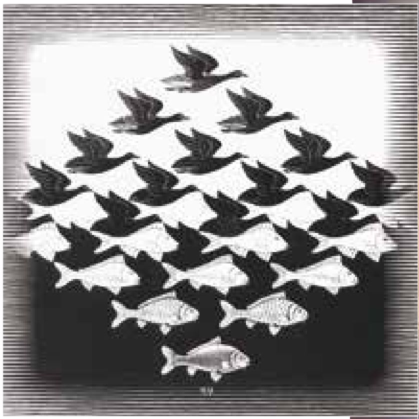
Wholeness in Science

A Methodology for Pattern Recognition and Clinical Intuition

Guus van der Bie MD



LOUIS BOLK INSTITUTE

BOLK'S COMPANIONS ON THE FUNDAMENTALS OF MEDICINE

We would be interested to hear your opinion about this publication. You can let us know at http://**www.kingfishergroup.nl/questionnaire/**

About the Louis Bolk Institute

The Louis Bolk Institute has conducted scientific research to further the development of organic and sustainable agriculture, nutrition, and health care since 1976. Its basic tenet is that nature is the source of knowledge about life. The Institute plays a pioneering role in its field through national and international collaboration by using *experiential knowledge* and by considering data as part of a greater whole. Through its groundbreaking research, the Institute seeks to contribute to a healthy future for people, animals, and the environment. For the Companions, the Institute works together with the Kingfisher Foundation.

Publication number: GVO 10
ISBN/EAN: 978-90-74021-42-5
Price €10
Postage € 7,50

KvK 41197208
Triodos Bank 212185764
IBAN: NL77 TRIO 0212185764
BIC code/Swift code: TRIONL 2U
For credit card payment visit our website at
www.louisbolk.nl/companions

For further information:
Louis Bolk Institute
Hoofdstraat 24
NL 3972 LA Driebergen, Netherlands
Tel: (++31) (0) 343 - 523860
Fax: (++31) (0) 343 - 515611
www.louisbolk.nl
g.vanderbie@kingfishergroup.eu

Colofon:

Translation: Caitlin Bevvino-Ring and
Christa van Tellingen
Cover: www.fingerprint.nl
Cover painting: M.C. Escher, 'Sky and Water I'

Wholeness in Science

A Methodology for Pattern Recognition and Clinical Intuition

Guus van der Bie MD

BOLK'S COMPANIONS
ON THE FUNDAMENTALS OF MEDICINE

LOUIS BOLK INSTITUTE

Specialization in science is not restricted to a certain area of research. Variation in scientific specialties occurs when a given specialty uses different methods to thoroughly investigate, describe, and understand the facts.

AGM van Melsen. **Wetenschap en Verantwoordelijkheid (Science and Responsibility).** Spectrum 1964

About the Author

Guus van der Bie MD (1945) worked as a lecturer at the Department of Medical Anatomy and Embryology at Utrecht State University, Holland from1967 to1976. Next to his practice as a general practitioner since 1976, he continued to educate physicians and therapists, and medical students at Utrecht State University and the University of Witten/Herdecke, Germany. He is a member of the Medical Section of the School of Spiritual Science at the Goetheanum, Dornach, Switzerland.

About the Project

The project *Renewal of Medical Education* aims to produce Companions that demonstrate how the insights of current biomedical science can be broadened by using the Goethean phenomenological method. This method innovates current concepts and expands the understanding of biochemical, physiological, psychological, and morphological factors in living organisms and their development in time and space, and in health, illness, and therapy. The project is commissioned by the Kingfisher Foundation, which aspires the development, application, and publication of the Goethean phenomenological research method in the widest sense, to complement and innovate the accepted scientific view and research method.

BOLK'S COMPANIONS FOR THE STUDY OF MEDICINE complement current medical education, specifically disclosing human qualities in the fundamental biomedical sciences of today.

BOLK'S COMPANIONS FOR THE PRACTICE OF MEDICINE contribute to a scientific phenomenological basis for integrative medicine and integral psychiatry.

Contents

Acknowledgment

This Companion was written at the Louis Bolk Institute, Driebergen, Holland under the auspices of the Kingfisher Foundation. A stimulating exchange of ideas with my colleagues lies at the source of the structure and content of this Companion.

A special word of thanks goes to Christa van Tellingen. Her comments on the content and design have essentially determined the final form of this Companion. It is a result of our comprehensive and rigorous collaboration over the years: I regard this common process with gratitude. Together with Caitlin Bevvino-Ring, she attended to the English translation.

I want to express gratitude to my colleagues Marko van Gerven, Loes van den Heuvel, Kore Luske, Thomas Scheffers and Wouter Endel for their support, criticism, and encouragement. I am most appreciative to them for their valuable comments. Many of the colleagues whom I have met in the course of my professional development and who have stimulated me to develop the reflective methods described here remain unnamed. However, without them, this Companion would not have become what it is today.

This project was made possible financially by generous gifts from the Triodos Foundation, Iona Stichting, Stichting Phoenix, the Bernhard Lievegoed Foundation, the Brigitta Rogmanfonds of the Stichting ter Bevordering van de Heilpedagogiek, the Raphael Foundation, the Stichting Bronlaak, and the Kingfisher Foundation.

Guus van der Bie MD
Driebergen, July 2012

Preface

Since its inception in the 16th century, the conventional scientific approach has led to impressive results. These results are not only tangible in the search for the elementary structure of matter, but also in the field of the life sciences, such as botany, and veterinary and human medicine. Andreas Vesalius (1514-1564), who researched human anatomy, could perhaps be considered the first physician to consistently apply scientific techniques. In 1543, he published the results of his analytical research in 'De Humani Corporis Fabrica.' It marked the beginning of a new approach to the human body.

The scientific method that he initialized has led to a huge number of discoveries. Concurrently, the connection between the discovered facts gradually became less evident. In recent times, inquiries regarding contextual data and biological systems have emerged: "Is it possible to study plant, animal, or human organisms as a whole and acquire an understanding of their setting?"

