AN ABSTRACT OF THE THESIS OF

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This thesis examines the morphology of Johann Wolfgang von Goethe (1749-1832) through several lenses. The first explores Goethe's morphology as he applied it in his botanical work and supplies an explanation of what Goethe referred to as archetypal phenomena and the archetypal plant. The scope of exploration then broadens to include how Goethe's morphology related to contemporary intellectual trends, in particular Linnaean taxonomy and Kantian Idealism. These contexts serve to situate the development of Goethe's own thinking from his initial formulations of morphology to later variations. The second half of the thesis focuses on contemporary applications of Goethe's ideas in morphology. Natural aesthetics serves as a natural extension. Modern theories of natural aesthetics seek out different justifications for aesthetic experiences arising from engagement with the natural world and this thesis offers Goethe's morphology as an additional possibility. The final chapter looks at The Nature Institute and how it has adopted Goethe's methods and applied them to modern genetics while expanding its scope to include cultural and ethical contexts. Through its presentation, this thesis intends that Goethe's morphology can be applied beyond it usual biological subject matter, including itself.

The Morphology of Goethe's Botanical Work

by
Andre M. Hahn

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Andre M. Hahn, Author

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Introduction

> In reality, any attempt to express the inner nature of a thing is fruitless. What we perceive are effects, and a complete record of these effects ought to encompass this inner nature. We labor in vain to describe a person's character, but when we draw together his actions, his deeds, a picture of his character will emerge.
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> -Goethe, *Theory of Color*

This thesis examines Johann Wolfgang von Goethe's (1749-1832) morphology, only one of his many pursuits which also included literature, law, and sketching. Though Goethe is mostly known for his literary accomplishments, his scientific writings form a substantial part of his overall work. The literature on Goethe reflects his many sides and focuses on his literary and scientific work. Goethe's morphology also takes on a multifaceted approach whether its subject matter is botany or color; it looks at the phenomena under consideration from a variety of what we would today call disciplines. In discussing Goethe's work, I have adopted a similar method by presenting Goethe's morphology from different perspectives. These perspectives are not meant to be exhaustive but are representative enough to begin forming a picture of the character of Goethe's morphology along the lines of the above quotation. The four perspectives I present look at his morphology philosophically, historically, in relation to natural aesthetics, and as an influence on The Nature Institute of New York. Each of these perspectives brings out a different aspect of Goethe's morphology, while still focusing on it as such.

The first chapter examines Goethe's morphology from a philosophical perspective. Here, methodological understanding is central; that is, how did Goethe

apply his morphology and what did its applications and results look like? Goethe's botanical work takes center stage and emphasis falls on *The Metamorphosis of Plants*. Looking at Goethe's work in this way reveals close connections between subject and object, a connection often considered tenuous and uncertain. This connection rests in the imagination and its ability to simulate perception, particularly vision, and create juxtapositions of forms unavailable to perception alone.

Chapter Two examines Goethe in relation to some of his contemporaries and the issues of his day while also considering the presentation of his morphological work. Here two ways of understanding the world become important: taxonomy and idealism. Goethe's relation to taxonomy dominated his earlier life when he began his botanical studies. Linnaeus and his followers played a major role in teaching Goethe about botany and ultimately acted as a springboard for him to publish his own ideas on botany. Goethe's relation to idealism comes largely through his interaction with Kantianism, especially through his close friend the poet and dramatist Friedrich Schiller. In addition to challenging Goethe philosophically, Schiller worked with Goethe to establish Weimar Classicism as the dominant trend in German art and letters. Goethe's work in this area and his engagement with idealism happens in the middle part of his life, after he had already developed many of his botanical ideas. Idealism expanded the scope of what Goethe saw as relevant to the presentation of scientific ideas. With Goethe's incorporation of idealism, the scientist himself/herself became one of the relevant perspectives of the natural phenomena in question, and the

subject matter metamorphoses from the natural phenomena of plants to the human phenomenon of biography and history.

Chapter Three moves beyond Goethe to explore how his work relates to contemporary ideas in the aesthetics of nature. Here I have drawn on two contemporary theorists in natural aesthetics: Emily Brady and Allen Carlson. Brady's and Carlson's theories bring out features of Goethe's morphology that can be applied in an aesthetic setting. Brady brings attention to the role of imagination in aesthetic appreciation which parallels, to a large extent, Goethe's morphological approach to nature. Carlson, on the other hand, points to the role of science in aesthetic appreciation of nature which allows us to examine Goethe's work for its conclusions. Yet these two ways of incorporating Goethe's morphology into natural aesthetics arrive at a similar place because of the close connection between subject and object where active participation in the observation of nature grounds aesthetic experience.

The final chapter looks at how Goethe's morphology has been taken up in present day New York and presented to the public by The Nature Institute. Through The Nature Institute, the subjects of the preceding three chapters reappear as ways of understanding nature under the name of "contexts." But these are not the only relevant contexts: ethical and environmental concerns become important as well. In this way, The Nature Institute shows how Goethe's morphology informs present understandings of nature.

This thesis strives to convey the participatory nature of Goethe's morphology. This participation occurs through the active relating of sensory and mental capabilities

by the individual such as vision and the imagination. Goethe joins these two capabilities together so that neither is neglected in favor of the other. Our senses, particularly vision, are not left to their own, but they are always drawing on mental capacities to make sense of sensory experiences whether through attempts at understanding or making aesthetic judgments. Likewise, mental capacities, like the imagination, are not left to themselves, working in a strictly theoretical realm, but are continually relating in one way or another to our sensory experiences. In this way participation becomes a participation with both our natural and mental landscapes.

Some notes on my use of certain words are also in order. In the German, Goethe attaches *Ur-* to words such as *Phänomen* (phenomenon) and *Pflanze* (plant). When these words occur in texts, they are often translated as primal, primary, or archetypal phenomenon or plant. I retain the translations as they are in the texts I quote and leave *Urphänomen* and *Urpflanze* untranslated in my own writing. My reason for doing so is to help emphasize the singularity of the experience attached to these words. When they are broken into two words such as archetypal phenomenon it is easy to begin to break apart the experience they refer to as well and focus only on one aspect of that experience. I hope that my reading of Goethe justifies approaching these words in this fashion.

The bibliographic scope of this thesis is diverse. It is common, when studying Goethe, to draw mainly on an edition of his collected works. These are most often in German, and since I am using English translations, I have chosen to draw on more thematic collections. Most helpful in relation to Goethe's scientific work have been

Goethe's Botanical Writings (originally published in 1952), translated and edited by Bertha Mueller, *Scientific Studies* translated and edited by Douglas Miller, which is volume 12 of *Goethe: The Collected Works* (originally published in 1988), and *Goethe on Art* (1980) edited and translated by John Gage. As biographical sources I have turned to *From My Life: Poetry and Truth (Part One to Three)* translated by Robert R. Hietner and also apart of *Goethe: The Collected Works*, Goethe's letters and commentary available in *Italian Journey* (originally published in 1968) translated by W. H. Auden and Elizabeth Mayer, and the two volume *Correspondences with Schiller and Goethe, from 1794 to 1805* (originally published 1877) translated by L. Dora Schmitz. Though some of these translations are dated, I have found them relevant.

For secondary work relating to Goethe, two collections are particularly relevant: *Goethe and the Sciences: A Reappraisal* edited by Frederick Amrine, Francis Zucker and Harvey Wheeler, and *Goethe's Way of Science: A Phenomenology of Nature* edited by David Seamon and Arthur Zajonc. I have also culled several articles from journals. In general, articles on Goethe deal with a particular aspect of his scientific writings such as botany, color, or method and some attempt an application of Goethe's methods. Each type of article may contain something of relevance for other areas of concentration in Goethe studies, so I have not limited myself to a certain group.

English monographs on Goethe's science are rarer. In terms of historical as well as philosophical context, Robert J. Richards' *The Romantic Conception of Life*

has been the most helpful. For Goethe's own use of history in his science Karl J. Fink's *Goethe's History of Science* was very illuminating.

In an attempt to historically contextualize Goethe's scientific thinking, I have related him to Michel Foucault's *The Order of Things*. To relate Goethe to the more current debate on natural aesthetics, I have used *The Aesthetics of Natural Environments* edited by Allen Carlson and Arnold Berleant. All the literature relating to The Nature Institute comes from their newsletter, *In Context*, books, and their website.

I have drawn on sources outside traditional Goethean scholarship in order to see how Goethe's thought compares with those of others. This comparison occurs in chapters two through four and shows where Goethe might be relevant today in historical, aesthetic, and scientific discussions. Before exploring these, Goethe's own morphological work is the subject of the first chapter.

Chapter One: Phenomena and *Urphänomene*: Goethe's Morphology in *The Metamorphosis of Plants*

> In his *Anthropology* (a book to which we will again refer), Dr. Heinroth speaks favorably of my work; in fact, he calls my approach unique, for he says that my thinking works *objectively*. Here he means that my thinking is not separate from objects; that the elements of the object, the perceptions of the object, flow into my thinking and are fully permeated by it; that my perception itself is a thinking, and my thinking a perception.
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> -Goethe, "Significant Help from and Ingenious Turn of Phrase"

Morphology as Theory or Method

Since Johann Wolfgang von Goethe developed his morphological methods, there have been differing interpretations of his work and how it can relate to other understandings about nature. One interpretation sees Goethe's morphological work as a completed theory arising from his empirical work with ideas such as the *Urphänomen* and *Urpflanze* taking on the character of conclusions.[1] An alternative approach towards Goethe's work has taken this ideal and seen it as a methodological practice. Out of this arose Goethe's association with biological morphology along

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[1] Robert J. Richards, *The Romantic Conception of Life: Science and Philosophy in the Age of Goethe* (Chicago: University of Chicago Press, 2002); Otto Haas, "Goethe and Evolution." *Osiris* 10 (1952): 35-42; Ernst Haeckel, "Goethe on Evolution," *The Open Court* 4 no. 131. (27 February 1890) American Periodical Series Online; Timothy Lenoir, "The Eternal Laws of Form: Morphotypes and the Conditions of Existence in Goethe's Biological Thought," *Goethe and the Sceinces: A Reappraisal*, ed. Frederick Amrine, Francis Zucker, and Harvey Wheeler (Dordrecht, Holland: D. Reidel, 1987), 17-28; Anne Harrington, *Reenchanted Science: Holism in German Culture from Wilhelm II to Hitler* (Princeton: Princeton University Press, 1996):4-7. Haas and Haeckel tended to see Goethe as an evolutionist or proto-evolutionist. Richard's account, though it also points to Goethe as a forerunner of Darwin, is much more complex than that of Haas and Haeckel since he also recognizes Goethe's gradual incorporation of idealism. Lenoir and Harrington point to Goethe's *Urphänomen* and *Urpflanze* as representing natural forces and laws applicable to the biological realm as gravity and Newton's laws of motion are in the physical sciences.

with the application of morphology to other areas of study.[2] Still another way of looking at Goethe's morphology attempts to take both of these aspects into account and describe what Dalia Nassar has called "Goethe's empirical idealism"[3] This approach to Goethe's morphology does not discount seeing Goethe's work resulting in theoretical conclusions, but rather identifies those conclusions as integral to methodological practice as well. Here the methodological aspects of Goethe's morphology are embedded in his work in such a way that theory and practice are mixed, or, more exactly, two aspects of the same thing. In this chapter, I follow this third way of looking at Goethe's scientific work and suggest that terms such as *Urphänomen* and metamorphosis of plants point to similar experiences which include both an ideal and sensorial aspect connected to the qualities of an object in a way that combines conclusions and method.

Recalling Goethe's first conversation with his close friend Friedrich Schiller is relevant here. When Schiller challenged Goethe that his morphological work was only an idea, Goethe responded, "Then I may rejoice that I have ideas without knowing it,

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[2] David M. Williams and Malte C. Ebach, *Foundations of Systematics and Biogeography* (New York: Springer, 2008). Williams and Ebach place Goethe within the taxonomic tradition alongside Richard Owen, Willi Hennig, and others.

[3] Dalia Nassar, "Idealism is Nothing but Genuine Empiricism: Novalis, Goethe, and the Ideal of Romantic Science," *Goethe Yearbook* 18 (2011): 67-95; Arthur Zajonc, "Facts as Theory: Aspects of Goethe's Philosophy of Science,"; Frederick Amrine, "The Metamorphosis of the Scientist," *Goethe's Way of Science: A Phenomoenology of Nature*, ed. David Seamon and Arthur Zajonc (Albany: State University of New York Press, 1998), 33-54; Chad Wellmon, "Goethe's Morphology of Knowledge, or the Overgrowth of Nomenclature," *Goethe Yearbook* 17 (2010): 153-177; Thomas Pfau, "'All is Leaf': Difference, Metamorphosis, and Goethe's Phenomenology of Knowledge," *Studies in Romanticism* 49, no. 1 (Spring 2010): 3-41; Richards can be included here as well as he relates Goethe with Schelling's synthesis of idealism and realism.

and can even see them with my own eyes."[4] One aspect of how this synthesis of the ideal and the sensorial, seeing ideas with one's eyes, worked for Goethe was by redefining the boundaries of an object.[5] Often, objects are defined by their spatial and temporal boundaries, but the object Goethe pointed to with *Urphänomen* and the metamorphosis of plants is ideally bounded so that it exists in each spatial-temporal object. Understanding these terms in this way allows for the possibility of seeing *Urphänomen* and the metamorphosis of plants as types of conclusions about what an object is as well as methodological directions; that is, the conclusion coincides with the naming of the object and the method lies in uncovering the object that is named.

What does this synthesis of the ideal and sensorial look like? Goethe's reflection on his original intuition of plant morphology in *Italian Journey* (1816-1817) states "that in the organ of the plant which we are accustomed to call the *leaf* lies the true Proteus who can hide or reveal himself in all vegetal forms. From first to last, the plant is nothing but leaf."[6] At first glance this appears as a purely theoretical conclusion, as an organizing principle that Goethe has come upon to understand plants. "The plant is nothing but leaf" is not something immediately apparent from

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[4] Johann Wolfgang von Goethe, *Scientific Studies*, ed. and trans. Douglas Miller, vol. 12, *Goethe's Collected Works*, ed. Victor Lange, Eric Blackall, and Cyrus Hamlin, (New York: Suhrkamp, 1995), 20.

[5] Pfau, 9, Pfau draws attention between the "object-knowledge in the modern, Cartesian or Newtonian sense" and Goethe's "knowledge as the mediation of life itself" as a kind of Heideggerian "event." I do not intend here to oppose Pfau's view, but hope to bring out what can be understood as "the mediation of life itself" as it relates to knowledge in ideal and sensorial forms.

[6] Johann Wolfgang von Goethe, *Italian Journey*, trans. by W. H. Auden and Elizabeth Mayer (New York: Schocken Books, 1968), 363. Though much of the writing in *Italian Journey* took place during his travels between 1786 and 1788, they were not published until 1816-1817 and so contain interspersed commentary after some 30 years of reflection.

direct observation. It even appears somewhat absurd at first glance. Plants not only have leaves, but they have flowers, stems, roots, seeds, stamens, etc. To take Goethe's statement seriously, we would have to hold contradictory ideas and somehow make sense of them: for Goethe a "plant is nothing but leaf," while in our ordinary experience, a plant is partially leaf. Once reaching this step, the methodological practice has begun by stepping away from the view that Goethe's statement is a finished conclusion which can be accepted or rejected. When approached methodologically, "the plant is nothing but leaf," refers to a potential for activity. Only by following up on this potential is it possible to experience the activity embedded in his statement. The statement may otherwise remain empty, unfamiliar, or strange. Here methodological activity is at work in addition to a theoretical conclusion.

After taking this first step into the method of "the plant is nothing but leaf," we can pursue it further. Next to the suggestion "the plant is nothing but leaf" is the ordinary experience of "the plant is partially leaf." Placing these two statements as pictures side by side, they do not line up except where leaf meets leaf. Where leaf meets flower, fruit, root, etc there is no correspondence. If we do not abandon Goethe's statement at this point, we would have to ask questions such as, "How is a leaf like a flower?" It is at this point that we can follow Goethe into *The Metamorphosis of Plants* (1790).

The Metamorphosis of Plants

Goethe recognizes that he is not the first to approach plant metamorphosis, seeing it as something which "has long been recognized by naturalist in a general way" and "even studied in detail."[7] With *Metamorphosis*, Goethe hopes to develop such ideas further and "avoid speaking in terms of what is fixed."[8] Even though he uses terms that normally call up ideas of fixed forms, this fixity should be understood as "an abstract idea or concept, or something which in actuality is held fast for but an instant" and not as the focus of Goethe's endeavor.[9] Without this central idea, *Metamorphosis* can appear more as the elaboration of a theory leaving the reader to overlook its methodological aspects.[10]

Goethe distinguishes between three different types of metamorphosis in his study: regular, irregular, and accidental. Accidental metamorphosis results from outside influences such as insects and Goethe leaves it to the side. His discussion concerns regular and irregular metamorphosis, also called by him progressive and

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[7] Johann Wolfgang von Goethe, *Goethe's Botanical Writings*, trans. Bertha Mueller (Woodbridge, Connecticut: Ox Bow, 1989), 31; Edward S. Russell, *Form and Function: A Contribution to the History of Animal Morphology* (Chicago: University of Chicago Press, 1982); William Whewell, *History of the Inductive Sciences, from the Earliest to the Present Times* (New York: D. Appleton and Company, 1859): 470. Russell views Goethe's work as unoriginal, saying Goethe overlooked others that had worked in the same areas as himself. Whewell gives Goethe the benefit of the doubt and recognizes similarities, but not identity, with others like Linnaeus and Peter Camper.

[8] Goethe, *Botanical Writings*, 23.

[9] Ibid., 24.

[10] Ronald H. Brady, "Form and Cause in Goethe's Morphology," in *Goethe and the Sciences: A Reappraisal*, ed. Frederick Amrine, Francis J. Zucker, and Harvey Wheeler (Dordrecht, Holland: D. Reidel Publishing, 1987); Harrington; Williams and Ebach. Both Brady and Williams and Ebach distinguish Goethe's morphology from Richard Owens by noting that Owens focused on the static *Gestalt* (form) while Goethe stressed the mobile *Bildung* (forming or formation). Harrington follows Goethe the other direction and sees him as emphasizing *Gestalten*.

retrogressive. The first refers to the normal step by step progression of seed, through leaves, flower, fruit, and back to seed. Irregular metamorphosis occurs in instances when we would expect a stigma, but instead there is a leaf. Goethe gives the examples of Persian buttercup (*Ranunculus asiacticus*) (Fig. 1) and the "perfoliate rose" (Fig. 2).[11] The *Ranunculus asiaticus* "is doubled when the stigmas and pistils of the fruit receptacles are transformed into genuine petals, while the stamen directly below the corolla are often unchanged."[12] With the "perfoliate rose," "Calyx and corolla are arranged and developed around the axis; however, the seed container

Fig. 1 (left) *Ranunculus asiaticaus* with a double flower. From *Goethe's Botanical Writings*, p. 60.

