

Cesalpino and Aristotelician Science: The Transformation of Medical Botany in the 16th Century

Quentin Hiernaux FNRS-Research Associate, ULB, Honorary researcher at
Meise Botanic Garden

Corentin Tresnie, Chargé de cours, Université de Liège

**Center for the study of medicine and the body in The Renaissance, 11
June 2024**



UNIVERSITÉ
LIBRE
DE BRUXELLES



Meise
Botanic Garden



LIÈGE
université

DE GRUYTER

Quentin Hiernaux, Corentin Tresnie
**ANDREA CESALPINO'S
'DE PLANTIS LIBRI XVI' (1583)
AND THE TRANSFORMATION
OF MEDICAL BOTANY
IN THE 16TH CENTURY**

EDITION, TRANSLATION, AND COMMENTARY ON BOOK I

MEDICAL TRADITIONS

DE
G



Introduction

- Collaboration to translate and edit the first book of Cesalpino's *De plantis Libris XVI* & commentary
- No translation or edition before
- Very important text for the history of botany + new relationship with medicine
- Importance of the Aristotelian context and philosophical influences



Cesalpino (1524-5 – 1603)

- Student of Luca Ghini at Pisa
- Became prof. of botany and of medicine
- Director of Pisa botanic garden
- Moved to Rome as Prof of Medicine at La Sapienza and as archiatrist of Pope Clement VIII
- His research and publications revolved around: botany, medicine, pharmacology, aristotelian philosophy, chemistry, physics, astronomy and theology

Historical context

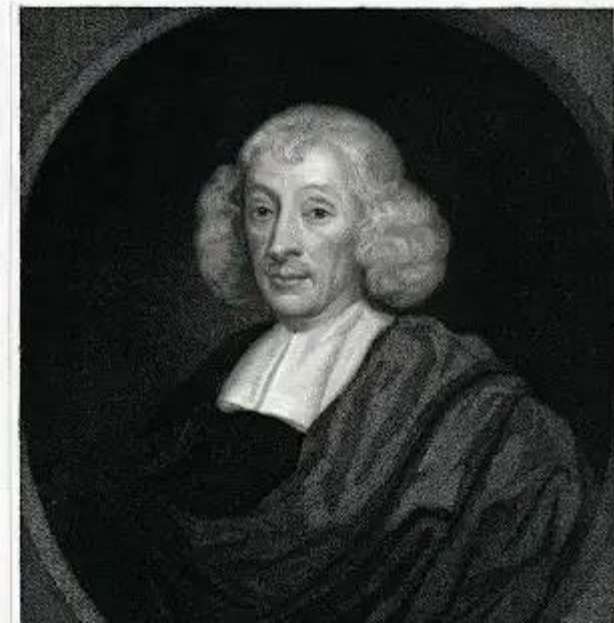
- *De plantis* is a landmark for plant morphology and above all for plant classification: Cesalpino dismisses laymen knowledge and uses of plants for botany + field practice: the variety and beauty of plants is a sufficient reason to study them (cf preface)
- Influence from Theophrastus and Aristotle but at the same time critical distance with ancient authorities
- Cryptical relationships with other Renaissance botanists (especially Italian + Jean Ruel)

Emancipation of botany from medicine

- “But Dioscorides, as a physician, only accepted the classification according to medical properties, on the account of which the saps, the tears, the roots, the seeds, and the other parts of plants are ordinarily looked for.” (Cesalpino 1583: Dedication letter V.)
- “I have considered it superfluous to add the medical properties; in fact, these have been expounded by many authors, and above all, at great length by Dioscorides and Galen” (ibid).
- “Finally, the differences that we are looking at here and which are a result of specific nature, like the medicinal properties of plants, their taste and other attributes in which physicians are primarily interested, are however not constituent to the substance, even if they are somehow present *per se*. » (ch. 14: §156)

Botanical influences

- Great influence on Modern botanists (esp. Between 17th to end of 19th c.)
- Hard to read: Philosophical aristotelician essay