This Companion attempts to specifically answer these questions and to practically familiarize the reader with a method developed by Goethe (1749-1832): to study organisms as they naturally appear to us in shape and function, and learn to interconnect the observed phenomena by a scholarly reflection on what we perceive. Various authors later elaborated on Goethe's method and provided evidence of its applicability in the study of the contextual aspect of current scientific knowledge. This Companion will first demonstrate Goethe's method to acquaint readers with it and then elaborate on it in connection with current scientific queries.

The ten previously published Bolk's Companions are primarily intended to help medical students and practitioners develop a coherent view on the healthy and diseased human organism. In this Companion, examples are often taken from medicine to practically explain the methodology. The method in point of fact applies to all areas of the life sciences. This Companion is therefore intended for all who work in and conduct research in bioscience and who search for an approach that does justice to the integrity of their subject. They will be able to appreciate the added value of this methodology for their work.

Overview of the Content

In Part 1, Goethe's method is introduced. The author introduces clinical intuition and how it is acquired exemplarily to demonstrate the applicability of Goethe's approach. Clinical intuition is a form of pattern recognition and pattern recognition supports the ability to recognize an integrated 'whole.' Goethe applied pattern recognition and further developed it in his investigation of living nature. Chapter 1 introduces the subject and Chapters 2 and 3 present practical exercises that allow readers to concretely train and expand their ability of pattern recognition through Goethe's methodology. Questions and introspection aid them to become aware of what they did. This makes obvious that clinical intuition, as experiential knowledge, can become a skill that is actively developed. Goethe calls the skill that is acquired in this way 'methodical pattern recognition.' Readers can familiarize themselves with it by reading about and doing the exercises.

Part 2, the Chapters 4 through 8, positions Goethe's methodology in relation to the contemporary scientific approach and engages the reader by way of several practical examples to how Goethe and others further developed his system of practicing science. The correlation between details and their associated organic context is developed. The dependence of each part on the whole, both in form and function, is discussed and in support of this, examples from among others the arts are presented. This discussion illustrates what may actually be understood when we speak about (human) organisms and when we define the 'whole.' A study of plants illustrates this research subject. Chapter 8 discusses how the 'whole' is present in the immediate experience of each researcher and how current scientific research has reached a boundary where it can only express the experience of the 'whole' through metaphor and analogy. This removes the perception of the 'whole' from scientific scrutiny and definition.

Part 3 demonstrates the practical (clinical) value of Goethe's method through two comparative studies. The author presents research using Goethe's and other investigators' findings on animals and humans. Again the complementary relation between analytical science and Goethe's science of wholes emerges, and the reader can observe how they are practically related. The combined practice of these methods leads to a deepened understanding and broadens our knowledge of study objects. The abundance of scientifically discovered details is ordered in its context thereby gaining meaning and understanding.

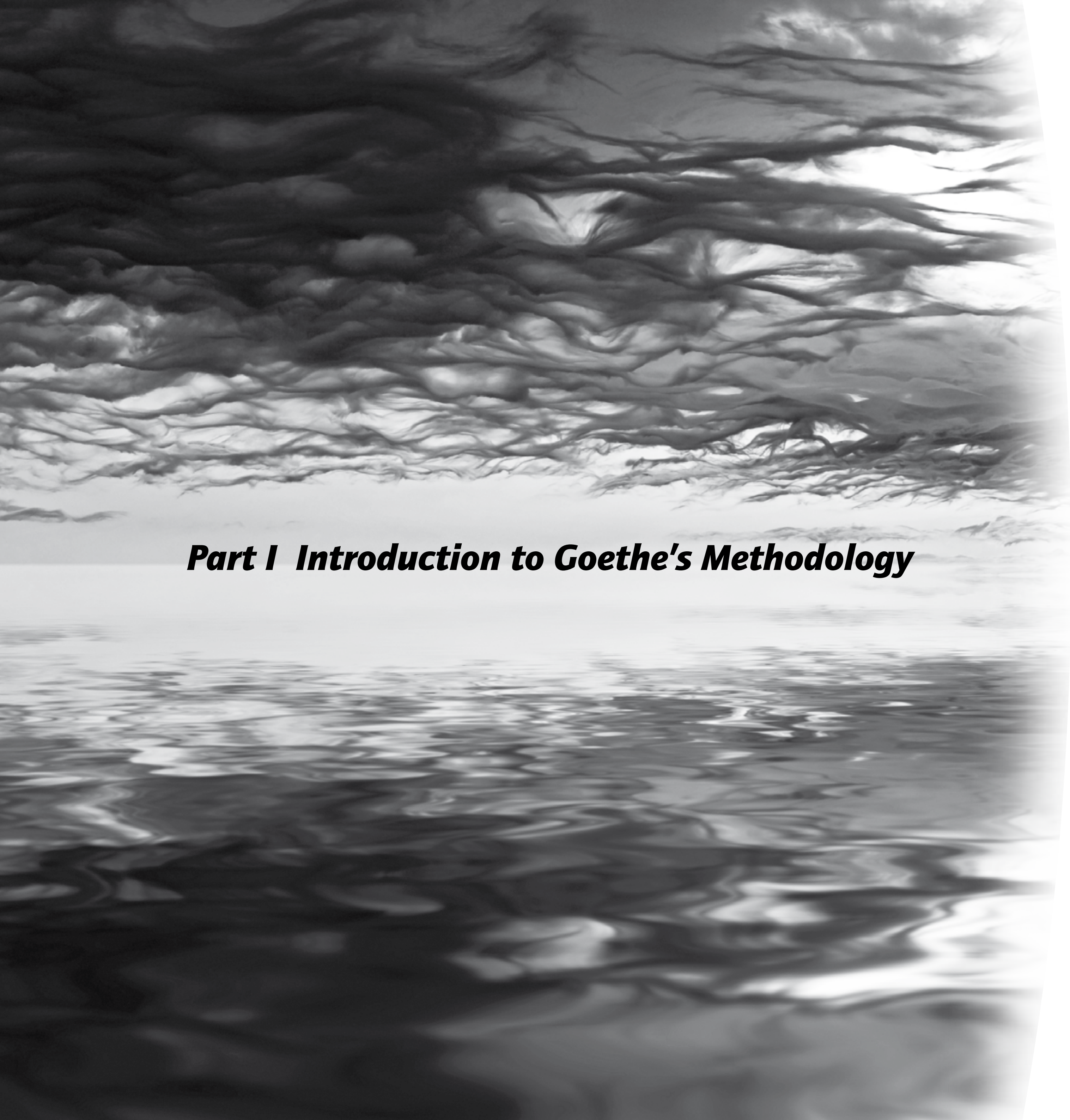
The contrast with today's highly developed scientific culture may cast the contents of this Companion in an amateurish light for some readers. The author is fully aware of this; as a family physician who has been employed in academic activity and as a trainer of medical students, current analytical science is well known to him. An example of this naiveté could be detected in the absence of definitions in this Companion. In natural science, definitions are a precondition for scientific research to arrive at valid conclusions.