Fig. 2 (right) Painting of "perfoliate rose" commissioned by Goethe. From frontispiece in *Scientific Studies*.

[11] "Perfoliate rose" may have been a name given by Goethe to this particular rose and so has no scientific name. Perfoliate denotes when a stem is completely surrounded by a leaf or in this case the flower. I was unable to find any reference to it outside writings that refer to Goethe's usage.
[12] Goethe, *Botanical Writings*, 60.

in the center is not contracted, nor are the male and female sexual parts *arranged* on and around it in ordered sequence; instead, the stalk shoots *upward* again, *half red* and *half green*."[13] With these cases of irregular metamorphosis, expectation by the observer of a certain form is not met and another form that was present at an earlier stage of growth reappears. Here, Goethe's statement that the plant is "nothing but leaf" becomes clearer through his recognition of the potential growth of a leaf, or other organ, at any point in the development of a plant as a result of retrogressive metamorphosis.

Though Goethe finds irregular metamorphosis particularly insightful, most of *Metamorphosis* is dedicated to regular metamorphosis. Goethe begins by describing the transition from seed to the emergence of the cotyledons, or seed leaves. Goethe notes that these leaves often do not look like the leaves we expect, being "misshapen, crammed, as it were, with crude matter, and as much expanded in thickness as in breadth."[14] But following them further these leaves lose some of their initial properties and become more identifiable as leaves. With the recognition that these are leaves, a node must also be present and so Goethe calls "the point where the cotyledons are attached... the first true nodal point of the plant."[15] Development of the stem leaves takes place at successive nodal points. Goethe views these leaves as developing from a simple to complex form as they emerge along the stalk. He attributes this complexity to the effects of air on the leaf pointing to the less complex leaves of underwater plants as justification. Goethe recognizes this as a phenomenon

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[13] Ibid., 73.
[14] Ibid., 33.
[15] Ibid., 34.

which occurs with incomplete anastomosis of the leaf veins, that is, the incomplete connection of veins by leaf matter.[16] Water crowfoot (*Ranunculus aquaticus*) serves as a particularly good example of this by having veins with little connective leaf matter forming below the surface of the water and completely anastomosed leaves with their connective matter above water. This shows even more clearly in leaves that form at the water's surface and develop both forms in respect to whether that part of the leaf is above or below water (Fig. 3).

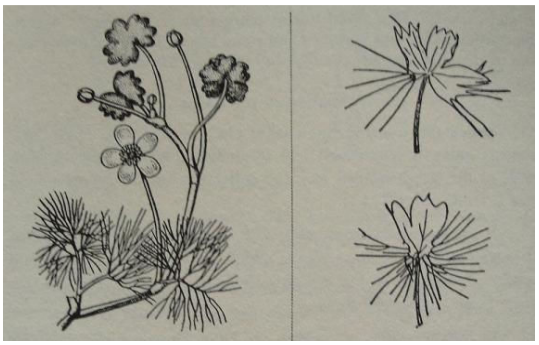

Fig. 3. *Ranunculus aquaticus*. Left Showing underwater leaves on the bottom and aerial leaves on the top of the same plant. Right showing floating leaves with bottoms underwater. From *Goethe's Botanical Writings*, p. 41.

The transition from leaf formation to flower formation signals "that the epoch we have been studying has drawn to a close and that a second is approaching – the epoch of the flower."[17] At this transition between "epochs," Goethe's remarks on the saps or fluids of the plant are relevant. These saps have various levels of refinement. In the leaves and stalk they are of a thicker, denser quality, while as they reach the flower they become thinner. As the leaves develop, these saps are "continually drained off and replaced by purer ones" until they become even finer in the flower.[18] Goethe connects these saps with the

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[16] Frederick Amrine, "Goethean Intuitions," in *Goethe Yearbook*, vol. 18, ed. Daniel Purdy (Rochester, New York: Camden House), 61-62. Amrine refers to Goethe's view of anastomosis as "mysterious and revealing," something that is an "enacted, displayed synthesis; *natura naturans* made visible."
[17] Ibid., 42.
[18] Ibid., 41.

nutrition of the plant, noting that when a plant flowers sooner than expected it is because nutrition is being withheld and that, conversely, excess nutrition delays flower formation. The excess nutrition leads to an excess of thicker saps which are drained through the leaves and bog down the leaf nodes. When this is not the case, "the nodal organs become more refined, the action of unadulterated saps becomes purer and stronger, and the transformation of the parts is made possible and proceeds irresistibly."[19] Goethe's ideas on plant sap reflect an attempt by him to incorporate ideas that are not strictly sense based. The English scientist William Whewell (1794-1866) was one of the first to criticize Goethe here for bringing in theoretical assumptions, but it is unclear where these assumptions come from and whether Goethe makes them himself or has gleaned them from others.[20]

Turning to the beginnings of flower formation itself, Goethe asserts, "It can be proved most clearly, it seems to us, that the leaves of the calyx are the very same organs which have previously made their appearance as stem leaves, but are now clustered around a common center, often in greatly altered form."[21] Here continuity is maintained between dissimilar forms. This continuity continues through to even more dissimilar forms that may appear in the corolla. Holding together this continuity are types of movement that are also central ideas for Goethe: that of contraction and expansion. Goethe notes that through the leaf development there had been a "great

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[19] Ibid., 42.
[20] See note 7. Whewell refers to Goethe's process as deductive rather than inductive while Russell notes that Goethe was preceded in his morphological discoveries by Aristotle, Linnaeus, and Camper.
[21] Goethe, *Botanical Writings*, 42.

enlargement and elaboration of the leaf, especially in its periphery."[22] This expansion gives way to "contraction of the outline" in the calyx which in turn becomes an expansion into the petals of the corolla.[23] With the introduction of the concepts of expansion and contraction, the leaf as the Proteus organ of the plant becomes clearer. No consistent form exists through the development of plants, but several forms exist side by side both spatially and temporally. The relation these forms take on is mediated through the movements of expansion and contraction so that what appear are not several unrelated forms, but a continuous dynamic, mobile form. This play between expansive and contractive tendencies is not between the whole and the parts of the organism in the Kantian sense, but between two movements of the whole form (expanding or contracting) and not hierarchically related static levels (whole and part).

This opposition of forces, or movements, at work in metamorphosis ends up playing two roles. When speaking more generally of these forces, Goethe places them within the process of metamorphosis, but they also take on significance for the understanding of metamorphosis, pointing to the entwinement of the conceptual and perceptual. Frederick Amrine has described this entwinement as "the metmorphosis of the scientist" where "Goethe's scientific ideal is to allow oneself to be transformed in following the transformations of the phenomena."[24] In the short essay "Problems" (1823) Goethe says metamorphosis, in an extreme form of expansion, "is like the *vis*

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[22] Ibid., 46.
[23] Ibid., 46.
[24] Amrine, "Metamorphosis," 37.

centrifuga" and "leads to formlessness; it destroys knowledge, dissolves it."[25] Expansion connotes here not only spatial expansion of the form, but also increase in the number of forms under consideration by the morphologist. This latter, quantitative, expansion occurs as a tendency to formlessness in nature through the occurrence of continual change. As this continual change from one form to another occurs with a plant, understanding of the form also continually changes through re-representing that form with the imagination. This is the case when moving towards understanding the next form in a sequence we must "dissolve" our understanding of the previous form so that it does not interfere with imagining the next. The notion associated with a form expands to include other forms. A relevant example is the common buttercup (*Ranunculus acris*, Fig. 4), which shows a dramatic change in leaf form going up the stalk. The more dramatic the change the more flexible our own conception needs to be of the change between forms. In this case two leaves may appear very different, such as the first and last leaves in the sequence, and yet they are connected through a morphological conception. The tendency to dissolve is in the tendency to say two forms in a sequence are not the same leaf. By doing this, what is united through morphological understanding becomes separate, broken apart, or dissolved in non-morphological, analytical understanding.

[25] Goethe, *Scientific Studies*, 43.

Working against this tendency to formlessness is "a *vis centripeta*," or "the drive for specific character" and "the stubborn persistence of things which have finally attained reality."[26] Here, once a form is established it is held on to with little change in forms occurring. The relation to contraction is through the focus on one form rather than several; there is no sequence of forms. Goethe uses the example of the genus *Erica*, which includes species such as the ninepin heath (*Erica mammosa*) that produces leaves and flowers that are identical in form at each node on the stalk. Here it is easy to maintain one conception relating to a several instances of a form since there is little variation in those instances. These opposing forces of dissolution and stasis, expansion and contraction, are constantly at work together and "any didactic description would have to show them simultaneously" which Goethe views as possible only through developing a "symbolism."[27] But he has doubts even about this.

Fig. 4 Sequence of stem leaves of common buttercup. First stem leaf on bottom left, then going clockwise until reaching the uppermost leaf on bottom right. From *Goethe's way of Science*, p. 94.

[26] Ibid., 43.
[27] Ibid., 43.

Turning back to the metamorphosis of a single plant, this breathing process between expansion and contraction continues in Goethe's description with the formation of the stamens as a contraction of the petals. Bertha Mueller, editor of *Goethe's Botanical Writings* uses the white water lily (*Nymphaea alba*) as an example to express this transition. Here the tip of the petal folds over as it decreases in width over four stages becoming a stamen (Fig. 5). This movement from petal to stamen explains intermediate organs found in the flower which Linnaeus described as nectaries. Goethe would also have us include here coronas as found on the daffodil (*Narcissus pseudonarcissus*). This contraction is carried all the way to the pollen where all that remains "are merely vessels in which extremely refined sap is stored" which the pistils then absorb upon fertilization, another form of anastomosis for Goethe.[28] Anastomoses occurs here because the style forms out of the same contraction process as the stamen; the contraction has worked in such a way as to separate the two (as had happened with veins of underwater leaves) which are then joined again in fertilization. The limit of this contraction marks the beginning of the fruit.

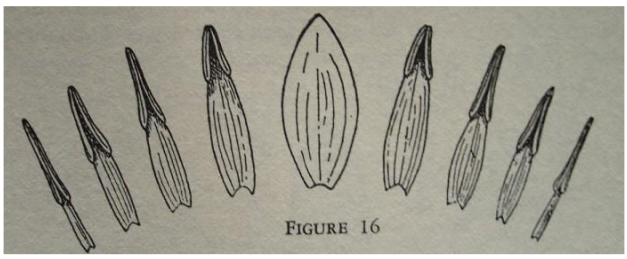

Fig. 5 Transition from petal to stamen in white water lily. From *Goethe's Botanical Writings*, 47.

[28] Goethe, *Botanical Writings*., 56.

The continuity to fruit is explained by taking the sections of fruit pods which enclose a seed as corresponding to individual leaves. These are usually joined together, yet Goethe finds special circumstances where their relation is revealed such as in devil in the bush (*Nigella damascena*) and yellow fennelflower (*Nigella orientalis*) (Fig. 6). In the first case, all seed hulls are tightly fused together. Yet in the second they slightly separate and individualize, giving the impression of a calyx.

Marigold (*Calendula officinalis*) seeds show the contraction of seeds. Here the seed appears in concentric circles. The outer most circle of seeds appear similar in form to sepals and are usually infertile. It is not until reaching the innermost circles do recognizable fertile seeds appear. The formation and completion of the seed marks the move back to the beginning of the plant's developmental process.

With these explanations, we can see Goethe's distinction at work between a fixed form and a dynamic form. This comes about by attaching words to processes rather than parts so that the statement "the plant is nothing but leaf" is not understood by "leaf" being an object, a part of a plant, but rather as a process of metamorphosis. Though Goethe had enthusiastically claimed the identity of metamorphosis with the leaf

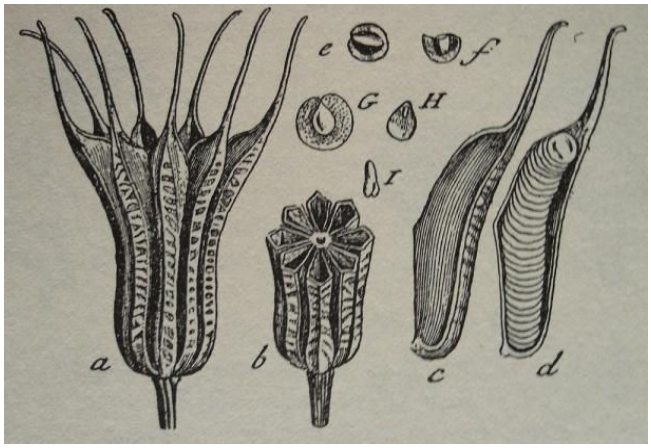

Fig. 6 Fruit pods of *Nigella orientalis*. From *Goethe's Botanical Writings*, p. 63.

with his initial intuition of plant metamorphosis, he ends *Metamorphosis* with a more sober call that

> It is self-evident that we ought to have a general term with which to designate this diversely metamorphosed organ and with which to compare all manifestations of its form... For we might equally well say that a stamen is a contracted petal, as that a petal is a stamen in a state of expansion.[29]

Here we see Goethe clearing up any confusion about the association of a literal leaf to the process of metamorphosis.

This is a small step towards disconnecting the idea of an object from its spatial and temporal boundaries since the process that unites the various parts of the plant is not the physical plant alone, but the continuity of form inherent in its parts. In this way, the various parts are abstracted from the actual plant and placed alongside one another. Goethe hints at this in some notes on method when he refers to "A semi-annual completed plant plucked apart."[30] The disconnecting of the object from spatial and temporal boundaries becomes clearer by considering Goethe's use of various plants.

Expansion from plant to plants

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[29] Goethe, *Botanical*, 77.

[30] Ibid., 94; Jochen Bockemühl, "Transformation in the Foliage Leaves of the Higher Plants," *Goethe's Way of Science: A Phenomoenology of Nature*, ed. David Seamon and Arthur Zajonc (Albany: State University of New York Press, 1998) 115-128. See figure 4 above. Bochemühl shows this very clearly by using plates of silhouetted leaves from a single plant in a progression from first to last. These are then juxtaposed to similar sequences from other plants to show the range of formal movements of "stemming," "articulating," "spreading," and "shooting."

As Goethe considered plant development he not only brought attention to particular parts of the development of certain plants, but also pointed towards what he would call an *Urpflanze*, which is usually translated as archetypal, original, or primordial plant. It is easy to fall back on more common conceptions of an ideal or ancestral plant.[31] What we can gather from *Metamorphosis* is that this is not the case. Although *Urpflanze* is not mentioned in *Metamorphosis,* it is implicitly there.

Though Goethe is explaining plant metamorphosis as if it were one plant, his examples draw on multiple plants. There are roses, lilies, daffodils, buttercups, and many more. In his *Theory of Color* (1810), Goethe explains this method clearly:

> In general, events we become aware of through experience are simply those we can categorize empirically after some observation. These empirical categories may be further subsumed under scientific categories leading to even higher levels. In the process we become familiar with certain requisite conditions for what is manifesting itself. From this point everything gradually falls into place under higher principles and laws revealed not to our reason through words and hypotheses, but to our intuitive perception through phenomena. We call these phenomena *archetypal phenomena* because nothing higher manifests itself in the world; such phenomena, on the other hand, make it possible for us to descend, just as we ascended, by going step by step from the archetypal phenomena to the most mundane occurrence in our daily experience.[32]

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[31] David M. Williams and Malte C. Ebach, *Foundations of Systematics and Biogeography* (New York: Springer, 2008); Harrington. Williams and Ebach are careful to distinguish between Goethe's and Richard Owen's ideas on archetype, noting the Owen's has more of the character of a general fixed idea as compared to Goethe's more flexible *Urphänomen*. Additionally, Williams and Ebach's whole project is to maintain taxonomy distinct from evolutionary influences, so viewing *Urphänomen* as an ancestor is also misleading for them. Harrington sees Goethe's work pointing to something like the more common understanding of a Platonic form as an idealized instance of an object. Also see 10 above.

[32] Goethe, *Scientific Studies*, 194-195.

These archetypal phenomena (*Urphänomene*), where we are able to ascend to the ideal and descend to the phenomena, also appear in *Metamorphosis* as the particular plants that Goethe uses as he is describing plant metamorphosis. As *Urphänomene* they are clear examples of a total process which is not tied to particular plants. At the same time, that process is not expressed as fully in other plants. The white later lily, the "perfoliate rose," and *Ranunculus aquaticus* all show properties of plants that are not obvious in other plants but do exist in others as potential properties. Using Goethe's terminology we could say that there is an expansion of particular features in certain plants that is contracted in other plants to the point that they disappear from view or happen rapidly through a small number of expressed forms. These *Urphänomene* then point to the *Urpflänze* which works through each individual plant in a particular way, expressing a different aspect of metamorphosis more clearly in one while expressing another aspect more clearly in another.

Fig. 7 Tulip with leaf-petal. From *Goethe's Botanical Writings*, p. 53.

The *Urpflänze* is differentiated from an idea in that it is immanent in all plants and not merely accessible to thought; its forms *are* the various forms of plants. Another example from *Metamorphosis* will make this clearer. Goethe had a painting of a tulip done in which the one of the petals is also connected further down on the stem (Fig. 7). The more common tulip we see, where petals and leaves are clearly

distinguished, shows one aspect of the *Urpflanze* where leaf and petal are kept separate. The tulip pictured shows another aspect, one where leaf and petal are not clearly distinguished and are in fact joined together while growing from two different places. The *Urpflanze* then includes a totality of forms which includes the forms of existing plants, plants with rare forms such as the tulip pictured, as well as past and future forms which are immanent in the plant world, thus distinguishing it from a pure idea.

This being said, we cannot ignore that there is an ideal aspect to the *Urpflanze*. Just as a plant, such as the tulip above, may show an aspect of plant formation that is usually not expressed, so too can the imagination create formations from the *Urpflanze*. To avoid the openness to any whim of the imagination, Emily Brady's phrase "imagine well" is helpful as a term to keep in mind while examining the ideal aspect of the *Urpflanze*.[33] What would it mean then to imagine well in relation to the *Urpflanze*? In a letter to Johann Gottfried Herder on May 17, 1787 Goethe explains

> The Primal [Archetypal] Plant is going to be the strangest [most amazing] creature in the world, which Nature herself shall envy me. With this model and the key to it, it will be possible to go on for ever inventing plants and know that their existence is logical; that is to say, if they do not actually exist, they could, for they are not shadowy phantoms of a vain imagination, but possess an inner necessity and truth. [34]

Goethe sees a "lawfulness" in his imagination of unseen plant forms that is akin to "lawfulness" in nature.

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[33] Emily Brady, "Imagination and the Aesthetic Appreciation of Nature," in *The Aesthetics of Natural Environments*, ed. Allen Carlson and Arnold Berleant (Toronto: Broadview Press, 2004.), 165. Brady uses this term to justify the use of imagination in natural aesthetics.