Contents of the first book

Chapters	English title
1	The properties and parts of plants
2	Nutrition
3	Development and growth: embryo, bud, shoot, and bark
4	Growth and development: heart, stem, soboles, and leaves
5	Vegetative reproduction
6	Seeds
7	Flowers
8	Fruits and seed coats
9	The pericarp
10	The parts dedicated to the protection of the fruit and fructification
11	The secondary parts
12	The four main genera and their divisions
13	Criteria for defining subgenera and species
14	Subdivisions based on the reproductive operation

Translation and edition

De Plantis Libri XVI (1583)

8

De Plantis

ligni subiecti. Præterea pleræque arbores circumciso in orbem solo cortice emoriuntur in totum, non emoriuntur autem excauata medulla. Dicimus corticem insitum ideo germinare; quia prorumpit ex subiecto ligno germen, cui cortex agglutinatur ob affinitatem; nisi enim corticis oculus, oculo ligni accomodetur, non germinat; producuntur autem & folia & fructus secundum naturam corticis: quia hæc in omnibus ex cortice ortum ducunt: semina autem interna non secundum naturam corticis, sed ligni subiecti sunt; nam si serantur, nascuntur, non pro natura insiti corticis, sed ut plurimum syluestre genus: ortum enim ducunt ex medulla, non cortice; quod autem corticis in orbem circumciso in plerisque arborem enecet, fit; quia germinatio non fit sine cortice, ut superius est explicatum, qui autem derelinquitur supra circumcisum locum, emoritur; quia ablatum est alimenti ductus ex infernis; si quis autem ex ligno subiecto alii possit, uiuit, ut contigit Suberi, & aliis quibusdam, quibus pertinaciter cortex ligno inheret.

C A P. I I I I.

P R I M A autem plantarum germinatio est à radice, quod enim primo nascitur siue ex semine, siue per putredinem radix est. Cum autem in eius capite sit ea pars, quæ cordi animalium respondet, inde germinis principium ducitur, aliquando vno caule, aliquando pluribus; cor enim in quibusdam indiuiduum est, unde vnus caulis affurgit, ut in plerisque arboribus: in quibusdam quodam modo diuisionem patitur, unde ab eadem radice multi caules erumpunt, ut in Tritico. Numquam autem vnum & idem cor author est plurium caulium: patet autem in iis, quæ amisso priori caule alterum fundunt, ut in ferulaceo genere; numquam enim ex eadem parte, sed à latere germinant; Vt autem vnum cor vnus est caulis, sic videretur vnus quoque radicis vnum cor esse, quod si hoc esset, nullæ essent, quæ plures caules ferrent. An radix vna vnum quoque germen initio profert; postquam autem eadem magnitudinem adepta est conspicuam, diuiditur in quibusdam in plura principia vel simul, ut in Tritico, vel successiue, ut vno extincto alterum subnascatur ut in Ferula. Plantarum enim plurimarum natura est, ut diuisæ uiuant: quia earum principium licet actu vnum sit, est tamen potentia plura: nihil autem refert, siue à nobis plantæ diuisio fiat, siue sponte diuidatur principium solum: diuisæ enim radices quædam, licet in paruas partes cõcisæ sint, germinant ut Graminis, Raphani Montani: nam ubiq; erat cor potentia, & hæc radice feri possunt: sponte autem multitudo germinum fit, vel eadem subiacente radice communi, ut in Feniculo: vel singulis germinum principiiis noua suborta radricula, ut in Ciperio.

Iride

Translation and edition

arborea circumciso in orbem solo cortice emoriuntur in totum, non emoriuntur autem
excauata medulla. <37> Dicimus corticem insitum ideo germinare; quia prorumpit
ex subiecto ligno germen, cui cortex agglutinatur ob affinitatem; nisi enim corticis oculus,
oculo ligni accomodetur, non germinat; producantur autem et folia et fructus secundum
naturam corticis: quia haec in omnibus ex cortice ortum ducunt: semina autem
interna non secundum naturam corticis, sed ligni subiecti fiunt; nam si serantur, nas-
cuntur, non pro natura insiti corticis, sed ut plurimum syluestre genus: ortum enim
ducunt ex medulla, non cortice; quod autem corticis in orbem circumciso in plerisque
arborem enecat, fit; quia germinatio non fit sine cortice, ut superius est explicatum, qui
autem derelinquitur supra circumcisum locum, emoritur; quia ablatus est alimenti
ductus ex infernis; si quis autem ex ligno subiecto alii possit, uiuit, ut contingit Suberi, et
aliis quibusdam, quibus pertinaciter cortex ligno inhaeret.

