



THE SEARCH FOR THE PRIMORDIAL PLANT

OSUN Connected Learning Contest Winner

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Course: Early Modern Science

The assignment asks students to venture to a park or garden and collect examples of A) morphological affinities among the organs of individual plants and B) morphological homologies between different species of plants. A preparatory activity acquaints students with the anatomy of an annual plant, and a concluding writing assignment asks them to reflect on their experience.

Early Modern Science

The course traces the development of what we now call science from ancient philosophy through Islamic Aristotelianism to the European enlightenment.

Practical and pedagogical value

In a semester when digital experience had come to replace much of our interaction with the outside world, the requirement of leaving the house (when possible; adjustments were made for students under quarantine or at risk) came as a welcome change: a literal breath of fresh air. This activity also facilitated collaborative work between students who lived in the same household. Those that did not were able to share their asynchronous experiences through an online forum, and in our discussion of the exercise in the following seminar. The activity was especially successful in providing all of us with a common core of lived experience through which we could interpret the text that we had read together: plants are present across the world, and the possibility of comparing them drove home many of Goethe's philosophical points concerning the similar form shared by all organisms.

The assignment required the use of a digital camera to make observations, and of image-processing software to compile the field report. The latter provided the students with rudimentary skills involved in the construction of scientific posters and in the integration of images or figures in written texts.

The search for the *Urpflanze*

*Whoever has a phenomenon before the eyes, often thinks beyond it;
whoever is only told about the phenomenon, doesn't think at all. —Goethe*

In a famous entry from his *Italian Journey*, Goethe describes his excitement upon entering the botanical garden in Palermo: “Face to face with so many new and renewed forms, my old fancy occurred to me again: Might I not discover the Primal Plant among this multitude? There must be one! How else would I know that this or that form *is* a plant, if all were not built from the same model?” Although he soon came to recognize that the Primal Plant could not consist in any particular specimen, Goethe’s insight into the affinity of botanical forms eventually bore fruit: a short treatise on the *Metamorphosis of Plants*, which—though little read at the time of its publication—contained the seed of a new science.

Although morphology—the term coined by Goethe to describe the science of transformation—is now firmly rooted in the history of biology, its origins remain obscure. This is probably due to two reasons: one ontological, and one epistemological. After all, if the *Urpflanze* is not a particular plant, then what is it? A Platonic idea? The thing in itself beyond appearances? Needless to say, the romantic metaphysics that seem to inhere in Goethe’s concept of nature do not sit well with the positivistic approach of contemporary biology. On the other hand, it is not clear what sort of knowledge Goethe’s science is supposed to communicate. While the analogies he observes between the various organs of a plant are impossible to deny, they do not seem to have much to do with the efficient causes which are the pride of modern science.

To approach these questions—and in true Goethean fashion—we will trade argument for observation, and attempt to gain first hand acquaintance with the phenomena that Goethe describes.