[34] Goethe, *Italian Journey*, 305-306; alternate translations come from Amrine, "Goethean Intuitions."

To further understand what this looks like, in explaining his method Goethe notes four different types that are active in scientific research. These are utilizers, fact-finders, contemplators, and comprehenders. The four can refer to different people doing different activities or to the various activities of an individual. Utilizers are practically minded and "the first to plow the field of science."[35] Finding a useful application is how interest in something is first sparked. For our purposes at the moment though, the last three are most relevant.

The fact-finders are more purely interested in knowledge for its own sake not for any practical reasons. It is this realm of the fact-finder that serves as a basis for comprehending something like the *Urpflanze* by becoming familiar with nature and exploring its plant phenomena. It is this gathering of phenomena that the contemplator uses as a resource.

At the stage of contemplation, even though there may be a repulsion "at the very thought of imagination" there is a compulsion "to call upon this selfsame power for assistance."[36] Beginning to interpret, the imagination becomes indispensable as one "become[s] aware of a series of stages" of development that are connected one to the other. Finally it is in comprehension where "proceeding from ideas... simultaneously express the unity of the whole."[37] It is at this stage that an experience of the *Urpflanze* occurs. The confidence in such an experience rests not only on the ability for comprehending but more so on the solidity of what has been gained from fact-finding and contemplating.

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[35] Goethe, *Botanical Writings*, 92.
[36] Ibid., 92.
[37] Ibid., 92.

We could say then in Goethe's case that one has "imagined well" when one is prepared to do so with the collected phenomena of the fact-finder, and builds upon that collection as a whole by relating its various pieces through contemplation or the use of imagination. Comprehension then emerges as a result of this work. This comprehension, though it takes on the form of an ideal, does not separate itself from the original facts so that they are all referred to by the comprehension. If they do not do so immediately, they then work to further inform comprehension and change it. The idea of the *Urpflanze* can only lead us back to its perceptual aspect.

Phenomenon and *Urphänomen*

To further clarify the *Urphänomen*, we must compare it with phenomenon proper. This brings us nearer to what marks the experience of *Urphänomen* as distinct from the experience of a phenomenon. First we will consider some of the views of others on Goethe's *Urphänomen* and then move on to what Goethe himself has said and see how this might apply to *Metamorphosis*.

Arthur Zajonc's formulation of *Urphänomen* is most succinct and serves as a good starting place. Zajonc notes that "we may hope to unite what arises within as concept with that which confronts us as percept so that the Idea itself stands in experience."[38] Here Zajonc points to an overcoming of dualism that is normally used to describe our perceptual experiences and our conceptual (thought) experiences so that the two are united in the Idea. This Idea has both perceptual and conceptual qualities and can be used to describe *Urphänomen*.

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[38] Zajonc, 237.

Another helpful way to see this connection between perception and thought comes from Ronald Brady.[39] Taking the familiar picture of a cube, Brady draws attention to the intention involved in viewing it as a cube (Fig. 8). One way to view the picture is as a cube pointed down. Yet by changing our idea about what we are looking at, we can also view the cube as pointing up. It is this change that takes intention to shift our working concept from a cube pointing down to a cube pointing up. An additional view of the cube is also possible. In this case we intend to view it two-dimensionally so that the picture loses its three-dimensional quality and becomes a collection of quadrilaterals and triangles around a square all with common edges. Depending on how used to looking at this picture in one of these ways we are, it may be difficult to intend to look at it differently or switching between two views may be easier than switching between all three. What Brady points out here is that a conceptual aspect of our perceptions often escapes our awareness. With the cube, it is easier to see this because the object is quite simple. It becomes more difficult to be aware of this conceptual aspect of our perceptions when looking at more complex phenomena such as

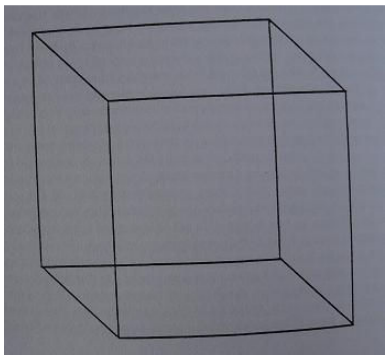

Fig. 8 Cube. From *Goethe's Way of Science*, p. 87.

[39] Ronald Brady, "The Idea in Nature: Rereading Goethe's Organics," *Goethe's Way of Science: A Phenomoenology of Nature*, ed. David Seamon and Arthur Zajonc (Albany: State University of New York Press, 1998), 83-111; Pfau, 11-12. Brady and Pfau look at the same aspect of Goethe's seeing though from different angles. Brady, as will be seen, takes an experiential approach, while Pfau works through philosophical terminology noting that "prior to all perceiving and representation – seeing is always and 'event.'"

plants.

Turning to Goethe's own distinctions between *Urphänomen* and other types of phenomena, in *Theory of Color* we find one of his clearest explanations.[40] He has just run through several examples of the effects of turbid media on color such as holding parchment paper in front of sunlight so that with each sheet added the coloring turns from yellow to red or the effects of dust mixed in clear varnish on top of black paint giving rise to blue. Goethe calls these appearances and what appears in all of them is the *Urphänomen*. Goethe also uses a different name here "*Grundphänomen*" (ground or fundamental phenomenon).[41] What both *Ur-* and *Grund-* point to is a common feature in the experience of each of these phenomena. The light shining through parchment paper turning from yellow to red and sunlight passing through the thicker lower atmosphere at sunrise and sunset are two different phenomena, yet they hold a phenomenon in common of light shining through a turbid medium.

Brady's idea of intention is helpful here and shows up in the recognition of the conceptual aspect of these perceptual experiences. This works by recognizing a common intention in viewing light passing through parchment paper and sunlight passing through the lower atmosphere. To do this we do not focus on the flatness of the paper or the murkiness of the atmosphere, but on the occurrence of light passing through a turbid medium. The use of intention can also be seen here in a reversed form where the conceptual aspect of light passing through a turbid medium is similar

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[40] Goethe, *Scientific Studies*, 195.
[41] Johann Wolfgang von Goethe, *Naturwissenschaftliche Schriften*, ed. Rudolf Steiner (1883-1897; repr. Dornach, Switzerland: Rudolf Steiner Verlag: 1982), 4:141-142

in all cases, as with the actual picture of the cube, while our perceptual field shifts from paper to a sunset, as with seeing different cubes in one picture.

Goethe goes on to explain more of what he means by *Urphänomen* by distinguishing it from an "*abgeleitetes Phänomen*" which has normally been translated as secondary phenomenon.[42] Translating it as an inferred or derived phenomenon points more directly to Goethe's meaning than secondary since it recognizes the phenomenon as coming from the interaction of *Urphänomene* and not simply following it in a sequence. These are phenomena that arise out the interaction of two *Urphänomen* and so are compound and not simple. Though he does not mention it at this point, Goethe has in mind Isaac Newton taking the spectrum which appears when light passes through a prism as an *Urphänomen*. Goethe sees this spectrum as derived, as compounded of two distinct spectrums, one (yellow to red) which occurs in the case of a darkened turbid media (parchment paper) in front of light and the other (violet to blue) occurring in the case of lighted turbid media (clear varnish mixed with dust) in front of darkness (black paint).[43] *Urphänomen* then are not just where we look for

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[42] Ibid.; Johan Wolfgang von Goethe, *Theory of Colours: With Notes*, trans. Charles Eastlake (1840; repr. La Vergne, Tennessee: Kessing Publishing 2011). Miller and Eastlake are the only two translations of Goethe's *Theory of Color* at this point. Eastlake's version (1840) translates *Ur-* as primary and so secondary makes more sense. I suspect that the Lockean notions of primary and secondary qualities served as entry point to understanding the two phenomena Goethe is distinguishing here. Miller's version (1988) translates *Ur-* as archetypal yet maintains Eastlake's secondary for *abgeleites* which loses the sense that the *Urphänomen* serve as a type of precondition, or underlying foundation, for the expression of an *abgeleites Phänomen*.

[43] Goethe, *Scientific Studies*, 218, Goethe demonstrates these two spectrums by using a prism as well by sprinkling hair powder in air so that it falls into the light emerging from the prism. Immediately upon exiting the prism, two colored edges emerge, one (BIV) on the top the other (ROY) on the bottom. Only once they are a distance away from the prism do they merge to form the more familiar ROYGBIV spectrum.

them, they are apparent in certain circumstances and more concealed, or mixed together, in others. Derived phenomena present instances where the *Urphänomen* is not apparent at first. In these cases we need to separate one or more *Urphänomen* as in the case of the color spectrum. Once we reach these *Urphänomen* though, we can go no further.

Goethe also points to the general tendency to try to do just this and go beyond the *Urphänomen* and not be satisfied with it, say that is "where we ought to acknowledge the limit of our perception."[44] This limiting quality marks the *Urphänomen* as distinct from other types of phenomena such as derived phenomena. We could also add what could be called ordinary phenomena which remain isolated from other phenomena in our experience of them. The red that appears when light shines through parchment paper is an example of this; it stays a mere phenomenon when taken singularly. Once we begin to bring these various ordinary phenomena into relation with one another, then the *Urphänomen* begins to emerge. Then when we look at an individual phenomenon, such as light shining through parchment paper, we see it with all other phenomena and together they point to and embody the same phenomena of light passing through a dark turbid medium, the *Urphänomen*. In this case, the ordinary phenomena are not a limit to our experiential knowledge since we can still arrive at the more fundamental phenomenon common to all of them.

Goethe expressed these ideas in relation to his work with color, something he did not do so clearly in relation to his botanical work. His *Theory of Color* came later in his life, published twenty years after *Metamorphosis*, and shows an awareness of

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[44] Ibid., 195.

the need to explain the methodological aspect of his work. Yet we can use *Theory of Color* to look at *Metamorphosis* and see the same method at work.

We can see a parallel between Goethe's collection of various experiences and experiments in *Theory of Color* as analogous to the examples of plants he presents in *Metamorphosis*. In *Metamorphosis*, the "perfoliate rose," ranunculus, tulip, and all the others take a similar position to the light shining through parchment paper, clear varnish over black paint, and the experiments with prisms and lenses found in *Theory of Color*. In both cases, Goethe attempts to construct a presentation of the *Urphänomen* through a collection of descriptions of ordinary and experimental phenomena. These descriptions serve as proxies for actual visual experiences with an implicit suggestion that the reader ought to explore these phenomena for themselves.

Goethe thought that it was important for readers of his written work to take it upon themselves to reconstruct what he recounts and take it further. To "bring the phenomena directly before the viewer's eyes and to repeat the presentation of many subjects in different contexts... is admittedly a great advantage denied the printed page."[45] This brings us back to our original point on approaching Goethe's morphological work as theoretical conclusion or method. To a certain extent *Metamorphosis* presents Goethe's own conclusions, yet he came to them by exploring various phenomena himself. Only by taking these conclusions as an impetus to explore the metamorphic relationships between plant forms can the reader reach similar conclusions. This would be similar to *understanding* that a picture of a cube can both point down and up as Brady suggested, but not bothering to try and *see* the

[45] Goethe, *Scientific Studies*, 157.

cube in each of these ways; that is, abstract understanding contextualized only by other thoughts ought to be connected to the practical context of seeing. This Janus-faced nature of Goethe's morphology will continue as we look at how it can be applied to an aesthetic appreciation of nature. Before turning there though, we will first look at some of the historical context surrounding Goethe's development of morphology.

Chapter Two: Taxonomy and Idealism: the Formation of Goethe's Presentation of Science

> The manifestation of a phenomenon is not detached from the observer – it is caught up and entangled in his individuality.
> -Goethe, *Maxims and Reflections*

Placing Goethe within a Relevant Context

Placing Goethe's morphological work within a historical context brings out features of his work that are not as recognizable when focusing on his work alone. Numerous scholars have asserted that Goethe's morphology is evolutionary or at least pre-evolutionary in nature.[46] This view of Goethe looks at him not in the context of his own time but in the context of the development of evolutionary ideas. It is not unreasonable that Goethe's morphological ideas contributed to softening more rigid views on the fixity of species, but it is debatable whether this sprang from Goethe's own evolutionary impulses.[47]

The transition suggested by Michel Foucault in *The Order of Things* between the Classical and Modern *epistemes* provides a more relevant intellectual context for looking at Goethe. The classical *episteme* refers to ordering the world taxonomically by physical features in the 17th and 18th centuries. The modern *episteme* roughly

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[46] Otto Haas, "Goethe and Evolution," *Osiris* 10 (1952), 35-42; Ernst Haeckel, "Goethe on Evolution," *The Open Court* 4 no. 131 (February 27, 1890), American Periodical Series Online; Robert J. Richards, *The Romantic Conception of Life: Science and Philosophy in the Age of Goethe*, (Chicago: University of Chicago Press, 2002).

[47] Ronald H. Brady, "Form and Cause in Goethe's Morphology," in *Goethe and the Science: A Reappraisal* (Dordrecht, Holland: D. Reidel, 1987), 268-269; Richards. Brady points to others who have seen in Goethe's initial conception of the *Urpflanze* an ancestral form, but that his later thinking diverges from this towards an abstracted idea from particular phenomnenon. Richards makes the most convincing case of Goethe's indirect contributions to evolutionary thinking.

followed in the 19th century and considered subjective elements in relation to knowledge about the world based on the finitude of the individual in relation to his or her claims to knowledge that extended beyond temporally bounded personal experiences, including the experiences of humanity as a whole. Foucault's framework gets away from the narrower context of evolutionary ideas and is able to place Goethe in an epistemic context which looks more at the contextual connections of the concepts than concepts themselves. Foucault's *epistemes* offer a complimentary context to those provided by Richard Holmes in *The Age of Wonder* and Tim Fulford, Debbie Lee and Peter J. Kitson in *Literature, Science and Exploration in the Romantic Era* which point out the close relationship between literary and scientific pursuits during Goethe's time.[48] Where Holmes and Fulford, Lee and Kitson show various pursuits synthesized within the individuality of particular people, Foucault shows how an *episteme* can synthesize the work of various individuals.[49]

Goethe's position in both *epistemes* can be looked at through his relationships to representatives of each. Regarding the Classical *episteme*, Goethe's interaction with the work and followers of Linnaeus becomes central. Goethe's more flexible

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[48] Richard Holmes, *Age of Wonder* (New York: Vintage Books, 2010); Tim Fulford, Debbie Lee, and Peter J. Kitson, *Literature, Science and Exploration in the Romantic Era* (New York: Cambridge University Press, 2007); also see Alexander Rueger, "The Cultural Use of Natural Knowledge: Goethe's Theory of Color in Weimar Classicism," *Eighteenth-Century Studies* 26, no. 2 (Winter 1992-1993) where he notes that "amateur" scientists often had access to better experimental equipment than "professional" scientists at universities.

[49] Giorgio Agamben, *The Signature of All Things: On Method* (New York: Zone Books, 2009), 15. Agamben draws attention to Foucault's formulation that "the episteme is the 'total set of relations that unite, at a given period, the discursive practices that give rise to epistemological figures, sciences, and possibly formalized systems.'" I see the synthetic nature in these "relations that unite."

view of species is, in part, a response to the efforts at classification of the Linnaeans.[50] From this point of view, Goethe's morphological work becomes an attempt to answer taxonomic questions. Along these lines, Robert Richards and Frederick Amrine's description of Goethe as a realist in the early part of his career is helpful.[51] Though Goethe reacts against the Linnaeans, he works within the possibility of an externally ordered world that is a reality. This realism contrasts with Goethe's later incorporation of an idealism into his thought.

Goethe's close friend, Friedrich Schiller, was crucial in engaging Goethe in discussions concerning idealism. This makes Schiller an appropriate representative for the Modern *episteme*. Schiller's affinity for Kantianism, which for Foucault marked "the threshold of our modernity," brings Goethe's own thought into relationship with the modern episteme.[52] For Foucault, instead "of establishing relations of identity or difference against the continuous background of similtudes, as was the case with Linnaean taxonomy, Kant brings into prominence the inverse

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[50] James L. Larson, "Goethe and Linnaeus," *Journal of the History of Ideas* 28 no. 4 (October – December 1967), 590-596.

[51] Richards, especially 463-471; Frederick Amrine, "Goethean Intuitions," in *Goethe Yearbook*, vol. 18, ed. Daniel Purdy (Rochester, New York: Camden House). Both Richards and Amrine recognize a transition in Goethe's work that moves from Realism to Idealist. Richards does so by focusing on Goethe's realationship with Schelling and paints Goethe as somewhat naive when it came to philosophy. Amrine takes a position that sees Goethe as philosophically sophisticated and approaching the subject more intuitively. He notes three stages of Goethe's life: Realist, Idealist, and Romantic. During Goethe's realist period, Spinoza becomes most influential, Fichte becomes primary in his Idealist phase, and Goethe becomes more self directed in his Romantic phase.

[52] Michel Foucault, *The Order of Things: An Archaeology of the Human Sciences*, trans. ---, (New York: Vintage Books, 1994), 242.

problem of the synthesis of the diverse."[53] Synthesis appears in Kant's transcendental arguments that unite various experiences such as beauty and the good in the mental capacities of understanding, reason, imagination, and others; that is, experiences of different situations are all described in terms of a few general mental functions. The drive to synthesize diverse phenomena was already inherent in Goethe's thinking and so his interaction with Kantianism enabled features of his thinking that he could not draw out under realism. Thus Goethe's relationship to Kantianism helped him express ideas implicit in his work while his relation to Linnaeanism highlighted how Goethe saw his ideas as different from Linnaeus.

In this way, Goethe becomes a transitional character between Foucault's Classical and Modern *epistemes*. Goethe struggled within both of these *epistemes*, not finding a home completely in one or the other. Before discussing Goethe as he stands within this shift from the Classical to Modern *episteme*, we will first look at the more concrete relations he had with Linnaeanism and Kantianism.

Goethe's Study of Linnaeus

Goethe's relationship to Linnaeanism has been viewed in both direct and reactionary ways. Directly, Linnaeus has been seen as presenting an idea of metamorphosis in *Philosophia Botanica* that suggested a unitary plan within nature. [54] This unitary plan has then been extended as the origin of Goethe's idea of *Urpflanze*. The reactionary connection has seen Linnaeus' system as an object for Goethe to rebel

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[53] Ibid; 162.
[54] Philip Rehbock, *The Philosophical Naturalists: Themes in Early Nineteenth-Century British Biology* (Madison, WI: University of Wisconsin Press, 1983), 19.

against and so develop his own ideas.[55] Here Goethe is seen as overwhelmed by the nomenclature and straining to include a role for the imagination. My focus here is on the latter interpretation.