This Companion illustrates that scientifically trained pattern recognition can lead to valuable insights. It makes explicit that the general applicability of this way of gaining insight holds true for all life sciences. For this author the driving force behind his attempt to develop Goethe's method professionally and accept it's remaining deficiencies a priori is truly his interest in a humanization of medicine. Deficiencies are an inevitable part of new developments. Critical self-reflection is an indispensable tool to aid the researcher to not get lost in a new approach.

Goethe's method of integrating details into a whole is not a novel super-specialization; a coherent understanding of the facts is its aim. To develop an eye for the uniqueness of each human individual in health and disease and an ecological awareness for all plants and animals under our care is what the author wishes for his readers.

This Companion could not have been what it is without the work of Henri Bortoft. His recently published book 'The Wholeness of Nature, Goethe's Way of Science' was of great significance to the author as he did his research for this Companion.

Part I Introduction to Goethe's Methodology



1. Introduction: On Patterns, the Human Being, and the Whole

Question: How does a physician gain knowledge about disease?

1.1. Pattern Recognition: Clinical Intuition

When someone gets sick, we search for a diagnosis. Imagine you have not actually seen the patient but you know the diagnosis: Pfeiffer's disease (also called mononucleosis, glandular fever, or kissing disease). Now that you know the diagnosis, can you predict which symptoms the patient in question will have?

Not at all. Patients with mononucleosis may have many different symptoms such as swollen lymph nodes, fever, difficulty swallowing, sore throat, a general feeling of malaise, a darker coloring of the urine, and jaundice. Does the patient need to have all of these symptoms to be eligible for the diagnosis? The answer once again is no. Symptoms of Pfeiffer's disease vary greatly from person to person. It is conceivable that one individual may have just the fever or just the lymph node swelling and no other symptoms, while another may exhibit all potential symptoms. Does mononucleosis then actually exist if the symptomatology varies so much?

This example represents a well-known phenomenon in medicine. The symptoms of the same disease may be considerably different in individual patients. Physicians learn to know what a certain disease looks like through study and clinical experience; the study gives them a general idea and experience eventually completes the picture. The doctor then 'knows' kissing disease quite well. Physicians apparently can still identify the diverse symptoms and can recognize syndromes such as Pfeiffer's disease, even if they appear in unlike guises in different patients.

Diagnosis is based on what is called 'pattern recognition'. This constitutes the essence of 'clinical intuition' or the doctor's 'gut feeling' (Stolper et al 2010). The physician's picture of disease is dynamic in nature. The course of the disease, how it begins, how it develops, and how it can be healed, as well as the symptoms, are different for each patient. Physicians have a varying yet recognizable image of 'the' illness: the clinical picture.

Physicians conceive of diseases as total concepts.

A physician experiences 'the disease' as generating many possible symptoms, all belonging to the disease, but in diverse combinations and patterns. It is even possible for a patient suffering from a chronic illness to have different combinations of symptoms during flares (exacerbations) than during periods with few symptoms (remissions), as described for asthma in the Companion Respiratory Disorders (Tellingen 2009). The symptoms may vary in length or severity, or there may be different complications at different times for the same patient. The physician's clinical expertise is based on the knowledge of something that can manifest in diverse ways and has many metamorphoses. This 'something' bears the name of the disease. Its detection is based on pattern recognition, or clinical intuition which often occurs 'at a single glance', pointing to the immediate appreciation of the pattern as a totality.

The question above could therefore be extended: How do you develop clinical intuition? Is there any practical use in exploring additional forms of science? What does Goethe's way of science provide that other scientific methods cannot offer? In the acquisition of clinical skills, it is essential to develop clinical intuition to become a good physician so that you are able to recognize symptom patterns as manifestation of disease. Developing this practical knowledge requires a method in which experience is the protagonist. What is developed as 'craft' grows to become expertise and is based on our natural ability to learn through experience and imitation. It is meaningful for every medical professional to understand and further develop this method of pattern recognition, which again will engender a greater professional understanding of patients and diseases. The same applies to other professions in which experiential learning plays a key role such as education and teaching, psychotherapy, and even farming or seafaring.

Identifying pattern recognition is the **first** of **two steps** toward characterizing Goethe's form of practicing science. The ability to recognize and read patterns and pictures is a little-known human ability (Friedenberg and Silverman 2006). Pattern recognition, however, is the most common method we use in daily life for identifying and understanding our environment. Expertise in general is largely based on pattern recognition and the resulting 'expert knowledge' such as the physician's clinical intuition (Böhme and Schiemann 1997, Margison 2000). Although its methodological development is still in its infancy, the value of practice-based experience is widely recognized.

1.2. Goethe as Pioneer of a 'Science of Wholes'

In this Companion, we focus on Goethe as a researcher, since he provides a key impetus to a practice-based scientific methodology for the study of *living* nature with the aid of pattern recognition. His research will shed light on a method to develop scientific pattern recognition and expert clinical knowledge.
Goethe's way of science has been called phenomenological, since it starts at the phenomena. Phenomenology can be described as follows:

> *"…. a science, which, instead of looking for the objectification and causal conditions of phenomena, stops at the phenomena themselves and compares them as they appear to the spectator as given facts…."* (Böhme and Schiemann 1997)

Goethe's phenomenological science, is a 'Science of Wholes'. Newton's vast contribution to the discipline of physics and the science of lifeless nature is comparable to Goethe's significance for a science of the living, organic world. Newton focused on analyzing, organizing, and quantifying studied phenomena such as light or gravity. He developed mathematical computing models that express mathematic collaterals. The great success of modern science in the field of medicine builds on what Newtonian science has achieved.