CAP. IIII.

<38> PRIMA autem plantarum germinatio est a radice, quod enim primo nascitur siue
ex semine, siue per putredinem radix est. Cum autem in eius capite sit ea pars, quae
cordi animalium respondet, inde germinis principium ducitur, aliquando vno caule,
aliquando pluribus; cor enim in quibusdam indiuiduum est, unde vnus caulis assur-
git, ut in plerisque arboribus: in quibusdam quodam modo diuisionem patitur, unde ab
eadem radice multi caules erumpunt, ut in Tritico. <39> Numquam autem vnum et
idem cor author est plurium caulium: patet autem in iis, quae amisso priori caule
alterum fundunt, ut in ferulaceo genere; numquam enim ex eadem parte, sed a latere
germinat; Ut autem vnum cor vnus est caulis, sic videretur vnus quoque radicis

completely if one makes a notch in the bark all the way around, whereas they do not
die if their pith is hollowed out.²⁹⁷

37. [Role of the bark in growth]

For this reason, we say that the grafted bark buds, because the shoot emerges on the
outside of the wood beneath it, to which the bark is connected. But if the eye of the
bark does not match the eye of the wood, there will be no budding. In contrast, the
leaves and the fruit are produced by the nature of the bark, because their growth is
generated from the bark. On the other hand, the seeds inside [the fruit] are not made
from the nature of the bark, but from the wood beneath it. Indeed, if they are sown,
they appear, not as the same nature as the implanted bark, but rather like the wood:
their growth comes from the pith and not from the bark. Conversely, what in many
cases makes a tree die when it is notched all the way around depends on the bark.
Indeed, budding cannot take place without bark (as we have explained above), and
what remains above the cut point dies, as it is separated from its nutritive source,
which comes from below. Nevertheless, if something can be fed from the wood
beneath the bark, then it survives, as in the case of the cork oak (*Suber*) as well as in
other species whose bark is firmly attached to the wood beneath.

Chapter 4 [Growth and development: heart, stem, soboles and leaves]

38. [Heart of plants]

The first stage of a plant's development happens from the root, as this is what is born
first – either from the seed, or from putrefaction.²⁹⁸ But since the part which corres-
ponds to the heart in animals can be found at its top, the principle of growth is linked
to it, sometimes by a single stem, sometimes by several. Indeed, in certain plants, the
heart is undivided, thus explaining why only one stem grows, as is the case in most
trees. In others [plants], a kind of division takes place, which explains the growth of
several [hearts] from one single root, as in wheat.

39. [Heart–stem–root relationship]

In contrast, one single heart is never at the origin of several stems. It can nevertheless
happen that plants that have lost their former stem generate another one, as in the
ferulaceous genus. Furthermore, this new stem never grows exactly in the same place
[as the previous one], but instead next to it. Since the same heart is linked only to a

²⁹⁷ This observation was already made by Theophrastus, *Historia plantarum* IV, 15, 1; IV, 16, 4, (ed. Amigues 1988–2006: 2.114–117; ed. and Engl. transl. Hort 1916–1928: 1.405 and 104, respectively), and *De causis plantarum* V, 17, 1 (ed. and Fr. transl. Amigues 2012–2017: 3.51–52; ed. and Engl. transl. Einarson and Link 1976–1990: 3.181–183).

²⁹⁸ That is, spontaneous generation.

Philosophical method

- Cesalpino, original thinker or Aristotelian commentator?
- *Quaestiones Peripateticae* I, 1, 1C-E on the three steps of (Aristotelian) scientific method: induction, division, definition