The reactionary interpretation draws a distinction between the static and reductive Linnaean method that ties identity to the number of stamens, and a mobile Goethean nature that takes the entire life cycle of the plant into consideration through forms that are accessible to the imagination. The Linnaean approach, by focusing on the sexual organs of the plant and counting them, reduced and named organisms according to those characteristics. Such characteristics are an aspect of the organism at a particular time in its development so that identity is reduced both to particular features and particular times. The Goethean approach avoided any systematic naming and looked at characteristics expressed throughout the time span of the organism. Additionally, these characteristics avoided fixity by expressing the organism's relationship to its surroundings. The main distinction that emerged was between the importance for the Linnaean approach of distinct features and the importance for the Goethean approach of shared features.

Looking at Goethe's own considerations of Linnaeus, his initial views of his system tended to be favorable and he spent a great amount of time learning the Linnaean system. He later reacted against it, but did not immediately dismiss it. Goethe first came across Linnaeus while studying at Leipzig from 1765-1768. This

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[55] Leslie P. Williams and Henry J. Steffens, *The History of Science in Western Civilization* (Washington: University Press of America, 1977), 11; Chad Wellmon"Goethe's Morphology of Knowledge, or the Overgrowth of Nomenclature," in *Goethe Yearbook*, vol. 17, ed. Daniel Purdy, 153-177 (Rochester, New York: Camden House, 2011); Amrine.

initial encounter happened at the home of the professor of medicine Christian Gottlieb Ludwig where conversations about the merits and errors of Linnaeus (along with Georges-Louis Leclerc Comte de Buffon and Albrecht von Haller) took place. Goethe says that these conversations "were entertaining and significant, and they gripped [his] attention" and also introduced him to "many new words" and "a whole extensive terminology."[56] This entertaining encounter served little more than an introduction and did not lead Goethe to press further into understanding the issues surrounding botany at that time.

After moving to Weimar in 1775, Goethe began to study Linnaeus in earnest. The Duke Karl August, who brought Goethe to Weimar, created an area for botanical study from the gardens of the court with an eye towards its scientific worth. Goethe's duties included helping to organize these new gardens and so required him to gain some botanical understanding. Out of these practical considerations Goethe took up Linnaeus' *Termini Botanici*, *Fundamenta Botanices*, *Philosophia Botanica* and Johann Gessner's *Dissertations in Explanation of Linnaean Elements*.[57] These introduced Goethe to the Linnaean system in depth, but they did not succeed in helping him master it. Assistance came in the summer of 1785 when the 17 year old Friedrich Gottlieb Dietrich, whose grandfather had exchanged letters with Linnaeus and who would eventually write his own *Lexicon of Gardening and Botany*, collaborated with

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[56] Johann Wolfgang von Goethe, *From My Life: Poetry and Truth (Parts One to Three)*, eds. Thomas P. Saine and Jeffrey L. Sammons, trans. Robert R Heitner, vol. 4 of *Goethe's Collected Works*, eds. Victor Lange, Eric Blackall, and Cyrus Hamlin, (New York: Suhrkamp, 1995), 196

[57] Johann Wolfgang von Goethe, *Goethe's Botanical Writings*, trans. Bertha Mueller (Woodbridge, Connecticut: Ox Bow, 1989), 153.

the older man. The young Dietrich, according to Goethe, "had a brilliant memory which held fast all the unusual terms [and] could instantly produce them."[58] The two spent time in the surrounding forests collecting specimens. Dietrich would be out collecting and returning each specimen by "announcing the Linnaean designation, both genus and species, with happy conviction" to Goethe who waited in a carriage.[59] The young enthusiast aided Goethe's mastery of the Linnaean system more than his own attempts to memorize the long lists of names in Linnaeus' own work. This practical understanding of the Linnaean system was crucial for Goethe's taxonomic views. Ultimately, however, it did not sit well with him and he realized that it was not a system that reflected his own disposition.

Much later in 1823, Goethe stated that "Nature has no system; she has – she is – life and development from an unknown center toward an unknowable periphery."[60] He had already begun to hint at this balance of form between expansive and contractive tendencies in *Metamorphosis of Plants* (1790) as we saw in the preceding chapter. Goethe's activity between his effort to understand the Linnaean system to denouncing any system of nature can be seen as an initial effort to realize a natural organization, one which Linnaeus himself had proposed existed but at the same time could not figure out beyond his own artificial system.[61] At the basis of this undertaking is Goethe's *Metamorphosis*. The book attempted to describe the

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[58] Ibid., 154.
[59] Ibid.
[60] Johann Wolfgang von Goethe, *Scientific Studies*, ed. and trans. Douglas Miller, vol. 12, *Goethe's Collected Works*, ed. Victor Lange, Eric Blackall, and Cyrus Hamlin, (New York: Suhrkamp, 1995), 43.
[61] Paul L. Farber, *Finding Order in Nature: The Naturalist Tradition from Linnaeus to E. O. Wilson* (Baltimore: John Hopkins University Press, 2000), 9; Larson.

flowering plant in its developmental totality and should be regarded as a move away from the Linnaean system focused on the particular parts of the plant.

Linnaeus had done similar but less detailed work in *Systema Vegetabilium* (1774) and, at the end of *Metamorphosis*, Goethe distinguishes what he has done from Linnaeus' work. Goethe points to Linnaeus' conclusion based on the observation of trees that the developmental cycle for flowers was six years. By basing his ideas mostly on the observation of annual flowers, Goethe believed he had a more widely applicable foundation for understanding plant development. Goethe also draws attention to Linnaeus' claim that the stamens originate out of the outer layer and the pistil out of the center of the stem. Goethe points to their common origin in the subsurface layer of the stem. Goethe also credits Linnaeus with recognizing plant metamorphosis. Linnaeus' description culminated in fruit formation and was immediately followed by the statement that "the principle of Fructification, the Foundation of Botany, should be traced higher," which leads him to discuss the order of nature as established by God and the classificatory work of botanists.[62] Goethe did not connect his description of metamorphosis to any work on classification, leaving his description of the plant open for use in the development of morphology. So it is here that Goethe departs from Linnaeus to develop what he thought of as an appropriate way of understanding nature that avoided systems.[63]

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[62] Carl Linne, "Linnaeus' Classification," *The Science News-Letter* 15 no. 414 (16 March 1929), 172.

[63] Wellmon draws attention the artificial nature of Goethe's method and his recognition of it as such since it is based on a compression of the time of development of a plant by mental picturing. Yet I maintain that it still seeks to mimic nature more for Goethe than did the Linnaean system of hierarchy.

It should come at no surprise then that in the same year the *Metamorphosis of Plants* was published, Goethe was also at work developing his ideas on morphology as a distinct science.[64] He hoped to distinguish it from other sciences of the time like physiology, natural history, physics, and chemistry while also connecting it with these disciplines through their treatment of "form, formation, and transformation."[65] Morphology rested on the analytic and holistic features of these disciplines; the analytic being applied to detailed structures and the holistic applied to vitalistic forces. For Goethe, vitalism points out that "life as a whole expresses itself as a force that is not contained within any one part"[66]

Goethe learned much from his acquaintance with Linnaeanism, yet this understanding was dynamic and evolved over time. He gradually shifted away from a sympathetic view of it to develop his own approach of understanding plants. Just as Goethe was open to changing his views on Linnaeanism, so too he was willing to reconsider his adherence to realism and make room for the perspective of idealism.

Goethe and Idealism

Goethe's relation to idealism takes an opposite trajectory from his relation to Linnaeus. In his essay "The Influence of Modern Philosophy" (1817), Goethe explains his relationship with Kant, describing how the "*Critique of Pure Reason* had long since appeared, but it lay entirely beyond [his] ken" and how he could not

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[64] Goethe, *Botanical*, 85-96.
[65] Ibid., 88.
[66] Ibid., 90.

"follow Kant."[67] Later, with *Critique of Judgment*, Goethe would "read the book again and again... and turn with pleasure to the sections [he] marked" remarking that "with this book a wonderful period arrived in [his] life."[68] Though Goethe came to an understanding of Kant, his full agreement did not follow.[69] When Goethe would talk with Kantians, they were little inclined to follow his conclusions on the implications of Kantianism with the same enthusiasm and were "unable to respond or help in any way" only admitting "with a bemused smile: this is indeed an analogue to Kantian thought, but a peculiar one"[70] This changed once he became friends with Friedrich Schiller.

Goethe and Schiller had known each other at first from a distance. With his drama *The Robbers* (1781), Schiller came to Goethe's attention after he had returned from Italy in 1788. Goethe was not impressed, for *The Robbers* contained "a completely overwhelming flood of ethical and theatrical paradoxes" that he had been trying to get away from.[71] At this time both lived in Weimar and met once, but mostly did not interact, "liv[ing] side by side as strangers."[72]

It was six years later, in July 1794, that the two had their first serious encounter and conversation. Both happened to be walking out at the same time from a meeting of The Nature Investigator's Club which had been started by August Batsch. Schiller commented on the fragmented nature of the meeting which gained Goethe's attention

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[67] Goethe, *Scientific Studies*, 28.
[68] Ibid., 30.
[69] See note 51.
[70] Goethe, *Scientific Studies*, 30.
[71] Goethe, *Scientific Studies*, 18.
[72] Ibid. 19.

and drew out a response explaining his own studies with plants. The conversation continued as they came to Schiller's home where Goethe went into even more detail on his botanical studies, describing the metamorphosis of plants and "with a few characteristic strokes of the pen [he] caused a symbolic plant to spring up before [Schiller's] eyes."[73] It was this drawing that gave the two something concrete to base their differences on. Schiller's response was "That is not an observation from experience. That is an idea." To which Goethe, summoning all the tact he could find at the moment, responded, "Then I may rejoice that I have ideas without knowing it, and can even see them with my own eyes."[74] (Of course this is all recounted by Goethe some twenty-five years later and so should be taken as such.)

This encounter served as a starting point for Goethe and Schiller to discuss their differing views. Judging by his reaction, Goethe had an attachment to seeing the picture he drew as a representation of actual plant growth (realism), not merely an idea about how plants might grow. Schiller, however, was quick to point out that Goethe's drawing was not actually of a plant, but it was probably a very general sketch of a single plant, or possibly a sequence of developmental stages.[75] But Goethe had in mind that he was depicting the metamorphosis of plants gained through observation as an artist might who would draw a plant as it changes during its growth cycle. For Goethe then it was still a sensory experience (or experiences) that he drew upon. If he

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[73] Ibid., 20.
[74] Ibid., 20.
[75] There are no descriptions of what this drawing may have looked like that I have found besides Goethe's description.

were to take Schiller to a plant, he would be able to point out the features of the plant that he expressed in his sketch.

The power of representation by a picture would stay with Goethe throughout his life. He would later state: "For my part, I should like to lose the habit of conversation and, like nature, express myself entirely in drawings. That fig tree, this little snake, the chrysalis lying there in front of the window quietly awaiting the future – all these are pregnant with meaning."[76] His conversation with Schiller turned out in just this way: his drawing was "pregnant with meaning" giving birth to his own meaning as well as Schiller's. Schiller's meaning, however, sees another side of what Goethe thinks he himself is doing. Schiller recognizes that Goethe has not seen the actual plant that he drew but that he was most likely generalizing from his observations of plant growth, thus he drew an idea, a pictorial synthesis of his perceptions. Recalling the supposed envy of nature for Goethe's discovery of the *Urpflanze* referred to in the preceding chapter, his is not as much synthetic as it is representative.

The two did not resolve their differences that night, only reaching a "truce."[77] Schiller would soon write to Goethe in June of 1794, requesting that he submit work to Schiller's newly forming journal, *Die Horen*. Goethe obliged and the two would continue a friendship and correspondence. Part of their friendship involved their attempt to establish Weimar Classicism as the dominant mode of art in German speaking culture to counteract what they saw as the degrading effects of popular

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[76] Johann Wolfgang von Goethe, *Goethe on Art*, ed. and trans. John Gage (Berkeley, California: University of California Press, 1980), 73.
[77] Goethe, *Scientific Studies*, 20.

culture on art and literature at the time.[78] In contrast to the "republic" Goethe sought to replace the "despotism" of the Newtonians in optics, he and Schiller looked to establish an artistic authority based in nature and the style of ancient Greece.[79] Like the scientist, the artist should strive to represent the *Urphänomen*.[80] Art and literature that did not do so could then be judged as poorly executed, despite its popularity. As a result the wide ranging relationship between Goethe and Schiller, Goethe began to incorporate ideal perspectives into his work.

By August 1797, Goethe wrote to Schiller about recognizing the role of his own knowledge and previous experiences in the creation of any new knowledge, writing that "certain objects, had a kind of sentimentality" on account of "that which [he] see[s] and experience[s] attaches itself right well to all [his] other knowledge."[81] Yet rather than try to work against such recognized bias, Goethe said that this was "not disagreeable to [him], because it [went] into the general mass of what he [knew], and help[ed] to increase the capital."[82] So instead of rejecting the role of his own personality in his production of knowledge, Goethe recognizes and begins to embrace it. This leads him to call the objects that he approaches with this sentimentality "symbolical," as

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[78] Rueger, "The Cultural use of Natural Knowledge," 226.
[79] Ibid.
[80] Goethe, *Goethe on Art*, 21-24. Here Goethe elevates style in art as "based on the profoundest knowledge, on the essence of things insofar as we can recognized it in visible and tangible forms."
[81] Friedrich Schiller and Johann Wolfgang von Goethe, *Correspondences between Schiller and Goethe from 194 to 1805*, trans. George H. Calvert, vol. 1 (New York: Wiley and Putnam, 1845), 303.
[82] Ibid., 303.

> eminent cases, which in a characteristic manifoldness stand for the representatives of many others, embrace in themselves a certain totality, require a certain sequence, excite in [his] mind things similar and foreign, and thus from without as from within make pretension to a certain unity and universality.[83]

Goethe begins to incorporate his own self into his knowledge at this point. This incorporation though is not merely to betray his biases, but to say those biases point to a way of organization.

In January of the next year, Goethe sent Schiller a short essay "The Objective and Subjective Reconciled by Means of the Experiment" written in 1793. Goethe thought Schiller would be "interested in seeing how [Goethe] looked at things in those days."[84] When he sent the essay, Goethe had recognized that his thinking had developed since writing this essay so he included a smaller supplemental essay now called "Experience and Science" by various editors which shows the development of his thinking.

In "The Objective and Subjective Reconciled by Means of the Experiment," Goethe approaches the issue of dealing with one's pleasure and displeasure as means of relating to the world and how these are to be set aside so that when "we observe a thing with reference to itself and in relation to others... we shall be able to regard it with calm attention and form quite a clear concept of its parts and its relationships."[85] It is this type of experience which "should have the greatest influence on natural science" in such a way that it leads to experience of the different phenomenological

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[83] Ibid,, 303-304
[84] Friedrich Schiller and Johann Wolfgang von Goethe, *Correspondences between Schiller and Goethe from 194 to 1805*, trans. George H. Calvert, vol. 2 (New York: Wiley and Putnam, 1845), 10.
[85] Goethe, *Botanical*, 221.

levels of an object which Goethe spells out more clearly in "Experience and Science."[86] The first level is that of "empirical phenomenon" which rests on the ability to observe things as just described. A "scientific phenomenon" emerges under experimentation which entails "systematically repeating the experiences of predecessors, contemporaries, or ourselves, and of reproducing phenomena that have arisen in part by chance, in part by plan."[87] At this stage it becomes important to begin working with others, but not merely by sharing the results one has come to but "to share each individual experience with others, and even each supposition" and "not to erect a scientific structure before the blueprints and materials are generally known, evaluated, and chosen."[88] In this way there can be as much certainty about "scientific phenomena" created by humans as there is about "empirical phenomena" created by nature. These phenomena then serve as a ground to support an experience of the "pure phenomenon" which "can never be isolated, appearing as it does in a constant succession of forms" and is describable only when the "intellect determines the empirically variable, excludes the accidental, separates the impure, unravels the tangled, and even discovers the unknown."[89] Goethe did not go as far as this "pure phenomenon" in his "The Experiment as Mediator," only referring briefly to "data of a higher nature."[90]

In "Experience and Science" he elaborates more fully, drawing out different levels of phenomena and how they work towards integrating subjective and objective

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[86] Ibid.
[87] Ibid., 222.
[88] Ibid.
[89] Ibid., 228.
[90] Ibid., 227.

elements. In "The Experiment as Mediator," Goethe stays with "scientific phenomena," explaining the potential obstacles and benefits of experiments in relation to developing a theory. We also find no mention of such "pure phenomenon" in *Metamorphosis*, either. Here Goethe uses the phenomenon of leaf in place of any terms suggesting an ideal aspect such as "pure" or *Urphanomen*.[91] In "Experience and Science," the focus became the creation of an experience of "pure phenomenon," a recent formulation in Goethe's understanding. This is the result of the conversations and correspondences between Goethe and Schiller that dealt directly with idealism. These conversations and correspondences no doubt engaged Goethe's idealist tendencies more than the Kantians who had thought his ideas "peculiar." With his idealist turn Goethe began to place more emphasis on distinguishing his experiences of the different areas of the sensorial and the ideal.

Goethe's Use of Idealism

The results of Goethe and Schiller's relationship can be seen in Goethe's incorporation of idealism more explicitly into his work. Robert Richards has suggested that Friedrich Schelling also played a major role in helping move Goethe towards idealism, while Frederick Amrine points to Johann Gottlieb Fichte's

[91] Arthur Zajonc, "Fact as Theory: Aspects of Goethe's Philosophy of Science," in *Goethe and the Sciences: A Reappraisal*, ed. Frederick Amrine, Francis J. Zucker, and Harvey Wheeler, 219-246, (Dordrecht, Holland: D. Reidel Publishing, 1987),232. Here Zajonc equates the pure (*Reine*) and (*Ur*-) archetypal phenomenon.

influence.[92] What has been presented so far shows that Schiller also played a role in drawing out idealistic explanations from Goethe.[93] This inclusion of the ideal by Goethe did not work completely against the involvement of human experience in the acquisition and production of knowledge such as through a mathematically based metaphysics. Rather, as with his August 1797 letter to Schiller, Goethe worked towards ways of incorporating human experience as a positive aspect of knowledge which points in a direction that reveals a particular understanding about the object under consideration.

Karl J. Fink's *Goethe's History of Science* shows this incorporation of human experience by tracing the gradual inclusion of historical (both personal and cultural) elements into Goethe's scientific writings.[94] Two examples pointed out by Fink illustrate this. The first comes from Goethe's optical writings. His "Contributions to Optics" (1791) was a short descriptive work of optical experiments, with little or no elaboration of theory or meaning. When he finally published his *Theory of Color* (1810), Goethe contextualized the descriptions of his experiments, not so much with theoretical implications, but with methodological explanations and historical backgrounds. What was meaningful for Goethe was not so much to elaborate a theory, but to situate his own experiments within the context of those that had

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[92] Richards, 421-434; Amrine, 35. Richards also refers to Schiller's influence in acquainting Goethe with idealism, but it is more as the role of an introducer and is not given the weight of Schelling's influence.