Life scientists tried to create the same "exact scientific analysis and quantification" in the biological and medical field. Repeatability of the experiment and replication of results were understood to be fundamental aspects of life science. This, however, contradicts our empirical understanding that in medical practice no situation can be entirely replicable because of the progress of patient, disease, society, and the physician. Plants and animals are also changing every day!

For a long time, insight into biological connections and ecosystems remained largely unnoticed in natural scientific progress. In medicine, patients were seen less as individuals in development than as part and parcel of an amalgamation of symptoms. We know this aspiration for exact scholarship as the practice of Evidence Based Medicine (EBM).
In recent years, a science of living wholes is evolving within systems biology. Goethe's method can offer what is still lacking in systems biology: an understanding of the self-regulating organism *as a whol*e.

A second characteristic of Goethe's methodology is to leave what you explore intact, as indicated in the above description.

This Companion's particular focus is on its significance for medicine.

1.3. Between Population and Genome: the Lost Image of Humans as Individuals

Over the course of the last half-century, medical research has shifted away from considering the individual . In fact, insight into the physical, emotional, and spiritual whole person has all but ceased to exist in the medical field.

This shift has two bases: First, EBM relies on an analytical approach. Anatomy, physiology, and genetics create a materialistic, molecular, biological, and simultaneously impersonal image of the human being. There is the danger of losing sight of people as individuals when you can no longer place researched details back into an overall picture and fail to see the original context of the individual patient. The bio-medical concept of the human being leaves no room for the patient's own experience of his or her illness. One example is the belief that depression is a disorder of serotonin metabolism (Gerven and Tellingen 2011).

EBM derives its strength and value from investigations carried out in large groups of patients. These population studies are the second reason for the paucity of understanding of individual patients. Randomized clinical trials (RCTs) have strict requirements for scientific evidence. Repeatability of the experiment and reproducibility of the results are key prerequisites. Statistical evidence and specific computing methods (algorithms) are crucial. This way of collecting evidence is taken from the research of lifeless nature (Rose 1998). It can only yield statements and insights relating to the relevant study group as a whole. Its significance for the individual is unclear.

The physician who treats individual patients needs to know their unique life situation. Population knowledge does not answer questions relating to individual situations. Facts determined at the population level can only be attributed in a grossly general way. There will always be a percentage of the group for whom the discovered truth is not applicable. At the office visit, the criteria to determine when and if the truths of the population study apply to the specific patient are generally lacking. EBM provides insufficient guidance and insight for individual cases in practice. As a result, medical treatment is based largely on probability.

Goethe's methodology offers a view of the patient as an individual and would promote more pertinent, personalized treatment.

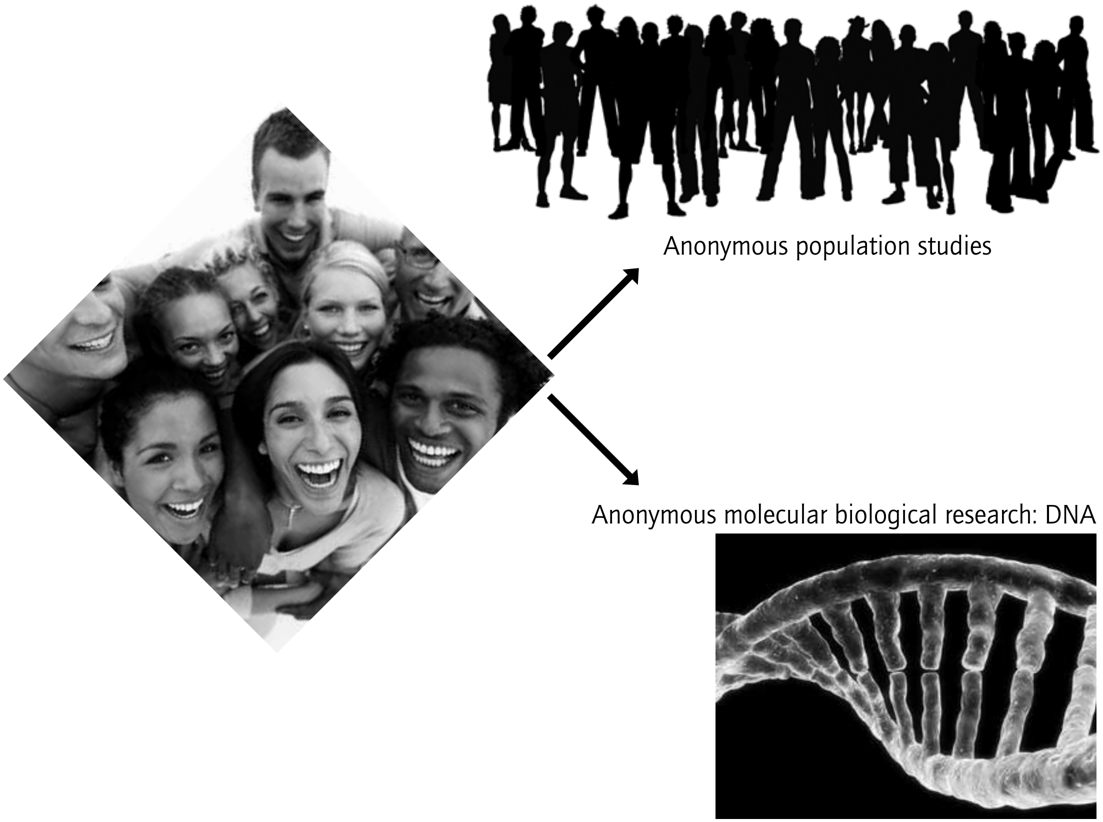


Figure 1.1. The shift away from the individual in medicine occurred for two reasons

1.4. Goethe's Scientific Approach: a 'Science of Wholes'

This Companion offers practical examples to illustrate the difference between a conventional scientific methodology and Goethe's scientific approach. In light of what is presented the reader can start to learn, understand, and imitate Goethe's method. This writing's bibliography can assist the reader in finding an epistemological orientation on the subject (Steiner 1886, 1892, 1894, Rose 1998, Sijmons 2008, Heusser 2010).