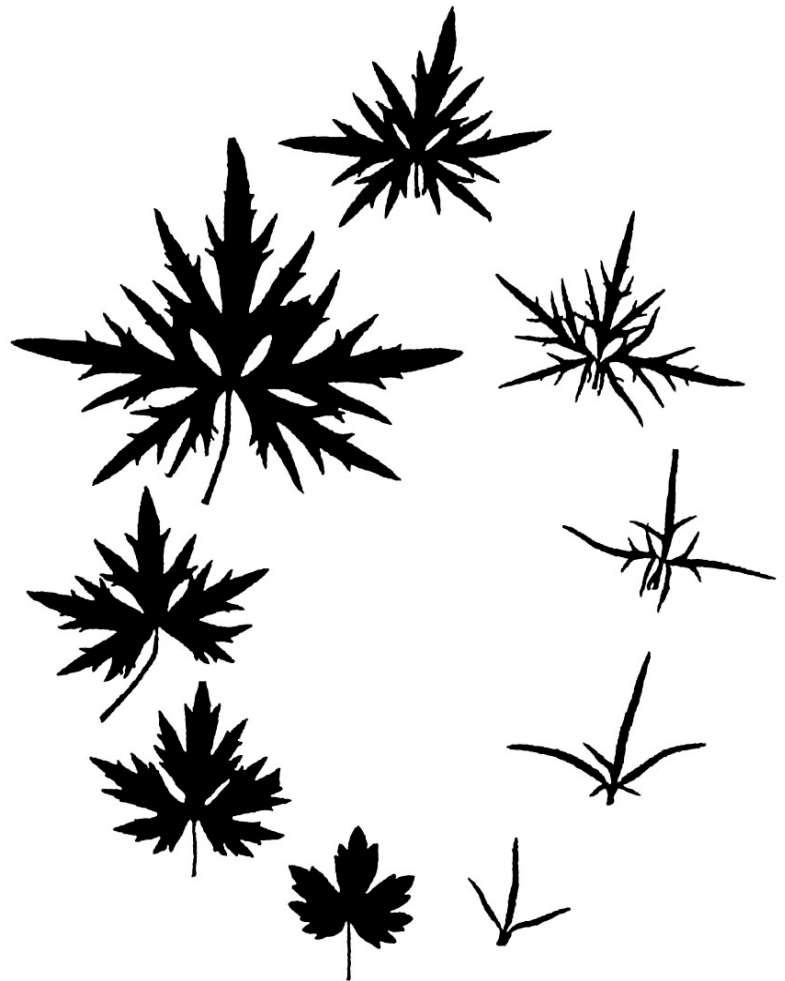


Fig. 1: leaf polymorphism in a *ranunculus*

Procedure

1. The Anatomy of a Plant. Although Goethe was no fan of “Nomenklatur und Terminologie,” it is necessary to develop a minimal acquaintance with the anatomy of a plant—if only to recognize how inadequate such terms are to account full the variety of natural forms. Label the following diagram of a typical annual plant with the terms found in the left hand column.