[93] Amrine, 35. Amrine points to the wide spread understanding of Schiller's influence on Goethe as being mistaken noting that Goethe was not as naive as he is often made out to be.

[94] Karl J. Fink, *Goethe's History of Science* (Cambridge: Cambridge University Press, 2009).

preceded him while also explaining his involvement in his own observations and experiments. His long polemic against Newtonianism within *Theory of Color* signaled his desire to see his own work alongside past contributions to understanding color. This desire takes on a less polemical form in Goethe's treatment of the rest of the history of color while still retaining its use for Goethe's project as whole.[95]

Goethe's *Theory of Color* connects with history proper, but his botanical work includes more of his own personal history which appeared in an edition prepared for publication in 1817 and later expanded upon in 1831. Here Goethe includes essays such as "The History of My Botanical Studies," along with "History of the Manuscript" and "History of the Brochure in Print" which related the reception of his *Metamorphosis of Plants* which was also republished at this time having originally appeared in 1790. By publishing *Metamorphosis* with these supplements Goethe hoped to show "how a middle-aged man of some reputation as a poet" could have written something like *Metamorphosis*.[96] The reader is given biographical, along with scientific information as a source for making their judgment on the material.

We may ask (and this will lead us back to Foucault) what does idealism, and Kantianism more specifically, have to do with adding historical elements to scientific research. Viewing the Kantian critique as an attempt to understand the role of the subjective element of an area of knowledge can easily lead to the inclusion of history or biography related to the pursuit of knowledge. Taken this way, Kantianism shows its effect on Goethe from the time he meets Schiller up to his later biographical

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[95] Fink, 75-85.
[96] Goethe, *Botanical*, 149.

publications. What Goethe did with idealism differed from Kant's elaboration of the role of various abstract mental faculties common to all by specifying the role of the individual as unique from the role of other individuals. It is perhaps such an understanding of Kant that bewildered others who viewed Goethe's thoughts as "an analogue to Kantian thought, but a peculiar one"[97]

Goethe as a Transitional Figure

A central theme of the Modern *episteme* for Foucault is the historicization of biology, where "historicity, then, has... been introduced into nature."[98] But the type of historicity that Goethe introduces is not exactly the same as what Foucault had in mind. The historicity that emerges in the modern *episteme* will ultimately be characterized by, though not limited to, evolution. In order not to limit his focus to evolution, Foucault goes to great lengths to show that Georges Cuvier, not Jean-Baptiste Lamarck, belongs to the modern *episteme*. Cuvier took part in "the breaking up of the great table" of taxonomy when he "introduced a radical discontinuity into the Classical scale of beings" through his work in comparative anatomy.[99] We can see that Goethe did something similar in his breaking away from the Linnaeans. But he did not merely help prepare the way for evolutionary ideas by opening up the foundations for historicity and related successive generations to one another, he placed the historical element directly into the plant itself, in how the form of an individual plant itself has a history.

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[97] Goethe, *Scientific Studies*, 30.
[98] Foulcault, 276.
[99] Ibid., 275.

The other aspect of history that Goethe incorporates into his work is not a history of nature, but a history of the understanding of nature both through successive generations, as was the case in his *Theory of Color*, and through the individual botanist, himself, in his essays relating to *Metamorphosis of Plants*.

The difference between these types of histories and a history of nature such as evolution then is that Goethe works with what is available to experience: that of individual plants which he is able to observe as they grow, the history of color available through texts, and his own history available to him from his memory. These histories are connected with sense experiences in one form or another which differentiates them from a history of nature which is largely inferred such as evolution is. With evolution, there is still a connection to sense experiences, like looking at fossil records or the behaviors of living animals, but they are used to reconstruct a past rather than as sources of descriptions about a past. Goethe's scientific work attempted to stay within the realm of human experience and not venture into a pre-human era.[100]

We can see then that Goethe breaks from Foucault's classical *episteme* as he loosens himself from the Linnaeans, working his way toward the modern *episteme* as he assimilates idealism into his own work. It is important to point out that what emerges in Goethe then is a sort of hybrid. He maintains the outwardly directed empiricism of the Linnaeans while incorporating Kantianism with it. Both worlds are relevant for Goethe's understanding of nature, so that such knowledge exists not

[100] Richards has pointed to some remarks here and there by Goethe that show an affinity for evolutionary thinking, but the bulk of Goethe's work that he had published and put effort towards shows that he refrained from making evolution a feature of his work.

wholly in nature nor wholly in the scientist but in the space where the two meet and relate.

This space will serve as a continued point of interest as we turn to the applications of Goethe's morphology to natural aesthetics in the next chapter. We find that it serves as suitable space within which to ground aesthetic experience.

Chapter Three: Goethe's Morphology in Relation to Natural Aesthetics

> Every new object, well observed opens up a new organ of perception in us.
>
> -Goethe, "Significant Help Given by an Ingenious Turn of Phrase"

Morphology and Natural Aesthetics

With Goethe it is natural to consider the connection between art and science. He was someone deeply interested and practiced in both activities. Goethe saw himself as establishing "morphology as a new science" to be "regarded as an independent science and as an auxiliary physiological science."[101] This science was to "include the theory of form, formation, and transformation of organic natures."[102] This emphasis on form gives Goethe's morphology a pictorial quality that can make its relation to visual arts more immediate than is usually the case with sciences that utilize mathematical or physical analysis. Goethe's desire to "express [himself] entirely in drawings" points to his own tendency to value the visual elements both in nature and art.[103] These close connections between the visual forms in nature and art point to an aesthetic aspect within Goethe's morphology that is less explicit in other sciences. The role of form in morphology offers a unique grounding for aesthetic experience of nature with the observer actively recreating in their imagination what they see around them as described in the second chapter.

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[101] Johann Wolfgang von Goethe, *Goethe's Botanical Writings*, ed. and trans. by Bertha Mueller (Woodbridge, Connecticut: Ox Bow, 1989.), 88
[102] Ibid.
[103] Johann Wolfgang von Goethe, *Goethe on Art*, ed. and trans. John Gage (Berkeley, California: University of California Press, 1980), 73.

This chapter focuses on the aesthetic aspect of Goethe's morphology as it relates to nature and places it besides some modern theories of natural beauty, in particular those of Emily Brady, who currently researches the intersection of philosophy and cultural geography in environmental ethics and aesthetics at the University of Edinburgh, and Allen Carlson, who is currently at the University of Alberta focusing on the appreciation of human and natural environments. Each of these theories approach the appreciation of natural beauty in a different way: Brady through the imagination and Carlson through science. Brady's stress on the importance of the imagination relates directly to the aesthetic aspects of Goethe's morphology. Carlson's desire to found a natural aesthetic on scientific grounds offers a perspective to evaluate Goethe's morphology as a productive science in this sense. Goethe's way of approaching nature is a special case within Brady's framework for aesthetic appreciation. The goals of each are also different. Brady seeks to validate aesthetic experience that involves the imagination and Goethe seeks to apply the imagination in order to understand nature. This difference allows for Goethe's morphology to be available to Carlson's conception of a scientific basis for aesthetic appreciation of nature. This affinity of Goethe's morphology with both Brady's and Carlson's projects ends up leading to similar evaluative destinations: the creation of a morphological idea by the aesthetic viewer. Such a creation supplies aesthetic experience to the viewer while also constructing a foundation on which to base aesthetic appreciations. While I include some aesthetic responses to nature, my focus in this chapter is on this foundation for these responses in morphological imagination.

Emily Brady: The Role of Imagination in Natural Aesthetics

Emily Brady's natural aesthetics has been called a non-conceptualist theory as opposed to a conceptual theory like that of Allen Carlson.[104] This is a result of Brady's emphasis on the role of imagination which is understood as a non-conceptual faculty that can be inventive to the extent that it leads away from the concepts of nature that have been arrived at through various sciences. The role of feelings in natural aesthetics, which is a focus of Noël Carroll, is another non-conceptual aspect of natural aesthetics.[105] What is worrisome to conceptualists about non-conceptual justifications of natural beauty is that they are not objective and so will not hold up when trying to justify ecological causes.

Brady hopes to develop a position that speaks to these concerns while maintaining a model that is both "non-science" based and guides "appreciation in the absence of artistic context" and where aesthetic judgments are possible and not confused with other types of judgments.[106] Here Brady wants to place natural aesthetics in its own realm that is distinct from other pursuits like science and art that have their own unique approach to nature. Where science approaches nature in order to understand it and art approaches nature to make visual reproductions of it, natural

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[104] Ronald Moore, "Appreciating Natural beauty as Natural," in *The Aesthetics of Natural Environments*, ed. Allen Carlson and Arnold Berleant (Toronto: Broadview Press, 2004.), 220-221. Moore points to the difference here as one between imposing a classification scheme on nature or leaving it free of such a scheme.

[105] Noël Carroll, "On Being Moved by Nature: Between Religion and Natural History, in *The Aesthetics of Natural Environments*, ed. Allen Carlson and Arnold Berleant (Toronto: Broadview Press, 2004.), 89-107.

[106] Emily Brady, "Imagination and the Aesthetic Appreciation of Nature," in *The Aesthetics of Natural Environments*, ed. Allen Carlson and Arnold Berleant (Toronto: Broadview Press, 2004.), 160.

aesthetics does neither. Brady views the ease of applying the methods of science or art and simply extrapolating them to natural aesthetics as misleading. Approaching nature aesthetically is different from approaching it scientifically or artistically and Brady's model "draws on our perceptual and imaginative capacities to provide a foundation for aesthetic appreciation of nature" that mark it as a unique discipline.[107]

Imagination and perception are closely linked for Brady since "imagination encourages a variety of possible perceptual perspectives" when looking at an object.[108] This ability to multiply perspectives already points to the usefulness of imagination when appreciating natural objects by enriching and rounding out experience. To counter this tendency of "expanding" our experience, the object we look at greatly "determines how much perceptual effort is required."[109] In this way, the object both guides and is tied to imagination.

To add further protection against the viewer being carried away by the imagination during aesthetic appreciation of nature, Brady offers four modes of imagination that can serve as guidelines to judge and understand the experiences of our own imagination when it is engaged in the appreciation of nature. The first is the exploratory, which "explores the forms of the object as we perceptually attend to it."[110] Looking at a daffodil for example, we would notice the forms of the leaves, stem, and the various parts of the flower. A quick glance can give us a general idea of a form. But the more we look, the more we notice about the details of the forms and

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[107] Brady, 160.
[108] Brady, 161.
[109] Brady, 161.
[110] Brady, 162.

how they relate. We may begin to notice similarities in form and texture or striking differences. The workings of the imagination may not be readily noticeable in such acts of observation, but there is a delicate exchange between the imagination and perception with each bringing a particular focus to the features of the other. By bringing something purely into imagination, one can notice what aspect of an object one has been paying attention to by way of the senses since certain features may be distorted or missing altogether. Looking again at the object after it has been imagined still other distortions of imagination may become apparent. This play between imagination and perception serves to harmonize the two while deepening the experience of the object in question through a more active engagement.

Projective imagination is Brady's second mode of imagination. Here the faculty of imagination asserts itself over perception so that the object that "is actually there is somehow added to, replaced with or overlaid by, a projected image."[111] Judging the geometrical properties of an object serves as an example. Given a sloppily hand-drawn circle, we will probably notice that it is not perfectly circular; this, in part, comes about from imagining a more perfect circle over the drawing that corrects some of the errors. Projective imagination also involves placing ourselves imaginatively into the conditions of the object we observe. Brady uses the example of an alpine flower and how imagining the environmental conditions it grows in allow us to "appreciate the remarkable strength hidden so beautifully in the delicate quality of the flower."[112]

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[111] Brady, 162.
[112] Brady, 162.

The third aspect of imagination is ampliative which need not have an image character per se. What is important here is creating a context for the observed object. This may include the history of the object; that is, how it came to be in its present state. This involves some knowledge of the object and how it fits into its environment. We can look at snow for example and in addition to noticing the brightness it brings to an otherwise overcast day, we can also think of the heights from which it falls from clouds that have carried the snow as potential from an unknown distance and how those clouds arose out of the condensation of evaporating water from below. Once we notice this then we can go further into imagining the Earth's water cycle and reach a sense of immensity of time involved in such a continuous cycle.

The revelatory is Brady's final mode of imagination and it is closely related to the ampliative. Following our ampliative imagination as we did with the snow, we can be led to "the discovery of an *aesthetic truth*" where "invention stretches the power of imagination to its limits."[113] We can think of our reaching the limits of the Earth's water cycle. We could research Earth's water cycle to see more clearly how it arose, but that would take us away from the aesthetic and it would not be "a kind of truth [which] has emerged through a distinctively aesthetic experience."[114]

We see Brady then carefully distinguishing between an aesthetic experience and what could be called an experience of understanding through science. Though both may lead to some sort of truth, their truths are different in character and are not qualitatively related. What we know about the water cycle and how imagining its

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[113] Brady, 163.
[114] Brady, 163.

continual reoccurrence makes us feel tell us two different aspects of it: one appreciable through scientific understanding, the other appreciable to aesthetic experience. An objection could be raised here that Brady is going back on her claim of a non-science based aesthetic of nature. An important distinction for Brady is that though scientific understanding may come into play in an aesthetic experience, it in no way serves to judge the validity of that experience. Though Brady does not address the ampliative in this way, we could just as well place the snow within the context, as Thomas Heyd does, of a narrative tradition, whether it be from a modern novel or a more traditional mythical narrative.[115] In this way science serves to provide a narrative and not necessarily a claim to truth in the strict sense, maintaining Brady's separation between science and natural aesthetics. Let us now see how Brady's theory can highlight certain aspects of Goethe's morphology.

Goethe's Morphology through Emily Brady's Imagination

We can apply Brady's ideas on natural aesthetics to Goethe's through the common role of the imagination in both.[116] Goethe's use of imagination is also at work in his poetry. The opening lines of "Phenomenon" proclaim, "When the Sun-god [Phöbus] mates with a curtain of rain, an arching rim shaded with colours at once

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[115] Thomas Heyd, "Aesthetic Appreciation and the Many Stories about Nature," in *The Aesthetics of Natural Environments*, ed. Allen Carlson and Arnold Berleant (Toronto: Broadview Press, 2004.).

[116] An interesting connection exists between Brady and Goethe. Brady coauthored "Topiary: Ethics and Aesthetics," in *Ethics and Environment* 8 no. 2 (Spring 2003): 126-142, with Isis Brook whose doctoral dissertaion was "Goethean Science in Great Britian" (1994). I am unaware of further aspects of their relationship.

appears."[117] In this line there are elements of projective and ampliative imagination where the appearance of a rainbow is explained by means of a god mating with a natural phenomenon. This poetical use of the imagination works well within Brady's framework, but it is very different from how Goethe utilizes the imagination in morphology. Goethe is much more careful and restrained here, not giving way to such flights of imagination. Within that carefulness is the workings of an imagination that is closely tied to visual perception, making Brady's four modes still relevant.

An instance of Goethe's use of exploratory imagination came as he traveled over the Alps to Italy in September of 1786. Goethe tells us he "not only saw new plants but also familiar ones with a different kind of growth" and that "in the mountains, branches and stems became more delicate, buds were spaced at wider intervals and the leaves were lanceolate in shape."[118] Goethe describes his observations of plants as one in which he is continually looking, and finding new forms in the plant world. At first glance, Goethe recognizes familiar plants, but he looks closer and takes note of their particular forms and the relationships between their parts. Exploring plants in this way is done so with an emphasis on the appearance of what is in front of him.

This example also demonstrates how Brady's different aspects of imagination are interwoven. Not only is Goethe making close observation of the plants surrounding him on the mountain pass, he is also comparing the forms of those plants

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[117] Johann Wolfgang von Goethe, "Phenomenon" in *Selected Verse*, ed. and trans. by David Luke (New York: Penguin Books, 1986.), 234.
[118] Johann Wolfgang von Goethe, *Italian Journey*, trans. by W. H. Auden and Elizabeth Mayer (New York: Schocken Books, 1968.), 15.

with plants that he has seen before at lower altitudes. This is one form of projective imagination. What Goethe was projecting were the forms of previous plants he had observed. Just as when one may project a more perfect circle over a sloppily hand drawn one and notice how they do not line up, so too Goethe projected the forms of plants from lower altitudes onto those of higher altitudes, and noticed how the two forms did not coincide in spite of their similarities. Using projective imagination in this way spreads Goethe's process of looking over many experiences beginning with the initial formation of an idea about a plant followed by continuing to look and finding instances of variation of the same plant. He formulated an idea that fit with all of his perceptions by going back and forth between the two and adding multiple forms to his ideas. In this way the image quality of imagination is used to recreate the image quality of visual perceptions while expanding the idea related to the imagination by means of uniting various perceptions.

Goethe's account of his plant observation in the Alps points to his method and how he would begin his plant studies. The fundamental aspects of his method involved the use of exploratory and projective imagination. But we can also see a form of the ampliative imagination at work as Goethe observes Alpine plants. As Goethe is observing, he is not only considering the plants he is looking at, but also their mountain environment. Elsewhere, Goethe states, "A plant, like every other natural entity, cannot be imagined without an environment."[119] This is not the only way Goethe could be said to have used the ampliative mode of imagination in his botanical work. *Metamorphosis of Plants* is also the work of ampliative imagination.

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[119] Goethe, *Botanical*, 95.

Here Goethe traces out, step by step, the development of a plant from seed to seed as a result of his observations. *Metamorphosis* attempted to capture both the preceding and future conditions of a plant. Like tracing the snow on its journey through the water cycle, the sprouting and growing of a plant requires the use of imagination.

What then does all this imagining lead to? Goethe tells us that later on in his journey in July of 1787, while in a garden in Palermo, "it came to [him] in a flash that in the organ of the plant which we are accustomed to call the *leaf* lies the true Proteus who can hide or reveal himself in all vegetal forms."[120] Here then we have reached the revelatory mode of imagination in Goethe's botanical studies: the expansion of exploratory, projective, and ampliative images has reached a limit and turned into an experience of the leaf as the originatory form taken on by the various parts of a plant. This experience also plays out more methodically in *Metamorphosis*, as Goethe moves from plant to plant while uncovering a common development and progression of form. Goethe's protean leaf then becomes an aesthetic truth about plants where "invention stretches the power of imagination to its limits."[121] This stretching fits well with the continual addition of forms to Goethe's imaginal picture of plants until he reaches a kind of saturation point where he recognizes that all these forms are not separated from each other but are the various formal expressions of the protean leaf.

