Drosera, Lychnis, &c.

Adventitious inorganic constituents,
   Silica—Tabasheer—Equisetum hyemale—pubescence of Deutsia scabra.
   Carbonate of Lime... ,0008 } per cent. in Sea Water;
   Iodine .....,000001 } secreted by Algæ.
   Phosphate of Magnesia, Carbonate of Soda, Nitrate of Potash, Sulphate of Lime, &c. &c.

Vegetable acids, alkaloids, oils, resins, &c.

Function of Nutrition,

1. Absorption—by spongioles.
   Roots from Lenticellæ—slips—layers.
2. Ascent—of crude sap.
   Hayles' experiment; force in Vine = 38 in. Mercury.
   Analogous effect with Endosmometer.
3. Exhalation—two-thirds of absorption.
   Stimulated by light—Sunflower, 30 oz. per diem.
   Nocturnal evaporation affords Carbonic Acid.
   Dropsical plants—Ward's cases.
   Stomata of succulents—none on submerged plants.
4. Respiration.
   Stimulated by light—reversed effect in animals.

Inorganic Compounds.		Elements	
CO_2.	Carbonic Acid ...	C, O	Various Organic Compounds.
OH.	Water	O, H	
H_3N.	Ammonia	H, N	

5. Descent—of elaborated Sap (proper juice).

Analyses of Sap.

Effect of "ringing" and ligatures, on Exogenous trees.

Intercellular rotation of contained fluid.

Ex. gr. Caulinia; Vallisneria; Chara, &c.

6. Development.

Cell formation—Cytoblast, Primordial utricle (Protoplasma), Nucleus, Nucleolus.

Multiplication by fissiparous division, and constriction.

Formation of starch.—Its relative size in,

Potato : Wheat : Quinoa :: ,007 : ,002 : ,0007 inches.

Officinal starches of Wheat, Rice, Maize, Sagus (Sago), Maranta (Arrow-root), Canna (Tous-les-mois), Arum, Manihot (Tapioca and Cassava), Orchis (Salep).

Conversion to Dextrine, and Sugar.

Effect of Diastase in germination—Malting.

Importance of Starch in Vegetable and Animal economy.

Comparison of nutritive properties of Vegetable and Animal matters—Ex. gr.

C_6	O_5	H_1	N_{14}	Potato	C	O	H	N	*Meat*
12	10	10	*	Cellulose ..... 8 Starch ..... 16 (*dextrine, c. sugar*)	10, 6	11, 6	1, 4	*	
(12)	(12)	(12)	*	*g. sugar* *alcohol, c. acid*					
48	15	39	6	Gluten (*caseine*, .. 2 *fibrine, albumen*)	1, 0 (12, 9)	, 4 (5, 2)	, 1 (1, 6)	, 3 (3, 6)	(26) *flesh*
*	1	1	*	Water 74	*	65, 6	8, 2	*	(74) *water*

For Carbon..8 oz.)
and Gluten..4, 5 oz.)

in excess

lbs. oz.		water	C	O	H	N
14,, 1	Potatoes ..	10,.6	1,,6,5	1,,10	*	*
4,, 11	Bread	2,,1	8,5	1,,2,5	*	*
4,, 13	Meat.....	3,,9	*	3	0,,1,5	0,,2,5

Growth of wood restricted to last formed portion.

Comparative injuries in pruning by "foreshortening" and "close-pruning."

Appearance called "Tree in tree."

Grafting successful in allied species.

Independent development of graft and stock.

"Greffe Diane."

"Greffe des Charlatans"—"Tot modis insitam arborem "vidimus, omni genere pomorum onustam; alio ramo "nucibus, alio baccis, aliunde vitis, ficis, piris, punicis, "malorumque generibus. Sed huic brevis fuit vita."—Plin. lib XVII. chap. 17.

Development of Fir stumps by intergrafting of roots.

Nutrition of flowering Parasites—distinguished from Epiphytes (επι upon, φυτον plant).

1. Defective absorption.—2. Defective assimilation.

Examples in various families.

* Stem Parasites.

LORANTHACEÆ (Viscum, Loranthus, Myzodendron) 23 Gen: 400 Sp.

Mode of dissemination and germination—uniformity of elaborated sap; variation in proportion of ash.

Early notices and superstitions respecting Misseltoe.