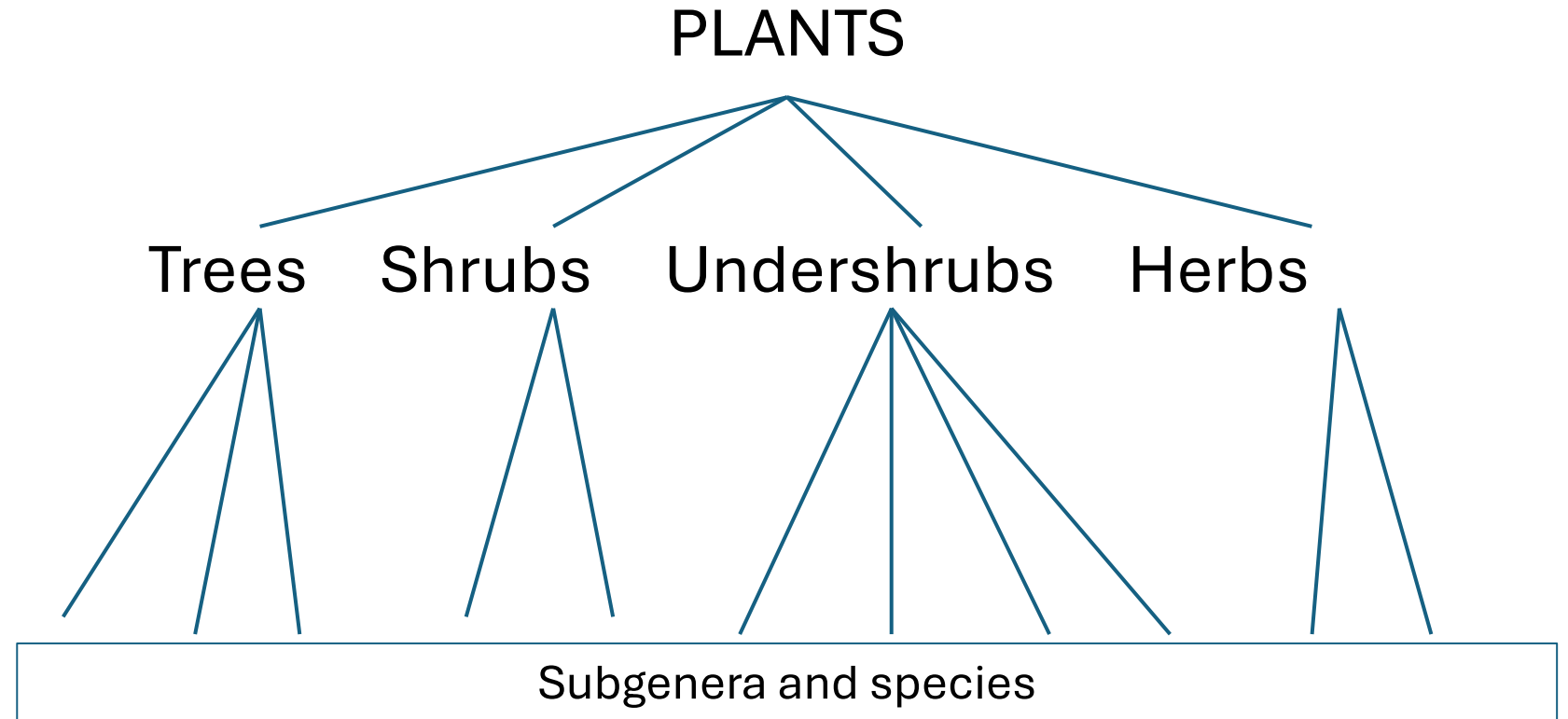
// Structure of Book I

- Method and conceptual framework explicitly rooted in Aristotle
- Observations and conclusions go far beyond Aristotelian doctrines

Finalism, nature and God

First *opus*:
feed & grow

Second *opus*:
reproduce



Finalism, nature and God

- The finalist vocabulary is ubiquitous: *gratia, datum est, tradidit...* (with a lot of constructions taking the dative of advantage)
- The « giver » is never said to be God, but always nature
- Finalist metaphysics: the God of *QP* is that of *Metaphysics* Λ 8
- The substance/definition of a plant is reducible to how it fulfills its two natural aims

Analogies

Most frequent occurrence is the analogy with animals, since they share the natural *opera* of plants (feed, grow, reproduce)

1. Descriptive use: part x in plants has the same function as part y in animals, so we may better understand x by our knowledge of y
2. Heuristic use: If some part x is present in animals with a certain function f, which is also displayed in plants, then there must be in plants some part y analogous to x, even if it is not observable.

E.g. : the heart in animal must have some analogon in plants

Analogies

3. Problematic use: animals differentiate suitable from non suitable food thanks to their sensation. Plants nourish themselves suitably. Therefore, plants ought to have some *analogon* to sensation.