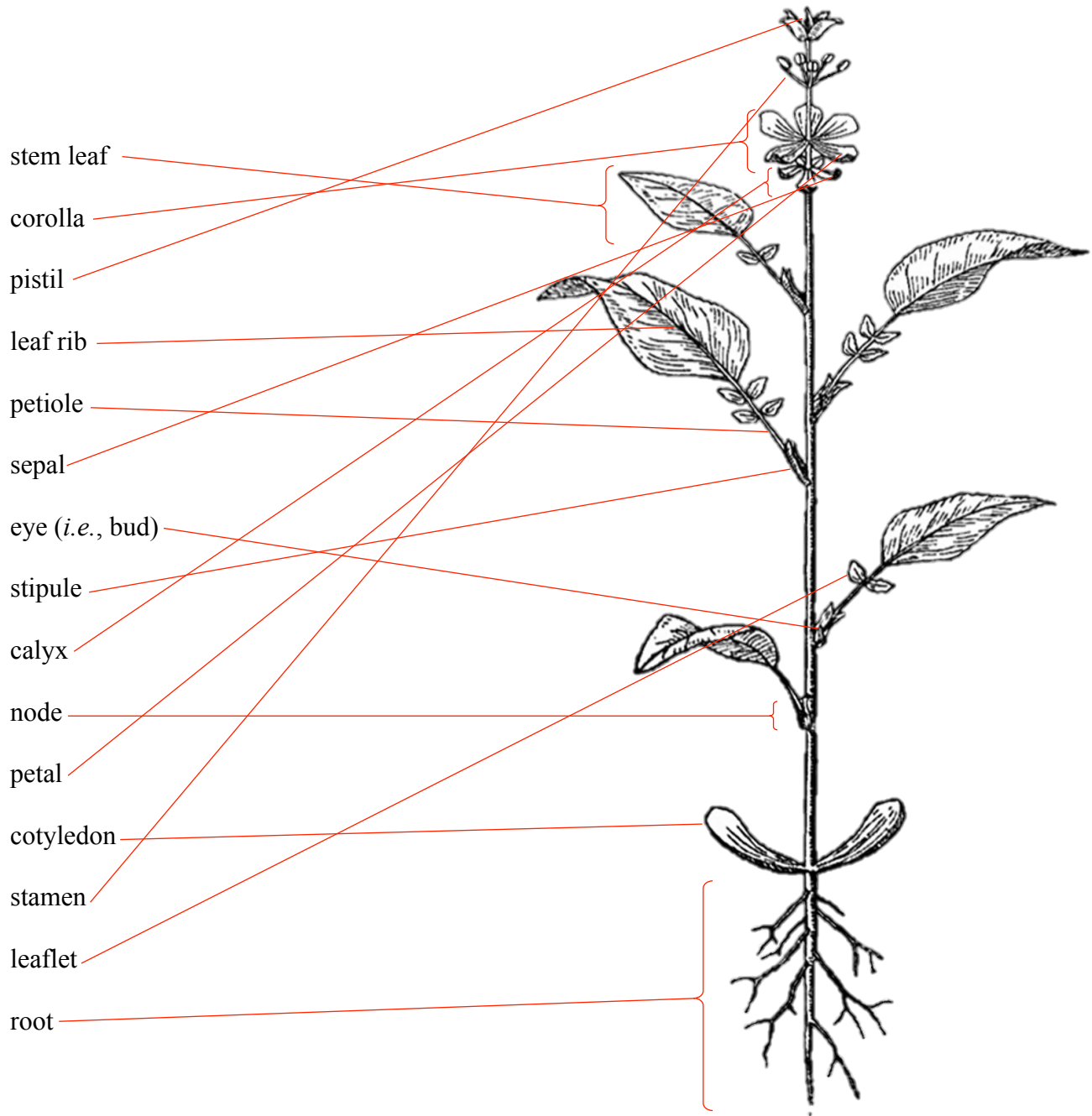


Fig. 2: diagram of a typical annual plant

2.3. Irregular metamorphosis. Occasionally an organ retrogresses to a prior form, as when a petal takes the partial form of a leaf, or when a stamen takes the partial form of a petal. Although these do not appear on the majority of plants, they are by no means rare. See if you can find an example (optional).

<p>organ 1:</p> <p>see <i>Metamorphosis</i> p. 39, 87 and example below</p>	<p>intermediate form:</p>	<p>organ 2:</p>
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In case you were unable to find any examples, here is an irregular metamorphosis in a quince flower (note the transition from petal to stamen via an intermediate form in cell B).



Fig. 3: irregular metamorphosis of *cydonia oblonga*

2.4. Reproduction. Goethe argues that the branches growing from the nodes of a plant can be considered “small plants placed on the parent in the same way that the parent is attached to the earth” (§90). Find a specimen in which this fractal structure is especially evident. Include a picture of the whole plant and a close up of the branch.

<p>plant:</p> <p>Pretty much any branching plant will do. For a variation on this theme, see the proliferous rose on <i>Metamorphosis</i> p. 94</p>	<p>branch:</p>
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3. Reflection. Now that you have collected some experience, answer each of the following questions with a few sentences:

3.1. How might one account for the different forms evidenced in leaf polymorphism?

Simple answer: different environmental conditions cause the leaf to grow in different ways (*Cf. Metamorphosis* §24-25).

More complex answer: since every individual plant can be conceived as a multiplicity, the organs of that plant are in an external relation to one another; hence, the influence of one organ on another can be considered a special case of environmental conditions. In Goethe's example, the juices refined by one leaf modify the development of the next higher leaf (*Cf. Metamorphosis* §26).

3.2. How might one account for the similarities between different organs of the same plant?

Each is a transformation of the other (*Cf. Metamorphosis* §67 among many other passages).

3.3. What does the possibility of irregular metamorphosis imply about the regular growth of plants?

That they really are variations of the same thing, even when this isn't apparent through formal similarity (*Cf. Metamorphosis* §7, §41).

3.4. If every organ of every plant is a transformation of another organ; if the branch of a single plant can be conceived as a second plant, growing out of an eye; if the seed—like the eye—is itself an organ; then what does this imply about the relation between a parent plant and its offspring? What does all of this imply about the relation between different species of plants?

That every plant is a transformation of another plant; that all natural forms have a genetic affinity. In his essays on comparative anatomy, Goethe uses this insight to develop a theory of the osteological "Typus" shared by all vertebrates. Although this concept of genetic affinity is not explicated in the text, it is suggested in the poem (written 10 years later):
 "As nature welds her ring of ageless power, / Joining another cycle to the last, / Flinging the chain unto the end of time— / The whole reflected in each separate part"