"Nihil habent Druides visco, et arbore in qua gignatur, "si modo sit robur, sacratius—Enimvero quidquid adnas- "catur illis, e cælo missum putant, signumque esse electæ "ab ipso Deo arboris. Est autem id rarum admodum "inventu, et *repertum* magna religione *petitur*: et ante "omnia sexta Luna, quæ principia mensium annorumque "his facit, etc. Omnia sanantem appellantes suo vocabulo, "sacrificiis epulisque rite sub arbore præparatis, duos "admovent candidi coloris tauros.—Sacerdos candida "veste cultus arborem scandit: falce aurea demetit: can- "dido id excipitur sago.—Tanta gentium in rebus frivolis "plerumque religio est!"—Plin. lib. XVI. chap. 95.

CUSCUTACEÆ (Cuscuta) 50 Sp.

Non-development of root, or caulinar appendages—Injuries to Clover and Flax.

* * Root Parasites.

OROBANCHACEÆ (Orobanche, Lathræa) 12 Gen. 116 Sp.

Annual and perennial species—Injuries to Clover, Hemp, Succory, &c.

MONOTROPACEÆ (Monotropa) 6 Gen. 10 Sp.

Fungoid character of group termed "Rhizanths," including

- Balanophoraceæ (Cynomorium, the fungus melitensis).
- Cytinaceæ (Cytinus).
- Rafflesiaceæ (Rafflesia, Hydnora).

SANTALACEÆ (Thesium).

SCROPHULARIACEÆ. Tribe Euphrasieæ (Euphrasia, Rhinanthus, Bartsia, Melampyrum, Pedicularis).

Exhaustion of Soils by removal of Crops.

Rotation of Crops—Clover failures.

Nosology exemplified in production of Galls, and in

The Diseases of Wheat—

- Bunt from Uredo caries.
- Smut..... segetum.
- Rust to ... rubigo
- Mildew to Puccinia graminis.
- Ergot ..... Ergotetia ?
- Ear-cockle..... Vibrio tritici.
- Abortion of grain by Cecidomya tritici (wheat midge).

Morphology—Relation of Leaf-buds to Flower-buds.

Function of Reproduction.

1. Flowering—its periodic returns.
   Formation of Anthers and Pollen.
   Structure of ovary, style, and stigma.
   Development of ovules.

   3 Primine or testa...with exostome
   2 Secundine or tegmen...endostome } foramen.
   1 Tercine or nucleus; its base and apex.
   4 Quartine or embryo-sack.

2. Fertilization.
   Dispersion of pollen.
   Instrumentality of Insects.
   Caprification of Fig—Economy of Vallisneria.
   Pollen grains exploded by moisture.
   Influence of stigma, and growth of Pollen tubes.
   Influence of Pollen tube on ovule.
   Modified action in Orchis; and in Asclepias.
   Limits to hybridization.
   Anomalous case of Cœlebogyne.

3. Maturation.
   Earliest appearance of Embryo, and its progress to maturity in different plants.

4. Dissemination.
   Various means by which it is secured.
   Preservation of vitality in seeds.

5. Germination.
   Influences of moisture, temperature, and oxygen.
   Duration of the process in different species.

Botanical Geography.

Habitations and Stations.

Botanical Zones.			Equatorial Alt.	Temp.
Polar.....82° to 72°	Frigid		...15200f.	... 28½
Arctic .....72 ... 66			...13300 ... 28½	to 32
Sub-Arctic .....66 ... 58	Temperate		...11400 ... 39¼	... 43
Colder Temp. ....58 ... 45			... 9500 ... 43	... 51¼
Warmer Temp....45 ... 34			... 7600 ... 51½	... 61
Sub-Tropical.....34 ... 23			... 5700 ... 63½	... 70½
Tropical .....23 ... 15	Torrid		... 3800 ... 73½	... 80½
Equatorical .....15 ... 0			... 1900 ... 80½	... 86

Isothermal lines (ισος equal, θερμη heat) annual.
Isotheral (θερος summer).
Isochimenal (χειμων winter).

Relative influence of Temperature, Light, Altitude.
Endemic species restricted by obstacles to dispersion.
Some Sporadic species, endemic to different Habitations.
General distribution of Vegetable Kingdom.

Species selected for 'Demonstrations' at the beginning of each Lecture.

Date.	Name.		Order.
	Gen.	*Sp.*	
	G.	*S.*	
	G.	*S.*	
	G.	*S.*	
	G.	*S.*	
	G.	*S.*	
	G.	*S.*	
	G.	*S.*	
	G.	*S.*	
	G.	*S.*	
	G.	*S.*	
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