But their lack of sensitive soul prevent them to have any kind of sensation

- Need of a new analogy: plants are comparable to a oil-lamp, as they use a kind of capillary filtration
- The (classical) animal analogy + the Aristotelian doctrines lead together to a new, quasi-mechanistic perspective on plants

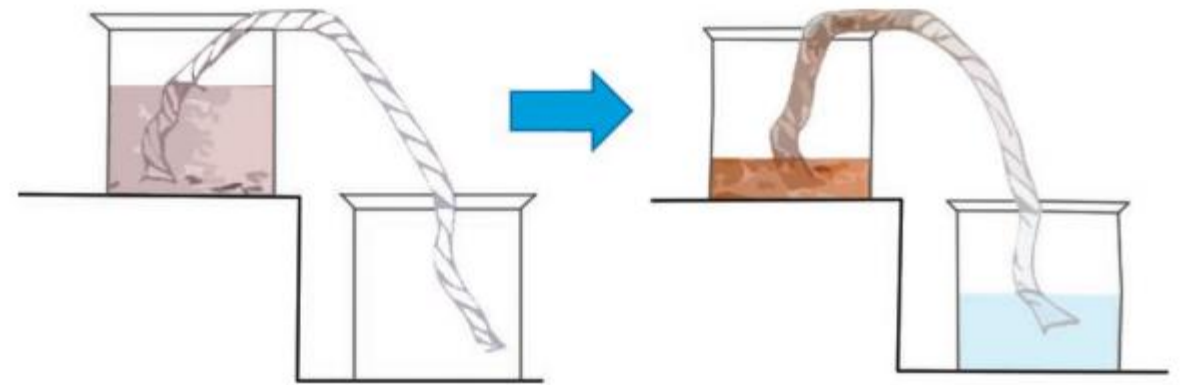


Figure 12: Illustration of capillary filtration.

Cesalpino's classification

- 1st modern botany treaty:
- -epistemological thoughts about classification
- -classification must be independant from medicine
- - based on multiple morphological features (esp. Flowers, seeds and fruits) >>> natural classification: coherent and stable
- However:
- -Theophrastus 4 great genera are the basis
- - importance of observation but aristotelian justifications and finalism (e.g. for the priority of flower and seeds)
- -no clear hierarchy or weighting of characteristics

Illustration in *De Plantis Libri*

Portrait de l'Arbre qui produit de ses fruits Canards riuans & volants.



V 11j

Portrait de l'Arbre qui porte des feuilles, lesquelles tombées sur terre se tournent en oyseaux volants, & celles qui tombent dans les eaux se muent en poissons.