The purpose of this Companion is to learn and practice a different mindset. The mind is used in Goethe's way of science to compare and connect, rather than to analyze and dissect. The way of thinking that develops from this, which will be described in detail later (Chapter 4. and section 5.1.), leads to an understanding of matters as they appear in their natural context. For this reason, the process delineated in this Companion is 'A Science of Wholes'.

In conventional science, an analytic approach to information is preferred. We use analysis to dissect observations and then understand the resulting components as cause of the whole. Genetics is such an example; the genome was long believed to be the cause of the organism. Since it has become clear that epigenetic factors are responsible for the "switching on and off" of genes, a more plausible 'cause' would be found in epigenetic processes (see sections 4.3., 8.1.1., 11.3.). A 'Science of Wholes' asks from us to expand our mind to embrace other modes of integrating information. To that purpose, we will examine the manner in which we perceive and remember (Chapter 2), and also the way we make assessments (Chapter 3).

Both forms of thinking - that of Goethe and that of Newton - are complementary to each other. Practiced together they provide more than each could alone. They are in no way mutually exclusive scientific practices. On the contrary, the scientific details found by analysis become more meaningful through Goethe's science of wholes and this approach can be developed further by thorough analysis of the data. For the patient, it ultimately means that he may be better understood as an individual and the physician can broaden and substantiate his clinical intuition and his therapeutic insights. By default, the health care system will also gain in depth and humanity as a result of this approach in medicine.
As Goethe has been less than systematic in describing his methods, other researchers who have thoroughly studied and developed them will also be cited in this Companion.

As a guide, we can use Goethe's personal development as a framework for understanding his approach. He once made a long trip to Italy and wrote many letters in which he describes his technique and reports on his experiences (Goethe 1817). When one reads these letters, one can gradually experience part of this way into science and can therefore imitate it and recognize it in his further scientific work. The experiences in Italy led to his later published "Metamorphosis of the Plant" in the book "Publications about Morphology I" (Goethe 1817). In chapters 2 and 3 of this Companion, the reader may familiarize himself with Goethe's way of science by actively making use of the practical examples given there.

1.5. Science of Wholes and Intuition: are they Significant for Medicine?

Medicine is more than diagnosing and treating symptoms. The doctor-patient relationship is essential for optimal medical treatment (Benedetti 2007, Schäfer and Oeltjenbruns 2008, Enck et al 2008, Benedetti et al 2009, Colloca and Benedetti 2009). Personal engagement with the patient and being perceptive of the personality and the individuality of the patient have a positive effect on understanding the patient, and on treatment outcomes.

> *"In modern medicine, the placebo response or placebo effect has often been regarded as a nuisance in basic research and particularly in clinical research. The latest scientific evidence has demonstrated, however, that the placebo effect and the nocebo effect, the negative effects of placebo, stem from highly active processes in the brain that are mediated by psychological mechanisms such as expectation and conditioning. These processes have been described in some detail for many diseases and treatments, and we now know that they can represent both strength and vulnerability in the course of a disease as well as in the response to a therapy."*
> (Enck et al 2008)

Professional empathy and clinical intuition are increasingly recognized as meaningful and therapeutically important skills of the physician. Understanding the patient and attention to his/her context are vital for successful treatment.

> *"Recently, the placebo effect has been studied with a different experimental*

approach, in which hidden (unexpected) medical treatments were carried out and compared with open (expected) ones. In all cases, the hidden medical treatments were less effective than the open ones. These findings show that the patient's awareness about a therapy is of crucial importance in the therapeutic outcome. Overall, all these studies show that the psychosocial context around the therapy, particularly the doctor's words, may induce changes in the patient's brain that, in turn, may affect the course of a disease." (Benedetti 2007)

Goethe's way of science plays a complementary role in this regard. It leads to a broader understanding of disease and of the diseased and to a medical scientific system that can perceive the individual in the patient (Havi 2011). This applies not only to somatic disease, but also to mental health problems (Benedetti 2007).
In his inaugural address, Smulders, professor of internal medicine, spoke of the need to develop intuition and subjectivity as a physician and warns against relying exclusively on the results of epidemiological population studies:

"With knowledge of epidemiology only you will not be able to make it. Think critically about how you approach a patient, how you diagnose, and why you choose a particular treatment. Nurture and develop intuition and subjectivity: It is no sin but a virtue." (Smulders 2008)

Clinical intuition is recognized as an important aspect of the diagnostic skill of the physician. Stolper confirms Smulders' assertion that the medical practitioner uses more than simply cognitive skills to exercise his profession (Stolper et al 2010).

It would seem meaningful to practice medicine in this way. What have been called subjective and intuitive capabilities are central skills in Goethe's methodology. Does developing these skills in medical training provide access to a skilled and professionally developed 'gut feeling?' Can we train for pattern recognition and professionally appropriate empathy? Does a practice-based method provide insight into the individual of each human being in health and disease? In this Companion, these questions will be taken seriously and an exploratory search for possible solutions will be described.

Is this an issue only in medicine, or does it have a larger impact? The molecular biologist Steven Rose who was quoted earlier made a noteworthy remark in his book "Lifelines", as he states:

> *"Reductive methodology has served the simpler sciences of physics and chemistry well for three hundred years, and it is still the method of choice for most of the experimental work biologists do. But it may be failing us in our attempts to solve the more complex problems presented by the living world with which the biological sciences must now wrestle."* (Rose 1998)

Rose believes that the scientific methods of the lifeless (inorganic) such as chemistry and physics, fail to understand and see through the complex situations of the organic world, the world of living organisms.

For medicine, it is crucial to develop the skills to understand physiological and psychological processes in their context and see them as part of the processes of the organism as a whole. This involves developing a 'Science of Wholes'.
This Companion describes the steps that are taken in a Science of Wholes.

1.6. A Characteristic of Science since Antiquity

The result of all scientific intervention could be described as connecting a *sensory perception* on the one hand with a *concept* that lights up in our mind on the other (Steiner 1894). Medicine is no exception to this. Even though what we consider as meaning is time bound and culturally determined, the basic principle of conceptualizing observations has always been the foundation of insight (Zajonc 1995). Since ancient times, the human being has strived to understand the significance of what he/she experiences through the five senses (sight, touch, hearing, taste, and smell). The significance, the assessment, or the meaning cannot be directly derived from your perception. Only when you reflect on your observation, can the concept or the meaning become clear.