But Brady's goals were aesthetic in nature, and so applying her modes of imagination to Goethe's attempts to understand plants may seem inaccurate since it

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[120] Goethe, *Italian Journey*, 363.
[121] Brady, 163.

leaves the realm of the aesthetic for the scientific. It could be objected that Goethe's protean leaf is not necessarily an aesthetic experience. As his friend Friedrich Schiller would later tell him, it is an idea. Yet, I would agree it is an idea that is connected with aesthetic experience. The expansiveness that meets us when contemplating the snow in relation to the water cycle is of a similar kind to the expansion that accompanies contemplating the countless variety of leaf, petal, stamen, and other plant forms in one thought. The difference comes from when and how the understanding of the water cycle and the protean leaf took place. When we consider the water cycle while observing snow, this is something we bring with us from our store of knowledge. Goethe, however, came to his protean leaf in the course of his observations and saw it as "an idea, pregnant with possibilities," creating "a tumult and enthusiasm in the mind, which makes one intuitively anticipate its further development and the conclusions towards which it points."[122] Goethe's mental state contains an aesthetic element similar to awe mixed with the curiosity to pursue an idea further.

So in spite of not perfectly coinciding with each other, looking at Goethe's morphological approach to nature through Brady's modes of imagination brings out the aesthetic character in Goethe's work and shows its relevance in natural aesthetics. Not all theories of natural aesthetics make room for the imagination as Brady does. Allen Carlson represents this type of conceptualist understanding of natural aesthetics, and we will now consider how Goethe's morphology as a science makes aesthetic experience possible as well.

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[122] Goethe, *Italian Journey*, 364.

Allen Carlson: The Role of Knowledge in Aesthetic Appreciation

Allen Carlson aims to place natural aesthetics on the firm foundation of scientific knowledge. For Carlson, "to aesthetically appreciate nature we must have knowledge of the different environments of nature and of the systems and elements within those environments."[123] Carlson bases his use of scientific knowledge in natural aesthetics on the role of experts in art. With art, the most qualified to aesthetically judge a piece are those who have an understanding of art history and art criticism. Analogously, those most suited to aesthetically appreciate nature are naturalists and ecologists. In this way, the appreciation of both art and nature stand on firm intellectual foundations.

Carlson justifies his approach by noting that there are various natural environments such as forests, wetlands, and open prairies. How we appreciate each of these environments will differ depending on what we know about it to the extent that "our knowledge of the environment in question indicates how to appreciate."[124] For Carlson, the ways indicated in "how to appreciate" various environments are each bound up with a different "act of aspection" that is appropriate for that environment[125] The aspective act of opening ourselves to the wide vistas of a prairie or a mountain top would have no place in a dense forest where our vision is interrupted by the growth of

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[123] Allen Carlson, "Appreciation and the Natural Environment," in *The Aesthetics of Natural Environments*, ed. Allen Carlson and Arnold Berleant (Toronto: Broadview Press, 2004.), 72.
[124] Carlson, 72.
[125] Ibid.

trees and their foliage. These acts of aspection serve as guiding thoughts directing our attention towards a particular perception of the environment.

The central feature of an act of aspection in relation to how it applies to natural aesthetics is that it establishes background and foreground for the viewer. Carlson notes that nature most often serves as "our unobtrusive background," escaping our notice.[126] When we turn our attention to it, nature becomes "obtrusive foreground" and the experience is a "'blooming, buzzing, confusion' which in order to be appreciated must be tempered by the common sense and scientific knowledge that we have discovered about the natural environment so experienced."[127] The knowledge of the naturalist and ecologist serves to dampen down our experience of nature, bringing it into focus as a foreground that is worth attending to. Appreciation is directed towards what relevant sciences understand, giving it an objectivity that it would not have in a non-conceptual natural aesthetics.

Goethe's Morphology as Alan Carlson's Knowledge

Applying Allen Carlson's theory to Goethe differs from what was said about Brady and Goethe above. Brady's and Goethe's views on approaching nature emphasized perception and imagination. Examining Goethe in the light of Brady's ideas helped to explain his process of perceptual-based observation of nature which led him to the idea of the protean leaf and plant metamorphosis. Applying Carlson's

[126] Ibid.
[127] Carlson, 73.

theory requires accepting Goethe's results since, for Carlson, knowledge validates aesthetic experience by preceding it.

A strict interpretation of Carlson's natural aesthetics would object to giving Goethe's morphology a place alongside scientific concepts in this way. The conclusions of a science, such as ecology, appear out of a method quite different from that employed in morphology and so the foundation of scientific knowledge required by Carlson for appropriate aesthetic appreciation is tenuous. This in part comes from the development of scientific thinking since Goethe's own time which largely focuses on the molecular level in biology, making Goethe's use of the imagination seem out of place. The point here will be to set aside such differences in order to compare these two methods as assumptive foundations for aesthetic appreciation, seeing how they are similar and dissimilar, where they overlap and part ways. Using Carlson's theory points to a different way to apply Goethe's morphology to aesthetic experience than Brady's theory does. Viewing Goethe's description of plant metamorphosis (i.e. the *Urpflanze*) as a conclusion creates a foreground, in Carlson's sense, for the appreciation of nature and leads back to the practice of morphology as a method. This circularity of morphology between theory and practice recalls chapter two's question of whether Goethe's morphology is a theory or method and highlight's Goethe's claim that "everything in the realm of fact is already theory."[128] In this way, Carlson's theory clarifies the picture of what morphology is capable of as a science by showing that it requires a different kind of participation in relation to natural aesthetics than a science like ecology.

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[128] Goethe, *Scientific Studies*, 307.

A common ecological concept, such as the nutrient cycle of a forest serves as an application of Carlson's theory. Here the flow of nutrients, usually elements such as nitrogen, phosphorus, potassium, and others, circle through the different forms and objects within an environment. The elements themselves are not visually accessible and so are determined through a process of data collection involving sample collection, isolating the nutrients in the samples, measuring the amount of the nutrient, and then looking at the nutrients distribution in the forest both spatially and temporally. Here we can follow nitrogen from the ground into growing leaves and then back into the ground as they fall and decompose.

If we bring this idea with us to the forest as Carlson suggests, we can follow the path of a nutrient cycle through the growth of plants and their decay while only having a very vague sense of what the nutrient cycle entails. According to Carlson then, the idea of the nutrient cycle draws our attention to what is perceptually involved in this cycle. We may walk into a forest during the spring as the leaf buds on the trees are just beginning to open and stop to appreciate the connection of this budding to the decomposition of the leaves from previous years that made the necessary nutrients available in the soil. We can then look at the ground and notice the decomposing vegetable matter there and perhaps come across the remains of an animal and continue our appreciation of all that is involved in the nutrient cycle, how life and death are so closely intertwined. Without such knowledge we may approach the forest and appreciate the leaves, but have our aesthetic experience ruined by the animal carcass and wish it were not there. In this case our aesthetic judgment would be lacking the

appropriateness that Carlson desires; we would mistake the value of the carcass in the ecology of the forest.

Applying Carlson's theory to approaching the same forest via the idea of plant metamorphosis, different connections come to the foreground than were the case with the nutrient cycle. By looking at the same leaves, the forms first come to attention. Instead of our experience depending on our understanding of the nutrient cycle our knowledge of leaf forms becomes important. We could compare these leaves with our own morphological knowledge so as to bring out the uniqueness in form and color more clearly. At the same time our attention would be drawn to other leaves and other plants, but always focusing on particular expressions of particular plants. This may continue indefinitely, over several visits to the same forest and to different forests, even to different environments. Other plant forms would then highlight how a particular leaf is a unique manifestation of that plant and of that particular environment.

What then are the similarities and differences that emerge by following Carlson's suggestion to bring an ecological concept such as the nutrient cycle and Goethe's plant metamorphosis as ways to focus attention and ground our aesthetic experiences? First of all, both guide attention, an important factor for Carlson. In both cases the leaves are able to emerge from an unobtrusive background and become an obtrusive foreground. With the nutrient cycle, the foreground varies between budding leaves, rotting leaves, a carcass, all being held together by the concept of the nutrient cycle. With plant metamorphosis, focus stays on the leaves and may move to other plant forms, but does not move as easily to others forms like an animal carcass.

The forms could include decomposing plants, but they would be connected through their form and not as holders of nutrients. By comparing plants from differing ecosystems, as Goethe did with high and low altitude plants, a sense of the differences between ecosystems also comes about. There is then a potential in both approaches to be led through a whole environment and between environments, yet each does so in a different way. With the nutrient cycle, the leaves lead to the carcass. With morphology the leaves are kept separate from animal forms. The connections within a particular environment revealed by the nutrient cycle and plant metamorphosis are each exclusive within themselves; each calls forth different acts of aspection which overlap but do not fully coincide.

Alongside these similarities also runs a distinction between using an ecological concept such as the nutrient cycle and a morphological concept like plant metamorphosis in aesthetic appreciation of nature. A distinction appears in the case of not being able to include the carcass with the budding leaves by way of morphology as it was with the nutrient cycle. With this distinction, it becomes clear that the nutrient cycle follows materials and morphology follows forms, making the two complementary and opening up different ways to appreciate an environment.

An additional difference between the two approaches includes what and who is involved in the completion of the forming of the concepts involved. The nutrient cycle of a forest is a conceptually completed model. Learning about the nutrient cycle prepares us to visit a forest and recognize the nutrient cycle at work. Such a visit would not necessarily add anything to our own concept. To do so would require measurements using specific methods and tools that are not readily accessible in a

casual stroll through a forest. Taking the effort to refine the concept of a nutrient cycle for a particular forest may lead to a more appropriate aesthetic appreciation as a result, yet the effort involved would bring us far from aesthetic appreciation.

With morphology, all one needs to bring to develop a concept further is the concept itself. Entering a forest with only the idea of plant metamorphosis and without knowing anything about the particular plants and ecology of the forest, one can still notice the various surrounding forms, making comparisons and observations to bring up on the next visit. The more visits and observations, the more the concept of plants and other natural objects within the forest grows. Reading about the morphological findings of others may be helpful, but it is not necessary for practicing morphology. Experiencing the protean leaf may be beyond the casual stroll through a forest and it is difficult to take seriously as a finished concept, but the idea of it serves to continually draw attention to different forms; the more plant forms observed, the more they enrich and add nuance to our own idea of the protean leaf. Just as when Goethe first came across the idea in Palermo, the protean leaf is still "pregnant with possibilities" today. The construction of the idea for the individual is wholly participatory; it does not need to be translated into statistical data which is then analyzed. Rather, all data collection occurs perceptually and is stored and analyzed mentally. The protean leaf is a meaningless idea without knowing at least some plant forms, but once those first few plant forms are known, it is only the beginning of a potentially endless journey through the forms of nature.

Morphology and the Aesthetic Appreciation of Nature

The foundation that Goethe's morphology supplies for the aesthetic appreciation of nature integrates elements later discerned by Emily Brady and Allen Carlson. Morphology takes on the exploratory nature of Brady's theory where perception and imagination are central. Such exploration leads to the revelatory aspects of imagination in concepts like plant metamorphosis. The formation of a concept like this leads morphology away from the strictly aesthetic applications of Brady, but allows for its application as a science along the lines of Carlson. Morphology maintains its character even when it is applied as a science. The open nature of the concept of plant metamorphosis allows for a continued involvement in the exploration of the forms of nature. Goethe's morphology then creates a bridge between Brady's more open exploration and Carlson's desire for a focused guide.

The focus on form of morphology gives it an aesthetic quality that other sciences which focus on analysis lack. Forms can strike us more immediately as pleasing, or not, than the path of a particular substance in a nutrient cycle. For morphology the actual forms of nature are important, not other forms we could project onto nature. Goethe's morphology stays with the forms of nature as they present themselves, just as we could stay with a work of art and appreciate it for the forms it embodies while not considering so much its cultural significance. Staying with the forms of nature in this way offers a unique approach to the aesthetic appreciation of nature.

A further value of morphology in relation to natural aesthetics lies in the activity it encourages: close observation and comparison. This activity is self-generated by the individual, creating the possibility for exchange between the observer

and the natural object through perception and imagination and so on back and forth. It is this activity of exchange that becomes the foundation morphology supplies for aesthetic appreciation.

Were Goethe's morphology to become more prominent in aesthetic appreciation, an intentional relationship would develop between observers and their surroundings. One would not rely on being drawn by the colorful or unusual to see something beautiful, but rather would spend time exploring some of the most mundane places of an environment. The green of a forest or a prairie would no longer wash away the endless variety of leaf forms that often disappear in the crowd. Each leaf would begin to gain its own character and its own beauty.

Lest we get too caught in the details, Goethe's morphology can also lead us to consider the form of an environment as a whole, applying his expansive and contractive qualities to a landscape and noticing its effect on us. Walking under high Douglas firs offers a protective, yet open feeling, allowing us to relax as we walk along. But walking down the hill into a grove of low hanging oaks, we begin to constrict our focus as the environment constricts around us. What was a relaxing walk can then become a quest to navigate ourselves back out into the open.

Natural aesthetics serves as one possible area of application for Goethe's morphology while suggesting its accessibility to non-scientists. Looking to Goethe in this way can offer inspiration for modern understandings of nature that seek that emphasize environmental stewardship. The next chapter will focus on how this accessibility has been utilized both to present and to bring a critique of contemporary genetics to the public by the Nature Institute located in New York. The Nature

Institute offers a perspective on Goethe's morphology that relates it more directly to contemporary discussions within and about science.

Chapter Four: Goethean Science in a Contemporary Setting

> Thus in scientific matters we must do the reverse of what is done in art. An artist should never present a work to the public before it is finished because it is difficult for others to advise or help him with its production. Once it is finished, however, he must consider criticism or praise, take it to heart, make it part of his own experience, and thereby develop and prepare himself for new works. In science, on the other hand, it is useful to publish every bit of empirical evidence, even every conjecture; indeed, no scientific edifice should be built until the plan and materials of its structure have been widely known, judged and sifted.
>
> - Goethe, *The Experiement as Mediator between Object and Subject*

Goethean Science?

It may be difficult to recognize the utility of Goethe's morphology today amidst our biological world view structured by the neo-Darwinian synthesis of Darwin's natural selection, Mendel's genetics, quantitative methods, and the structural perspectives of heredity founded on the work of James Watson, Francis Crick and Rosalind Franklin. While the results of Goethe's morphology are far from modern biology, as we have seen in the last chapter, its participatory nature, by entwining subjective and objective elements, offers a unique opportunity do develop an aesthetic appreciation of nature. Goethe's morphology also encourages artistic activity through its pictorial nature. By creating an aesthetic relationship through immediate observation and art an ethical relationship can develop as well between individuals and natural environments that differs from the more distanced intellectual understandings conveyed through modern biology.

So far we have seen Goethe's science in three different forms: as a way to observe and understand plants, as a historically situated shift from taxonomic classification towards the incorporation of idealism, and as an observational method

relevant to natural aesthetics. This final chapter draws on each of these aspects while presenting a contemporary legacy of Goethe's science: The Nature Institute. In 1998, Craig Holdrege founded the Nature Institute in Ghent, New York as a non-profit organization with Steve Talbott as a senior researcher and Henrike Holdrege as an associate researcher. Both Craig and Henrike Holdrege taught high school biology before starting The Nature Institute. Henrike also taught mathematics. Talbott worked as a computer programmer and editor for O'Reily and Associates which publishes computer literature. Craig Holdrege and Talbott have been the most prolific authors at The Nature Institute, so this chapter focuses on their writings and refers to Craig Holdrege as Holdrege while designating Henrike when necessary.

The Nature Institute incorporates Goethe's morphological methods into its own research, educational programs, and critiques of contemporary scientific trends. Looking at The Nature Institute offers an opportunity to explore Goethe's methods without looking at him directly. Holdrege and Talbott use Goethe's method, shaped by their own intentions, to supply different directions of application for Goethean methods. What results incorporates Goethe's use of the imagination into understanding the natural world, while also backing away from direct reference to any *Urpflanze*. The *Urpflanze*, as represented in *The Metamorphosis of Plants*, becomes a practical way for looking at individual plant species.

The Nature Institute draws on the biographical and historical elements that Goethe began to incorporate into his scientific work in the latter part of his life. Holdrege and Talbott incorporate themselves into their scientific writings, noting why they are interested in a particular subject or presenting their opinions on the

implications of different scientific practices. Broader social and historical contexts are also central to many of the projects at The Nature Institute, following Goethe's inclusion of these themes in *Theory of Color*.

Aesthetic considerations are also central to The Nature Institute's work. Both in their own work and in their educational programs appreciation of nature is a goal beyond understanding nature. These aesthetic considerations come into play for understanding as well. Holdrege's research often involves his own drawings and artistic activity is also important in their educational courses.

Drawing broadly on Goethe's work in this way has made the kind of research carried on at The Nature Institute difficult to convey as it sits on the boundary between science and art. In the first *In Context* (Spring 1999), their semi-annual newsletter, Talbott addresses this issue by giving a list of possible names for the type of research the Nature Institute plans on conducting: holistic, Goethean, phenomena-centered, qualitative, participative, or contextual science. With none of these being completely adequate, Talbott admits that they "will probably continue to jump from one term to another" while "searching for the 'inspired' terminology that conveys to the public imagination something of the vision [they] are pursuing."[129] Through Talbott's list of possible names as well as his "searching," The Nature Institute incorporates Goethe's work while also working out how to present itself to the public. How The Nature Institute has attempted to situate itself within this space by relaying its own research and other scientific research to the public is the focus of this chapter.

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[129] Stephen L. Talbott, "Goethean Science?" *In Context* 1 (Spring 1999): 4.

Engaging the Public

The public, rather than other researchers, is the intended audience of The Nature Institute. The most direct interaction between The Nature Institute and the public is through their educational courses. The main courses offered at the Nature Institute occur during the summer and are led by Holdrege and his wife, Henrike Holdrege. They have offered a variety of courses over the lifespan of The Nature Institute, but the longest running ones are week long summer courses aimed at the general public and teachers.

The public courses appeal to those interested in "a practical introduction to Goethean phenomenology."[130] These courses include the integration of observation of nature with geometrical and artistic activities such as drawing, painting, or clay modeling. The geometrical exercises, done both on paper and mentally, look at geometrical forms in relation to each other. An example of this is the relation between a circle, point, and line. As the radius of a circle decreases to zero, the circle becomes a point. In the other direction, as the radius approaches infinity, the circle appears as a line. Practicing morphology in relation to geometry is intended as a "practice overcoming rigid habits of thought and to lay the groundwork for experiencing plant growth."[131] The artistic activities contribute to this intention as well by also focusing

[130] "Coming Alive to Nature: Practicing the Goethean Approach to Science Public Summer Course," *In Context* 26 (Fall 2011): 20.
[131] "Coming Alive to Nature: Summer Courses at The Nature Institute, 2008 Summer Courses," The Nature Institute, http://natureinstitute.org/educ/summer/2008.htm (accessed February 10, 2012).

on the morphological aspects in nature and are intended for "deepening [the participants] experience in observation."[132]

Including geometrical and artistic aspects alongside Goethe's morphology has the effect of isolating the two main aspects involved in Goethe's method: bringing mobility to thinking and imagination while refining observational and perceptual skills. The geometrical exercises bring attention to thinking and imaginative aspects in preparation for imagining the transformation of more complicated plant forms. The artistic activities place focus on the sensory experience and what one is observing so that it bypasses thinking and goes directly into the hands to create another object for observation.