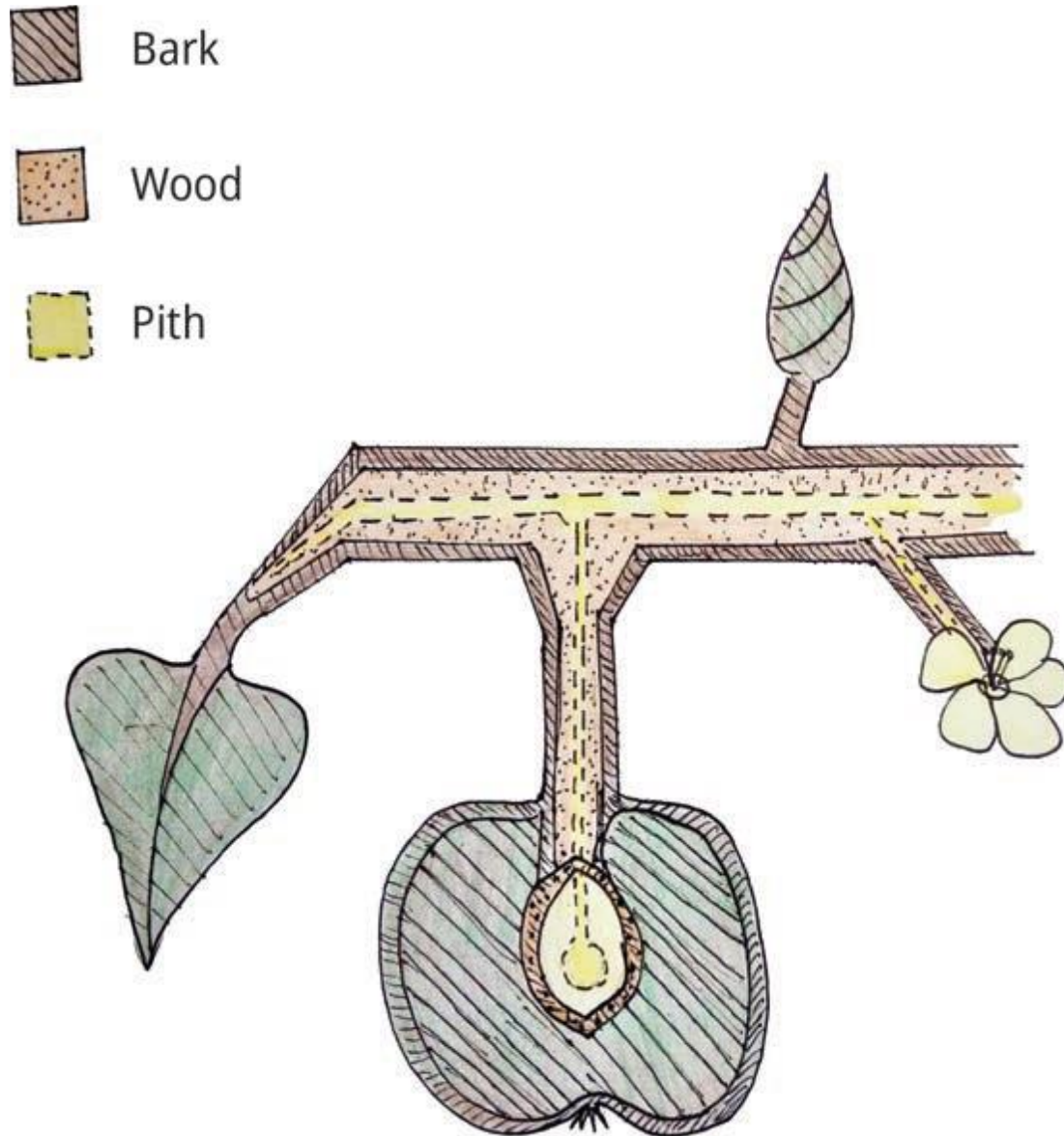
- NO illustration (innovation)
- « He who assigns them a classification according to nature, finds himself at the greatest ease, security, and advantage of all for memorising as well as observing [their] properties. [...] The inquiry pursued according to this way of ordering plants has the effect that a shorter description is sufficient, for we are not forced to repeat for individual [plants] what is common to the whole genera; and thus is gained from this short description such a solid knowledge that a picture could not produce a more certain one: indeed a picture does not show all the differences, as words can.” (Cesalpino 1583: Dedication letter V.)
- >>> methodological choice: a good description is better
- “[my work will] contain a very clear enquiry on plants, unadulterated by inventions, as is often observed with printed pictures » (ibid VII)
- >>> Images can be misleading and not exhaustive
- A species can be deduced from the description of its genus

Cesalpino dried herbarium



- 760 species collected between 1553 and 1563
- The drying conservation method between sheets was invented by Ghini
- A specimen collected on the field is more faithful than an illustration
- Cesalpino's Herbarium is one of the six oldest conserved, not the oldest or the biggest but clearly the most scientific because it follows DPL classification

Cesalpino's Physiology



- Contribution to blood circulation discovery (with Harvey)
- Theory of plant nutrition and growth in a more mechanical/empirical fashion, circulation of the ascending and descending sap
- >>> sense of observation but no real experimentation
- Anatomical theory of interlocking tissues layers in plants (bark, wood, pit) and their properties in all parts: « deductive » physiology but influential till Linnaeus

Conclusions

- DPL is a landmark for botany because of Cesalpino's sense of observation: morphology and natural classification by affinities
 - Classificatory characteristics should exclude medicinal properties
 - Criticism of the Authorities
 - Empirical dimension & « proto mechanism »
 - At the same time: strong aristotelian influence
 - Speculative theories/use of analogies
 - >>> turning point towards modern science
- 