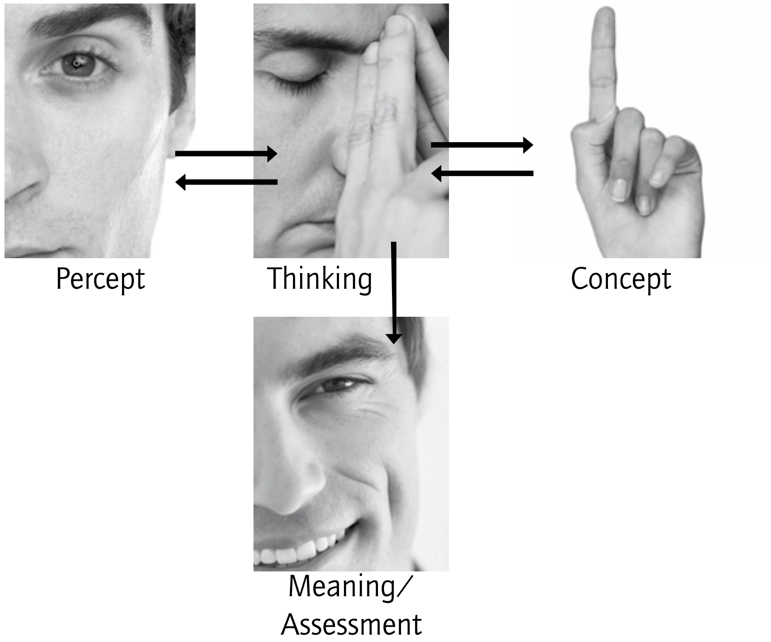


Figure 1.2. The relation between the observation and the concept that lights up in our minds

Children develop ever changing and ever more accurate concepts about what they see, smell, taste, touch, or hear over the course of their development. They therefore develop shifting concepts of the truth as they grow toward adulthood. The scientist continues this development as an adult in a methodical way. This could result in a positivistic materialistic concept of truth. With Goethean practice-based skills you may pursue this development further towards new concepts of truth.

In this Companion, we will endeavor to make this development visible.

1.7. Summary

Nature as an organism and people as individuals have lost integrity and identity in modern science. With epidemiological knowledge on the one hand and a molecular biological view on the other, humans as individuals became obscured. In modern disease concepts, human individuality is becoming increasingly less important. As a result, research findings cannot be understood within their context and are not directly applicable in practice.

The natural ability of pattern recognition that we use in daily practice is the basis of expert knowledge, such as the clinical intuition of the physician. Goethe's way of science can promote the natural skills of pattern recognition and thereby enhance clinical knowledge. This 'Science of Wholes' is a complement to conventional bio-medical science.

This Companion provides a technique based on Goethe's methodology. The choice of Goethe's method in this writing is inspired by its great practical applicability in the life sciences, and by its academic enhancement of pattern recognition and intuition.

This Companion attempts to give a clear view on a 'Science of Wholes.'

2. Training your Memory - Practicing Goethe's Scientific Method I - Exact Memory Pictures

Question: Is human perception reliable?

If you want to get to know Goethe's method, it is hardly adequate to 'read about' it. You can really only become acquainted with Goethe's system by practicing it yourself. The next two chapters provide exercises that are intended as a practical introduction to his scientific approach.

Goethe's way of science is a research method that perceives and understands subjects as a whole in their particular context. Microscopic images are also sensory phenomena, albeit that by their nature they represent a fraction of the whole. We can, however, discover the meaning of details as we place them back into the whole picture. For example, single cells cannot be assessed as 'benign' or 'malignant'. The significance we attach to 'malignant change' in cells is determined by the symptoms of the patient, not just by the shape of the cell. Physicians are guided by the context of microscopic details, not just by the details themselves.

2.1. Perception

We will examine perception first (2.1.), then memory (2.2.).

2.1.1. Sensory Stimuli and Perception

In the course of modern scientific progress, human perception was increasingly thought to be unreliable. It is frequently replaced by research equipment ranging from registration and measuring equipment or imaging equipment such as X-ray and MRI, to IT technology based on quantitative data. The idea is to reduce perception to numbers on a display. The argument that human perception is unreliable comes from the observation that perceptions are ‘subjective’ and would give a personal *and therefore* distorted view of reality without objective value. Is such total rejection of human perception necessary and desirable? The following exercises can be helpful in examining your own perception. But first the relation between perception and sensory stimuli needs to be clarified.

Humans are constantly exposed to visual, acoustic, haptic, and many other sensory stimuli. There is a difference between a sensory stimulus and perception. A sensory stimulus can be defined as any biological response of one of the senses to an external influence or to an influence from inside the organism itself, as in a headache. As such, the sensory stimulus is an objective phenomenon.

Normally speaking, you only become aware of a small part of the sensory experience. Perception emerges in the part where you become conscious of the sensory stimulus: you ‘see’, ‘hear’ or ‘touch’ something. Consciousness itself is, however, a subjective phenomenon, as evidenced by the difference in people’s ability to make observations and the trainability of perception. People cannot improve on their ears or eyes so to speak, but they can pay more attention to the sensory stimulus, thereby developing better hearing and vision.

Perception emerges when *sensory stimulus and conscious attention* come together. Attention is a controllable phenomenon of consciousness. This control of attention, also called intentionality, determines whether a sensory stimulus is processed and becomes perception.

First Exercise

1a Own activity:

Find a simple object, perhaps an object in living nature or a product of nature. Plants, shells, animals, or parts of a skeleton or skull can be used for this purpose, for example the whelk below. Do not choose an object that is too complicated. The rule of thumb is: the simpler the better.

Observe your object well. Then cover it and draw the object from memory as accurately as possible. Compare the drawing you made with your object and adjust the drawing where necessary.

Figure 2.1. Perceiving and drawing – the whelk

The key to this exercise is to focus more attentively than usual on what there is to be seen. The advantage of drawing is that it focuses your attention, first in observing and then at the drawing. This exercise engages and enhances the conscious part of observations through intentionality.