The inclusion of apparently non-morphological activities is designed to prepare the individual before they approach nature, rather than as tools to look at nature. The promotional literature for the courses often refers to Goethe's notion "that the human being is the 'best and most exact scientific instrument'" and that "If we wish to gain a living understanding of nature, we must follow her example and become as mobile and flexible as nature herself."[133] This appeal to the transformation of the individual carries with it the suggestion that learning to look at nature by drawing on Goethe's morphological methods is not only useful for understanding nature, but can be applied more broadly wherever thinking and perceiving are involved. The potential for

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[132] Coming Alive to Nature: Summer Courses at The Nature Institute, 2009 Summer Course," The Nature Institute, http://natureinstitute.org/educ/summer/2009.htm (accessed February 10, 2012).

[133] "Coming Alive to Nature: Summer Courses at The Nature Institute," The Nature Institute, http://natureinstitute.org/educ/summer/index.htm#courses (accessed February 10, 2012).

broader applications taken up by individual participants, not necessarily learning facts about nature, form these courses' public appeal.

The other regular course offered by The Nature Institute has been geared towards science teachers. The emphasis for these courses is on a "path of experience-based learning" for the students of the course participants.[134] The approach is reminiscent of Goethe's *Theory of Color*, since it teaches the participants ways for their own students to "experience the phenomena from a variety of perspectives" while also engaging "thinking, imagination, and feeling."[135] In *Theory of Color* Goethe presented this method through description of observation after observation and experiment after experiment, creating a panoramic view of the various phenomena. Likewise, the goal for the teacher is to present natural and experimental phenomena, not second-handedly, but through multiple experiences where the students themselves struggle to understand what they are seeing and how to describe it.

Through both courses, there is an emphasis on what Frederick Amrine called the "metamorphosis of the scientist" in regards to Goethe's morphology where "the goal of science is not to end with an abstract theorem but rather with new capacities that are themselves incitement to ever greater activity and ever enhanced perception."[136] Amrine relates the individualized "metamorphosis of the scientist" to Thomas Kuhn's broader community revolutions between scientific paradigms. The

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[134] "Bringing Science to Life: A professional development program for science teachers," The Nature Institute, http://natureinstitute.org/educ/HS-science/index.htm (accessed February 10, 2012).
[135] Ibid.
[136] Frederick Amrine, "The Metamorphosis of the Scientist," *Goethe's Way of Science: A Phenomenology of Nature*, ed. David Seamon and Arthur Zajonc (Albany: State University of New York Press, 1998), 47.

difference remains that the "metamorphosis of the scientist" occurs through each individual's intention to remain "plastic in their way of seeing" where one explanation does not necessarily overthrow another, but adds another dimension to what was previously understood.[137] Whether it is through observation, artistic activity, or the use of multiple experiments, the experience of a particular phenomenon is rounded off rather than sharpened through a single perspective.

By offering these public courses, the Nature Institute works along lines similar to what Mary Fissell and Roger Cooter called "the commonsense model of the production and diffusion of scientific knowledge."[138] Here The Nature Institute diffuses its knowledge to course participants. But the knowledge that is diffused is not knowledge of nature, but the production of knowledge of nature. The effect is knowledge production that is not centered in a particular group, but is potentially centered within each individual whether it is the general public or teachers and their students. This recognition of the public as capable of producing knowledge of the natural world extends as well through the Nature Institute's presentation of the scientific work of others, especially as it relates to genetic engineering. Before examining this we need to look at the research of The Nature Institute itself.

Methodological Applications

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[137] Goethe, "Preliminary Studies for a Physiology of Plants" (Vorarbeiten zu einer Physiologie der Pflanzen), *Goethes Werke, Weimarer Ausgabe* (Weimar: Hermann Böhlau), II.6:349, quoted in Amrine, "Metamorphosis," 46.
[138] Mary Fissell and Roger Cooter, "Exploring Natural Knowledge," in *The Cambridge History of Science: Volume 4 Eighteenth-Century Science*, ed. Roy Porter (Cambridge: Cambridge University Press, 2003), 129.

Though The Nature Institute does attempt to engage scientists at times through scientific journals, much of its research ends up in their own semiannual newsletter, *In Context*, or in a handful of books. Each issue of *In Context* contains articles and reviews, mostly written by Holdrege and Talbott, where they present the results of their own research or critique aspects of contemporary scientific ideas. Holdrege is the central researcher of biological phenomena drawing on his own background as a high school biology teacher. Since beginning The Nature Institute and educating more adults, he completed a PhD in Environmental Education from Prescott College. His plant studies on bloodroot, skunk cabbage, common milkweed and tree formation exhibit the most direct connection to Goethe. In addition to these plant studies, Holdrege has drawn on Goethe's methodology to look at various animals such as elephants, giraffes, and sloths. Since our focus so far has been on Goethe's botanical work, we will focus on Holdrege's own work with plants.

Holdrege takes Goethe's *Metamorphosis of Plants* and directly applies it to individual plants. Rather than describing an overarching *Urpflanze* as Goethe did, Holdrege uses the description of the *Urpflanze* to depict particular plants. His first major plant study was focused on the skunk cabbage.[139] Holdrege has revised his study three times, each time introducing his own interest first and telling why he was drawn to the skunk cabbage. Having recently moved to New York, he saw his first

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[139] Craig Holdrege, "Skunk Cabbage (*Symplocarpus foetidus*)," *In Context* 4 (Fall 2000): 12-18; Craig Holdrege and Steve Talbott, *Beyond Biotechnology: The Barren Promise of Genetic Engineering*, (Lexington, Kentucky: The University of Kentucky Press, 2008); "Goethe's Delicate Empiricism," eds. Brent Dean Robbins and Craig Holdrege, special issue, *Janus Head* 8, no. 1 (Summer 2005). Though he first published on the skunk cabbage in 2000, Holdrege has repeatedly turned to it to demonstrate a Goethean approach.

skunk cabbage while walking in a wooded swamp where the buds of "some strange looking plants... emerged directly out of the icy ground."[140] Being the only sign of growth at that time of year, Holdrege spent the next six years observing and reading about skunk cabbages until writing his thoughts on the plant.

This personal introduction recalls Goethe's use of biographical information to supplement the republications of *Metamorphosis* in 1817 and 1831. Goethe's biographical supplements displayed both his enthusiasm and experience with the subject matter. Holdrege too suggests such a connection saying,

> So that's how it begins. Something captivates your interest, and you move toward it. For me this meant returning to the skunk cabbage again and again – in all seasons and at different times of the year. I did this over a period of six years, in which time I also read everything I could get my hands on regarding the skunk cabbage (which wasn't a whole lot).[141]

An introduction like this allows the reader to gain a sense of the experience of the author while at the same time connecting the subject matter with that author; that is, the production of knowledge presented becomes explicitly tied to the author in the text. This is a common style for literature directed at a popular audience, yet the usage with Goethe and Holdrege is something more than that.[142] Biographical or personal information serves a purpose beyond making something more readable for the public. It adds a contextual element to the subject matter that ought to be considered alongside

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[140] Holdrege and Talbott, *Beyond*, 210; *Janus Head*. The same description appears in both.
[141] Holdrege and Talbott, *Beyond*, 210.
[142] See for instance Stephen T. Asma, *Stuffed Animals and Pickled Heads: The Culture and Evolution of Natural HistoryMuseums* (Oxford: Oxford University Press, 2003). Asma takes on a very familiar tone with the reader in his journey to discover what goes on in museums.

it and not separated from it. To this effect, Holdrege places emphasis on engaging in a "conversation" with the skunk cabbage, emphasizing the entwinement of subjective and objective elements.

Another point of entry for Holdrege is to begin addressing the reader as if they were walking together down to the still frozen wetlands in midwinter where they come upon a growth of skunk cabbages. This too can be seen as merely a way to engage the reader's attention without offering immediately relevant information. Yet from a Goethean perspective, it provides an imaginative introduction to the environment of the skunk cabbage. Frozen wetlands, a nearby stream surrounded by short brush under a bare canopy of tall maples and alders are all relevant because they surround the skunk cabbage. This recalls Goethe's relation of plants to their environment where "a plant, like every other natural entity, cannot be imagined without an environment," something Holdrege will explore in more detail with his description of tree growth.[143] This way of introduction primes the imagination of the reader with images from Holdrege's own study.

Holdrege begins to describe his "conversation" with the skunk cabbage by telling how he "began building up a picture of the plant's development through the year."[144] This involved visiting the skunk cabbage about every one or two weeks, making sketches, taking photographs, and asking questions. These questions would both pertain to specifics such as the form of a particular part or be left open to however the skunk cabbages appeared that day. We get a hint here of what Goethe

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[143] Johann Wolfgang von Goethe, *Goethe's Botanical Writings*, ed. and trans. by Bertha Mueller (Woodbridge, Connecticut: Ox Bow, 1989.), 95.
[144] Holdrege and Talbott, *Beyond*, 211.

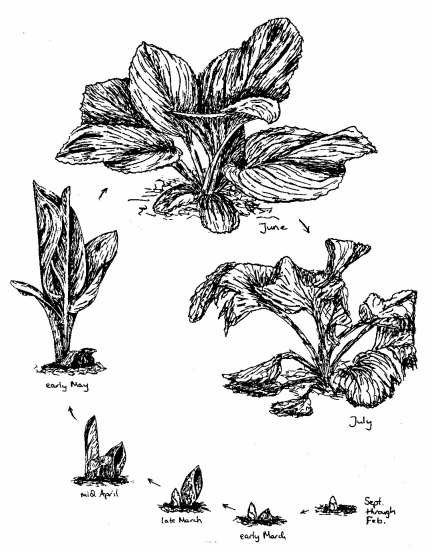

Fig. 9 – Skunk Cabbage Development From http://natureinstitute.org/pub/ic/ic4/skunkcabbage.htm.

was referring to in Chapter One as the centripetal and centrifugal forces in morphology as they relate to knowledge. Focus on individual forms serve to bring in attention, while the continual change of plants dissolves or widens attention by moving it beyond a particular form. Holdrege hones in on particular aspects with questions (centripetal) while alternating with times of having no question at all to focus his attention (centrifugal). Though focus in such observations seems natural, a lack of focus may appear unnatural and Holdrege points out that it is unlikely we are completely open to our perceptions. Yet to move towards an open disposition, Holdrege refers to Henry David Thoreau's "true sauntering of the eye" where the observer should "Go not to the object, let it come to you."[145] The lack of precision in Thoreau's statement shows Holdrege's value for interpretative space for approaching nature.

Holdrege traces the development of the skunk cabbage from its first appearance in March to its decay in August (Fig 9). The movement inherent in this development from beginning to end is one context that defines the skunk cabbage. Initially, its form is a tightly contracted, bud-shaped spathe, which encloses the flower throughout it development all the way through pollination. By holding this form, the skunk cabbage mirrors all other plants in the environment which are budding at that

[145] Holdrege and Talbott, *Beyond*, 212.

time. The early stages of the skunk cabbage are marked by its similarity in form to its environment. After pollination and the leaves have fully emerged, decay sets in for the skunk cabbage just as the rest of the forest has reached peak greenness in June and July. The opposition of the skunk cabbage in its decay to the lushness of the environment marks its final stage.

As was mentioned in Chapter 4, during his trip through the Alps, Goethe related plant forms to the environment. Holdrege also relates the successive stages of the skunk cabbage not only to its own development, but to the broader context of the development of its environment. Rather than comparing the same plant in two different environments (mountain and lowland) as Goethe did, Holdrege compares the skunk cabbage to the same environment at different times of the year. In Goethe's case, plant forms showed more definition in the Alps than at lower altitudes. Holdrege's find is different. The common formal features are more specific both formally and temporally in the bud, which opens and disappears in late winter and early spring.

All Holdrege's descriptions emphasize context, and not just one context, but several. First is the subjective context of the author: why Holdrege is interested in the skunk cabbage, and what about his own background can serve to inform the judgment of the reader on what he presents. The individual development of the skunk cabbage is another context in which each stage has its place. The environment holds yet another context the skunk cabbage exists in. Each of these contexts highlights something significant about the skunk cabbage that cannot be seen in the others: the skunk cabbage as a curiosity for humans in its unique form, how the different forms of

the skunk cabbage throughout its development relate to each other, and how those forms relate to the forms of the environment.

Holdrege approaches the relation of from and environment in another way in his study of tree growth. Since trees can grow over many hundreds of years, it is impractical to study their growth in the same way as a skunk cabbage. Holdrege compares trees surrounded by the different environments of a forest, an open field, and a hillside. Holdrege focuses on the tendency to form completed crowns by these trees. In isolation, a tree does this on its own, yet when it is near other trees this is not so and can be quickly recognized by comparing the form of a tree from a group to one that is isolated (Fig 10). The tree taken from a group appears unnaturally tall with a crown only emerging on the very top, while the isolated tree appears full with its crown reaching toward the ground.

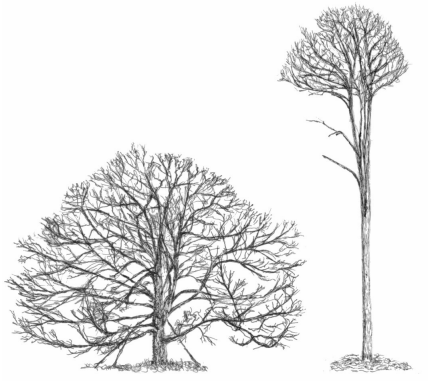

Fig. 10 – Two different specimens of white oak *(Quercus alba)*. The specimen on the left is a free-standing tree, while the tall, slender tree on the right grew in a forest. From http://natureinstitute.org/pub/ic/ic14/trees.htm.

In describing the various forms of trees, Holdrege did not apply neo-Darwinian assumptions and "consciously avoided the terminology of competition often applied to biological phenomena."[146] By doing so, he focuses on the morphological aspects of the trees and relates them directly to their environment, emphasizing his contextual approach.

[146] Craig Holdrege, "The Forming Tree," *In Context* 14 (Fall 2005): 21.

These are only two examples from Holdrege showing his own approach to understanding an organism. These, along with his other studies, inform a way for him to approach the claims of modern genetics and contextualize our understanding of genes.

Engaging Genetics

In 1996, two years before starting The Nature Institute, Holdrege published a critique of genetics and its use in genetic engineering. In *Genetics and the Manipulation of Life: The Forgotten Factor of Context*, Holdrege presents contextual ways of looking at organisms and provides an overview of the history of genetics.[147] Holdrege views the gene as an ill-defined term and signals the potential harm of its use in genetic engineering. His work at The Nature Institute continues these themes and applies them to educating the public and engaging scientists.

The first attempt by Holdrege while at The Nature Institute to engage scientists came in April 2005, when he joined with Malte Ebach, then at the Buffalo Museum of Science, in writing a letter to *Nature* on the increased usage of DNA barcoding.[148] Taxonomists use DNA barcoding to identify plants through genetic markers rather than through morphological methods. Knowing whether a specimen shares a genetic marker with other specimens of a known species determines if it is classified into the same species. It can also be used to determine a new species if a specimen does not

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[147] Craig Holdrege, *Genetics and the Manipulation of Life: The Forgotten Factor of Context* (Hudson, NY: Lindisfarne Press, 1996).
[148] Malte C. Ebach and Craig Holdrege, Correspondence, *Nature* 434 (7 April 2005), 697.

share a genetic marker with a known species. Holdrege and Ebach focus on two areas of concern regarding these methods: the diversion of funding from taxonomic research towards barcoding; and the shift from the knowledge gained through taxonomic efforts towards the informational style of barcoding. They point to the First International Barcoding Conference held in February 2005 at the Natural History Museum in London as place where several research institutes met to promote using museums and other similar institutions as "centres for DNA barcoding" through initially small grants and plans for larger future grants.[149]

Two subsequent responses appeared in *Nature* to Ebach and Holdrege that supported the use of barcoding. The first appeared in April 2005 by T. Ryan Gregory of the University of Guelph.[150] Gregory spoke to two of Ebach and Holdrege's concerns. He first pointed out the potential of finding new species with barcoding and that when new species are discovered they would then go through traditional taxonomic procedures of being named based on features and environment. Gregory also points to DNA barcoding funding being largely in the form of "big science" so that barcoding would not compete with taxonomic funding but rather with other "big science" grants like physics and medicine.

The second response came in May of 2005 from David Schindel and Scott Miller of the Consortium for the Barcode of Life, a part of the Smithsonian Institution. Schindel and Miller address Ebach and Holdrege's concern of barcoding replacing taxonomy by agreeing with them that "DNA barcoding is no substitute for taxonomy"

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[149] Ibid.
[150] Ryan T. Gregory, Correspondence, *Nature* 434 (28 April 2005), 1067.

and that taxonomy will continue and be supplemented by barcoding which will aid in sorting collections, identifying damaged specimens, and clarify boundaries between certain species.[151]

These responses show that practicing biologists are aware of Holdrege and Ebach's concerns. To elaborate on those concerns more fully, Holdrege and Ebach responded in a longer commentary piece in the May issue of *BioScience*.[152] They reemphasize DNA barcoding's informational character claiming that all the effort going into collecting this information would draw attention away from actual problems and issues in taxonomy. In addition, they claim that all the new information from DNA barcoding will require an even more in-depth knowledge of morphology and ecology. They agree with Gregory's point that "big science" funding is different from funding by smaller grants, but they maintain that "big science" funding will place barcoding in a prominent position where it will be seen as the modern form of taxonomy and eclipse traditional methods leading to their defunding. Their most pointed critique comes with regard to barcoding as a way to protect biodiversity, claiming that it is ironic "that only enormous numbers of cataloged species, each with its own unique mitochondrial DNA sequence, will motivate human beings to gain, at last, respect for life" and that such a method does not lead to any relevant knowledge about "the creatures we are supposed to care about."[153]

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[151] David E. Schindel and Scott E. Miller, Correspondence, *Nature* 435 (5 May 2005), 17.
[152] Malte C. Ebach and Craig Holdrege, "More Taxonomy, Not DNA Barcoding," *BioScience* 55, no. 10 (October 2005), 823-824.
[153] Ibid.

Though Holdrege's work is not taxonomic, and, as we saw with Goethe in Chapter Two, is even partially anti-taxonomic by offering only individual studies of plants, taxonomy is more akin to his methods than DNA barcoding. The taxonomy Holdrege and Ebach support still requires similar skills in observation and imagination that Goethe's morphology puts to use. Holdrege's study of the skunk cabbage shows his naturalist tendencies and his "conversational" methods contrasts sharply with what he sees as the mere collection of information in DNA barcoding.