1b Exercise in self-observation: a closer look at the drawing process

Accurate self-observation shows how you drew the shell. You may notice that perception and drawing do not occur at the same time. While drafting you do not notice the object. Perceiving, remembering the perception, and drafting constantly alternate, sometimes at a rapid pace: watching, remembering, and drawing occur in a repetitive cycle. When you are observing attentively that is all you do and while sketching you recollect as clearly as possible what you have seen and confer it to the drawing as well you can. The created sketch is representative of the picture you have shaped in your memory. If the process of remembering did not interject, you would have simply copied all that you observed faultlessly.

Result 2.1.1.

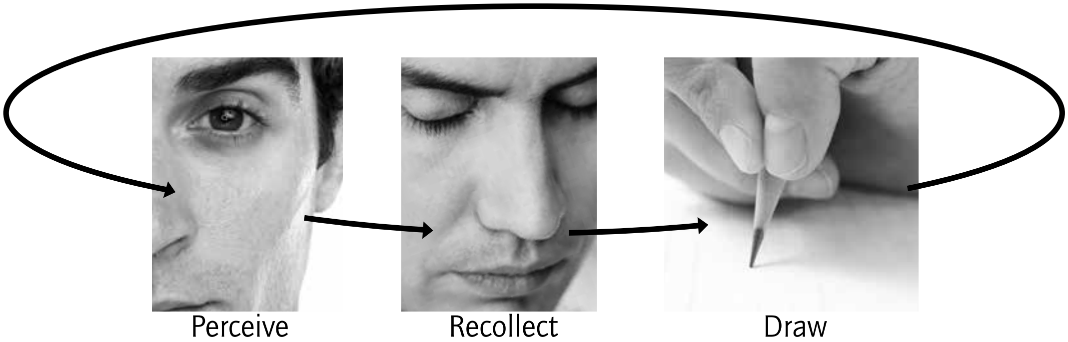


Figure 2.2. Practicing Goethe's scientific method I

In this exercise, the attention focuses back and forth between perception, memory, and drafting activity. Try this with one or more other objects and you'll find that your ability to focus and your memory will improve. Your perceptions become ever more precise, more 'objective.' They increasingly approach reality and your memory of the object becomes more and more similar to the observation. In this way, you may improve on your ability to perceive through practice while it gains in objective quality.

Uneducated perception is unable to generate an exact recollection; skilled intentional observation, however, may do that increasingly well.

With the following exercise, you may further investigate the nature of perception. Section 2.2. explores the memory process. In Chapter 3 the process of finding the meaning or making an assessment of perceptions and forming opinions about them will be considered.

2.1.2. Optical Illusion, Perception, or Assessment?

Second Exercise

2a Look carefully at the figure below: what do you see?

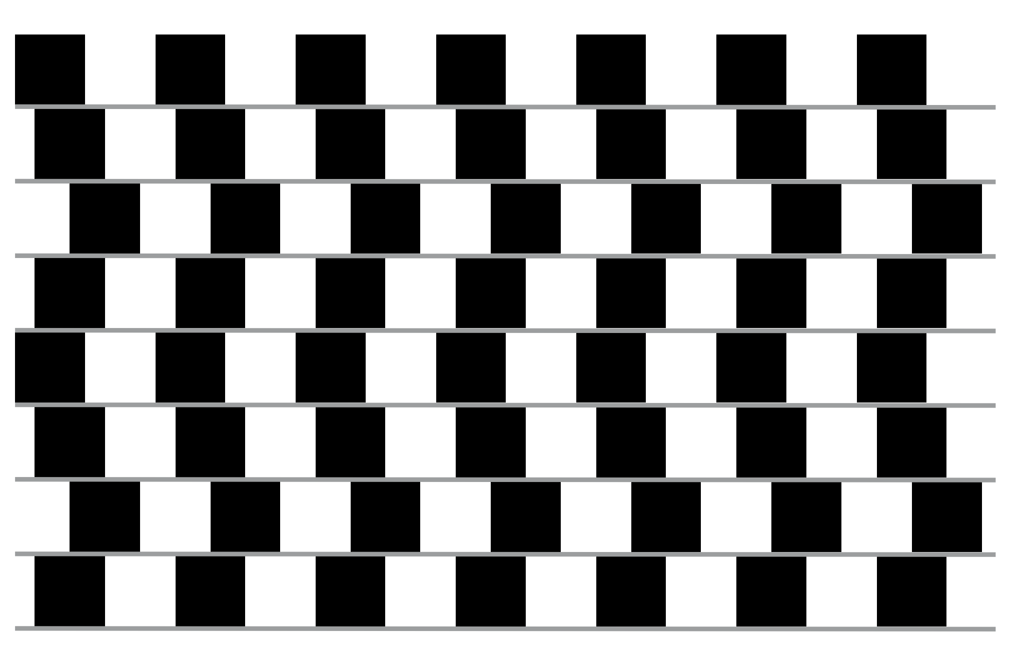


Figure 2.3. Perception or assessment?

One of the arguments for regarding human perception as unreliable has to do with phenomenon of the 'optical illusion': something is not what you think it is. There is extensive literature on optical illusions with many entertaining examples. But the question remains whether these represent illusions in the sense of wrong perceptions. Images such as figure 2.3., in which you can experience the optical illusion, often prove to be a problem of *meaning* or *assessment* and not a perception problem. Looking more closely at figure 2.3. could aid in understanding this. This image combined with your spontaneous opinion on what you see, illustrates the difference between perception and assessment of the perception.

The idea that the structure of the image provokes after superficial observation is that it consists of curved, non-parallel, gray lines, between which unequal black and white areas are placed. However, if you concentrate and intentionally direct your *attention* from one black square to the next or from one white square to the next, you will notice that this idea is not tenable. With focused attention it will be increasingly evident that the squares are actually all the same size, both white and black.

This highlights an important and basic aspect of Goethe's scientific method:

*You have to become able through practice to experience **the perception** separate from the **meaning** or assessment.*

In other words: human consciousness may learn to differentiate between the sensory experience and your understanding of an object. In a science of wholes, the conscious distinction between what you see (perception) and the meaning you give this (your assessment) is particularly essential.

According to Goethe, the view of human perception as unreliable is a misconception. He differentiates with great clarity what he perceives from the meaning he gives it in his mind by conceptualizing. Keeping strictly apart what we see (sensory content) from the associated concept in the mind (understanding) was for Goethe a key requirement in scientific work. He expressed it concisely:

"It is not our senses, but our judgments deceive us."