The Nature Institute researchers rarely engage scientists in this fashion. The lay public has been a more receptive audience for their ideas and has garnered most of their attention. By reaching the public through their newsletter and website, more space is available to make their presentation than a few columns in *Nature*. Their appeals to the public on ethical considerations of science include the work of others at The Nature Institute besides Holdrege, such as Steve Talbott.

Organism or Mechanism

Talbott initially worked within the computer industry as both a software developer and technical writer. He has also been an editor of *Pensée*, a journal dealing with science in popular culture, and at O'Reily and Associates, which focused on computer literature. With his background in computer technology, Talbott works at The Nature Institute mainly as a critic of the mechanical interpretation of natural phenomena and how it leads to attempts at mimicry with computers.

Talbott uses the mimicry of animal behavior by others to illustrate what he calls "phenomena-avoidance."[154] One example of "phenomena avoidance" he addresses early on in *In Context* (Fall 1999) looks at Craig Reynolds' BOIDs: simple animations programmed to follow three rules in order to simulate bird flocking behavior. Each BOID is to keep the least possible distance between itself and other objects, maintain the same speed as surrounding BOIDs, and move towards the center of the group. If an animated object is in the way of a flock of BOIDs, the flock breaks in two and rejoins after passing the object, just as real birds might. The movement of BOIDs is not only used to describe birds, but other animals that move in herds as well.

While such descriptions appear interesting, with their promoters saying they have "capture[d] the essence, not only of flocking behavior in birds, but also of herding behavior in sheep and schooling behavior in fish," Talbott points to their lack of applicability when looking at actual flocking birds.[155] Talbott illustrates these limits by pointing to the flocking behaviors of starlings as a "boiling mass," chickadees' moving "serially" one after the other, and geese taking on a v-formation.[156] Starling behavior points to birds that do not always move to the center of the group, but the group both expands out from and shrinks towards the center. Chickadees and geese show instances of birds flocking but not maintaining minimal distances or similar speeds.

Just as Holdrege attempts to show the role of context by positively displaying its relevance to understanding the skunk cabbage, so too Talbott tries to show the

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[154] Stephen L. Talbott, "Ignoring Details on Principle," *In Context* 2 (Fall 1999): 3-4.
[155] Ibid.
[156] Ibid.

relevance of context by pointing to instances where it is lacking. With models like BOIDs, "the world itself begins to disappear behind a veil of hypostatized, abstract concepts viewed as mechanisms" which "fails to engage the world of experience."[157] A model that set out to imitate a natural phenomenon lost all similarity with that phenomenon to the point where Talbott wonders if it actually tells us anything at all. This stripped down picture of an abstract driving mechanisms of nature is also the picture presented to the public by The Nature Institute of the modern understanding of genes.

Nontarget Effects: Bringing Science to the Public

In 2008, The Nature Institute addressed genetics in two ways: the web-based "The Nontarget Effects of Genetic Manipulation," and the publication of *Beyond Biotechnology: the Barren Promise of Genetic Engineering* coauthored by Holdrege and Talbott.[158] "Nontarget," in addition to being web-based (nontarget.org), also had an issue of *In Context* (Spring 2008) devoted to introducing and documenting unintended side-effects of genetic engineering in the scientific literature in order to counter the idea that "genetic manipulation of organisms is a 'precise science.'"[159] To show the "invasive actions" of genetic engineers, they brought scientific research to the public from journals such as *Plant Molecular Biology*, *American Journal of Botany*, *Nature Biotechnology*, and many others, summarizing the findings where

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[157] Stephen L. Talbott, "Toward a 'Final Theory' of the Sloth?" *In Context* 3 (Spring 2000): 3.
[158] Holdrege and Talbott, *Beyond*.
[159] Craig Holdrege and Steve Talbott, *In Context* 19 (Spring 2008): 2; Steve Talbott, "Toward a More Informed GMO Debate," *In Context* 19 (Spring 2008): 3.

unexpected results occurred.[160] The Nature Institute rooted their presentation of nontarget effects in their multi-contextual, Goethean presentation of plant and animal development, a presentation contrary to reducing traits to an essential ingredient like DNA.

One example is the article "Trans-gene Expression of a Bean Alpha-Amylase Inhibitor in Peas Results in Altered Structure and Immunogenicity," published in *Journal for Agricultural Food Chemistry*, in 2005. The use of language just in the title may not be immediately understandable to some readers of *In Context* who are likely unfamiliar with the terminology of molecular biology. In his summaries, Holdrege explains more plainly the reaction of mice fed genetically altered peas, stating "the scientists found that the mice developed an immune response to the peas, meaning they produced antibodies against the genetically modified protein."[161] "Nontarget" reports other researchers who followed up on these initial studies found that feeding the genetically altered peas to livestock decreased starch digestion in pigs and chickens. Additionally, the chickens gained less weight than chickens fed unmodified peas. In all, The Nature Institute has summarized eighty-four different non-target effects in both plants and animals to show that unexpected results in genetic engineering are more common than generally understood.

Holdrege notes four basic categories of how nontarget effects have been reported. Firstly, they are not reported at all. Holdrege refers an article from 1995 in *Current Opinion in Cell Biology*: "Organisms that do not perform as expected are

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[160] Ibid.
[161] Craig Holdrege, "Some Examples of Nontarget Effects of Genetic Manipulation," *In Context* 19 (Spring 2008): 5.

discounted as defective or atypical... It is important, therefore to recognize that most published works represent a selected subset of transgenic organisms that have been produced."[162] Holdrege holds that these overlooked or discarded nontarget effects are of an unknown number and that they are unaccounted for in the scientific literature.

The remaining three categories of how nontarget effects provide substance for the "Nontarget" project. This includes where nontarget effects are not directly identified as such, but the article shows some evidence of them, such as leaves changing from simple to compound forms.[163] Articles may also refer to unexpected effects but not focus on them; they are merely seen as "side-effects." Finally, nontarget effects may be the central focus of the article through studies of risk assessment for health and safety.

Combing through all of the scientific literature to make summaries of relevant findings recalls Goethe's presentation of numerous experiments and observations in *Theory of Color*, in spite of being a collection of the results of others. The organization of the project is similar to Goethe's categorization of experiments under physiological, pathological, physical, and chemical headings. Goethe attempted to "categorize empirically" so that "everything gradually falls into place under higher principles and laws revealed not to our reason through words and hypotheses, but to

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[162] W. G. Doughtery and T. D. Parks, "Transgenes and Gene Suppression: Telling Us Something New?" *Current Opinion in Cell Biology* 7 (1995): 399-405, quoted in Craig Holdrege, "Understanding the Nontarget Effects of Genetic Manipulation," *In Context* 19 (Spring 2008): 9.

[163] K. Müller, X. He, R. Fischer, and D. Prüffer, "Constitutive *knox1* Gene Expression in Dandelion (*Taraxacum officinale*, Web.) Changes Leaf Morphology from Simple to Compound," *Planta* 224 (2006): 1023-1027, quoted in Holdrege, "Understanding," 9.

our intuitive perception through phenomena."[164] For Goethe, it made sense to group together descriptions under physical colors the production of color by means of lenses, prisms, and other manipulations of light and dark by an apparatus. More general categories such as this then have subcategories of refraction, reflection, and the conditions for the appearance of color.

The organization of experimental results in relation to nontarget effects takes on a similar style appearing on a webpage which allows for more flexible categorization by placing the same experiment under several headings.[165] This recalls Goethe's claim that "Nature has no system," discussed in the second chapter, by offering several organizations of the same phenomena. The broadest categories contain the most overlap in this way. Here "Unintended Effects," "Intended Effects," and "Manipulated Organism" are three categories that each included all of the collected research results. Under each of these three, they then take on more strictly the character of Goethe's categorization methods. Under "Unintended Effects" there are different types: behavioral, environmental, physiological, morphological, food and feed quality, and scrambled DNA. The "Manipulated Organism" section is divided into plants and animals before being further categorized into specific kinds of plants and animals. Incorporating several organizational schemes for the same set of phenomena, each with its own "intuitive perception" along the lines of Ronald Brady's

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[164] Johann Wolfgang von Goethe, *Scientific Studies*, ed. and trans. Douglas Miller, vol. 12, *Goethe's Collected Works*, ed. Victor Lange, Eric Blackall, and Cyrus Hamlin, (New York: Suhrkamp, 1995), 194-195.

[165] "Unintended Effects of Genetic Manipulation: A Project of The Nature Institute," The Nature Institute, http://natureinstitute.org/nontarget/report_class.php (accessed February 10, 2012).

cube discussed in Chapter One, highlights them as products of knowledge rather than inherent in nature itself.

The Nature Institute focuses solely on nontarget effects of genetic engineering, losing the panoramic view Goethe presented in *Theory of Color*. The organization lacks the depth of Goethe's, but this can be attributed to the scope of each project. Goethe took on a very large topic: color. The nontarget effects of genetic engineering are already a subset of a larger subject. Had the project been to look at all the effects of genetic engineering, it would need to be categorized in a different way. These limits come from the intention of the project to publicize something "simply not widely known."[166] With this there is the recognition of an audience not so much of other scientists, with whom these results are "not disputable or even particularly controversial," but of the broader public.[167] There is a particular image of genetic engineering that exists in the public imagination that is not the same that exists among geneticists and the project aims to rectify this. The diffusion model of conveying science to the public is at work here, intended not to promote scientific results, but to bring scientific questions to a broader public.

Talbott's introductory essay on the project opens with the questions, "Is genetic engineering good for you? Is it good for the planet? And what about the organisms themselves – the ones we are so enthusiastically engineering? Do they have anything to say about the matter?"[168] The "Nontarget" project intends to answer the last two questions by showing how organisms have responded to genetic

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[166] Talbott, "Toward," 2.
[167] Ibid.
[168] Ibid., 3

engineering. The first two questions are more directly answered by Holdrege and Talbott in *Beyond Biotechnology*.

Beyond Biotechnology: Enlarging the Context of Genetic Engineering

The Nature Institute does not intend to be a "neutral" research center when it comes to the applications of scientific research. Talbott addressed this from the start in 1999, describing the Nature Institute's "inescapable ethical commitment" where "the ethical element is always present, and is not something just tacked on at the end."[169] Here, science is engaged in as a "conversation" which itself "expresses our ethical respect or disrespect for nature."[170] Holdrege and Talbott's *Beyond Biotechnology* (2008) represents the application of the ethical entwinement with science by collecting and presenting various aspects of their previous work as a unified statement.

As a part of the University of Kentucky Press "Culture of the Land" series, *Beyond Biotechnology* focuses on modern agricultural practices and the use of genetically modified organisms within those practices. While they present aspects of the "Nontarget" project and examples of their own contextual approach to understanding nature, *Beyond Biotechnology* also expands to include the social and economic context surrounding the use of genetic engineering within agriculture, particularly examining the claims that these practices are a solution to problems of hunger and helpful for farmers. The broad scope of *Beyond Biotechnology* adds to its

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[169] Steve Talbott, "A Way of Knowing as a Way of Healing," *In Context* 1 (Spring 1999): 3-5.
[170] Ibid.

public character, for it does not speak about genetic engineering in isolation, but speaks about how it has been applied and what has resulted from those applications.

Regarding hunger, Holdrege and Talbott point to the Green Revolution in Southeast Asia of the 1960s as bringing about "a shift toward intensive cultivation of fewer crops, like wheat and rice, which are often grown for export."[171] The effect of growing fewer crops along with the use of machines in farming expanded the size of farms and reduced the need for workers, pushing many towards the cities to try to earn a living. By centralizing the production of food, the need to buy food to eat arose on a wider scale; people were no longer growing their own food. This situation led to "nearly eighty percent of all malnourished children in the developing world in the early 1990s liv[ing] in countries that boasted food surpluses," showing that hunger is not only a problem of an inadequate food supply, but also a problem of the supply chain.[172]

One response to this situation has been "golden rice" which was genetically modified to produce beta-carotene within the endosperm of rice (making it appear gold rather than white) to combat widespread vitamin A deficiency. For the creators of "golden rice," which included the Rockefeller Foundation and the European Union, it is a simple solution to a specific problem. Holdrege and Talbott draw out the complexity of the problem. Beyond the historical context described above, the cultural context also plays a role. The eating of white rice has cultural significance

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[171] Holdrege and Talbott, *Beyond*, 18.
[172] G. Gardener and B. Halweil, *Underfed and Overfed: The Global Epidemic of Malnutrition*, World Watch Paper 150 (Washington, D.C.: World Watch Institute, 2000), quoted in Holdrege and Talbott, *Beyond*, 18.

dating back to Confucius while agriculturally numerous varieties of rice are still grown in Southeast Asia. If "golden rice" were to be effective, it would need to be widely grown and many of the other varieties of rice given up.

An additional context is that of nutrition and whether the beta-carotene of "golden rice" will be available for absorption when eaten. Bringing up these questions adds another consideration in relation to the use of genetically modified food to answer problems of malnutrition. Holdrege and Talbott note that the agriculture that predated the Green Revolution provided beta-carotene through the many different types of greens that were grown and that rather than trying to maintain the large-scale monocultures of a few crops that can be exported, malnutrition would be better addressed by "polycultures" that "allow, as long as there is enough food, a balanced, life-sustaining diet."[173]

Supplying broader social and economic context for the use of genetically engineered food highlights the "conversation" that has taken place between the developers of large-scale agricultural methods and the problems they sought to address, while illustrating Talbott's claim that "the ethical element is always present." Though scientific research may take place within an isolated lab where the impact of its effects are limited, when the modified organism leaves that lab, its effects move beyond what the scientist understands to it interacts with new environments. To understand these effects, a broad perceptual scope helps more than a narrow one.

The Nature Institute has engaged the public in order to involve them within science. Though they at times resort to some heavy language in some of their titles or

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[173] Holdrege and Talbott, *Beyond*, 18.

present an unbalanced focus on only nontarget effects in genetic engineering, these efforts attempt to present what scientist know in contrast to what is often conveyed, or not conveyed, to the public consciousness through media, food labels, and other outlets. Though many of their efforts have appeared as confronting current conceptions of genetics, their website currently points to their agreement with certain geneticists and displays their self-conception as a source for the public on information on current scientific research:

> It hasn't hit the public consciousness yet, but the "epigenetic revolution" is radically transforming scientists' thinking about genes and their relation to the organism as a whole. It makes much more sense, researchers have been discovering, to say that the whole organism is in charge of its genes, than to put it the other way around.[174]

Here the diffusion model referred to by Fissell and Cooter is still at work. Yet when most of the current scientific papers written do not address the general public, transmitting it to the public in some form is still necessary. Working to present science as fully as possible works within Goethe's own desire "to publish every bit of empirical evidence, even every conjecture" so that "no scientific edifice should be built until the plan and materials of its structure have been widely known, judged and sifted."[175]

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[174] "The Nature Institute: Viewing Nature, Science, and Technology in Context," The Nature Institute, http://natureinstitute.org/index.htm (accessed February 10, 2012).
[175] Goethe, *Scientific Studies*, 13.

Conclusion

> What has been said of my *objective thinking* may be applied equally to my *objective poetry*. Certain great motifs, legends, ancient traditions made such an impression on my mind that I could keep them inwardly alive and active for forty or fifty years. They were like a miraculous possession, worthwhile images I often saw renewed in the play of my imagination. There they metamorphosed repeatedly – without changing they ripened into purer form, more definite in outline.
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> -Goethe, "Significant Help Given by an Ingenious Turn of Phrase"

This thesis has presented Goethe's morphology within several contexts. Each of these has stressed a close relationship of subject and object. This relationship rests on the imitative ability of the imagination to mimic perceptual phenomena. This mimicry metamorphoses natural phenomena into imaginal phenomena. The metamorphic relation of object and imagination requires active participation by the individual to ensure continuity of form and to remain open to correction in order to guard against misrepresentation.

The Nature Institute promotes contemporary applications and further development of Goethe's morphology, yet it represents only one possibility. This possibility shows that Goethe's morphology is flexible enough to offer insights into the growth of individual plants without directly aiming for his concept of the *Urpflanze*. The contextual emphasis of The Nature Institute extends Goethe's ideas into new areas that include the social effects of applied sciences.

This thesis also discussed the first step in applying Goethe's morphology to another area, natural aesthetics. There is a natural affinity between Goethe's morphology and aesthetics in the pictorial nature of its methods. But it need not be

limited in application to visual perceptions. Auditory, tactile, olfactory, and other applications are also possible depending on the imaginative capabilities of the individual. Even where they are minimal, something may be gained.

To find more of its potential, Goethe's morphology itself needs to be looked at, both directly and in relation to its trajectory outside the realm of Goethe scholarship. This scholarship is largely self-contained and its subject is large enough to merit its own annual publication in *The Goethe Yearbook*. But because of this, there is little interaction of his ideas with other disciplines where they may be useful. By looking more directly at Goethe's methods, I have tried to isolate and enumerate them in a way that allows them to be applied in other areas.

The historical context of Goethe's ideas helps to further emphasize their developmental nature. Goethe's botanical work did not stop with *The Metamorphosis of Plants*, but continued to the end of his life as he supplemented it with biographical, historical, and critical considerations of his and other scientists' work before him.

These different aspects of Goethe's botanical work allow for applications of morphology beyond Goethe's own efforts. What Karl Fink called "thresholds of change in natural processes," or "the joints of nature where Goethe discovered the kinetics of life," emerge when the primary focus of study in any area is relationships rather than individual objects or persons. The flexibility in nature Goethe saw as an aspect worthy of imitation through imagination extends beyond what is usually considered morphology. Its value lies in its ability to connect things that appear different such as a leaf, stamen, and seed without removing them from view through reduction or abstraction. The goal of Goethe's morphology is not to clean up the

diversity of the world by imposing an ideal structure on it, but to take as far as possible how it presents itself by juxtaposing seemingly irreconcilable phenomena without saying one is more essential than the other. The strength of Goethe's morphology is not in explaining many things in relation to one thing, but in comparing those many things to each other.

Though this thesis argues that a broader recovery of Goethe's methods and ideas would benefit contemporary pursuits, it does not see the possibility, or necessity, of wholly recreating Goethe's science. Scientific knowledge has continued to change since Goethe's time and will continue to do so. What Goethe can offer today is a methodological framework to reexamine contemporary issues as we have seen with The Nature Institute's critique of genetics and the application of Goethe's morphology to natural aesthetics. Through these endeavors, Goethe's ideas act as inspiration to use the imagination to create a bridge between subjective and objective elements. The subjective and aesthetic elements are central to Goethe's science and can help us recognize where they are in other sciences as well. All that Goethe's science includes would supplement the strong analytic tendencies in biological research today with a synthetic and holistic counterpart that does not just reintegrate what was analyzed, but takes its own path from perception to thought.

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