In figure 2.3., the question was: "what do you see?" The correct answer would be: black and white squares and straight gray lines.

The big problem in this last exercise is the combination of the image's composition and the physiology of eye and nervous system. It is actually almost impossible to draw this picture without actually measuring it out. It requires utmost attention and concentration to note that all black and white areas are the same size and that all lines are parallel. In particular, the latter creates almost insurmountable problems. Once you have been alerted to it, you can actually arrive at the correct concept, albeit with great difficulty. You have to hold back your judgment to get there.
Goethe himself was acutely aware of the necessity to practice empathic perception by holding back one's opinion in order to penetrate to the core of the object being researched. He described this as follows:

"I have practiced resignation all of my life."

By this he meant that he was holding back his judgments. Perception and concept are naturally intertwined in humans, and likewise in animals. Only through active training, can people learn to develop perceiving and judging as separate activities and also experience them separately. Any immediate and spontaneous assessment will usually be biased. The risk of prejudice is that it hinders pure perception thereby obstructing an accurate assessment. In a science of wholes, assessments are made by another method that requires that judgment (prejudice) be held back for a time.

Conclusion: At the beginning of this exercise we seemed to see an optical illusion. At closer consideration it appears to be an illusion of opinion. Thus we see that it is not our senses that deceive us, but our premature assessments (prejudice) that mislead us.

To further follow-up on these exercises it is important to realize that the 'concept' or 'meaning' we give to our perceptions can never be perceived with the senses. Concept or meaning occurs in our consciousness and human consciousness is 'invisible' to the senses.

2b. How sweet is glucose?

To answer the above, a simple experiment can be done: take a spoonful of sugar and keep that in your mouth for some time.

Of course you will experience a sweet taste. Can it then be assumed that sugar is sweet?

Sugar consists of glucose. Outside the human mouth, glucose has no taste; it has just chemical properties. Only people and animals can taste the sweetness of sugar when it dissolves in saliva (experience). It is a property of the organism to be able to dissolve glucose and have the taste buds excited (physiology). Being sweet is not an intrinsic property of glucose.

Again we experience how quick our judgment is. We have to conclude that physiological phenomenon and psychological experience are two separate phenomena even if they occur simultaneously.

Brain research confirms this. Specific neuronal activity of the brain may, for example, be associated with the invisible conscious experience of sound, light, or movement. Brain research, however, cannot explain why these two related occurrences manifest as split phenomena: one visible and measurable, the other as the invisible content of our conscious experience. Establishing that certain chemical compounds occur in the body simultaneously with particular emotions does not explain why the 'corresponding' human experience is a phenomenon of undetectable conscious emotion instead of another measurable phenomenon. None of this is apparent just by looking at the nature of the substance. Knowledge of serotonin cannot explain why serotonin seems to be connected to depressed mood, anxiety, or compulsion. Solving this problem by stating that they are 'basically the same' is unhelpful.

The conscious phenomenon in the mind is not a property of the substance or of neuronal activity.

2.2. Memory

After having done exercises to explore perception specifically in relation to understanding and awareness, you can now try some exercises to examine how memory works.

Third Exercise

Activity:

3a Observe the picture of the ammonite as attentively as possible

3b Put away the picture and draw from memory what you have seen

Figure 2.4. Ammonite

Compare your drawing with the original picture. There are probably inaccuracies and missing elements in the drawing compared to the original. Notice the differences and put the picture away again. Make another drawing putting the first drawing out of sight.

Repeat this exercise several times with intentionality and watch the recollections that come up successively. Do the memory pictures remain the same, or do they change? Is there a tendency to change in a specific direction? These questions are important tools to further explore memory processes and, to a certain extent, learn to objectify. The word 'objectify' should be understood here as becoming more similar to the object that we perceive (see Note 2.1. below).

In medical practice, the physician develops an increasingly saturated, ever more complete memory picture of diseases by seeing a number of patients with the ‘same’ disease. Since the resulting ‘disease concept’ becomes continually richer in his memory, the experienced physician will be able to identify the disease with less information or symptoms (see section 1.1.). This clinical expertise is created through ‘experiential learning.’ Clinical experience is a valid learning tool for the physician in acquiring clinical intuition.

3c Exercise in self-observation: a closer look at memory

In the above exercise, you may have observed that your memory changes during the process. The memory picture becomes more saturated and richer in terms of detail, more similar to the original object, which in this case is the (picture of the) ammonite.
You may now notice that it is a focused, creative, and conscious activity that generates an improved memory picture in the recollection process.

The ability to recall appears to be a *resourceful, (re)creative skill*, which also relies on the capability of human creativity. The memory picture is generated as a recreated image of your observation that can become an increasingly exact imitation. Remembering becomes a conscious and creative activity.

2.2.1. Exact Memory Pictures and Pattern Recognition

Summarizing what we have seen in observation and remembering, the following applies:

Exact perception is based on a *focused attention* to the sensory experience of the object (see sections 2.1.1. and 2.1.2.). Memory then arises from an inner attentive, conscious, and creative process: as an ever more *exact picture* of the sensory experience (2.2.).

Its memory becomes more accurate as the memory picture starts to bear more resemblance to the original observation through repeated practice. It can then be considered more *objective*. The word objective in this writing means ‘equal to the object’ (see Note 2.1. below). Goethe called this phase in the research process: *exact sensory perceptio*n. This is a significant stage of the scientific process in his research that is based on an *exact memory picture* of the perceived object. It forms in attentive experiential learning as the picture that is underlying pattern recognition (section 1.1.).

It is important to keep the goal of this activity in mind: we are forming an exact memory picture by remembering, thinking, and conceptualizing. We do not use the mind to think analytically about the memory picture or to look for a hypothetical ‘working principle behind the facts.’ The mind has no other function than to name the phenomena such as line, plane, curve, straight, dark, or light. The observed object is not interpreted with the mind.

Note 2.1.: Objective or Equal to the Object

> *The phrase ‘equal to the object’ deserves further consideration. To create an exact memory picture, one does not create a material entity; the observed plant or animal is not re-created as a living being (objective). What is created is the representation of the plant or animal in your mind (subjective). This representation could be seen as the ‘second half’ of the full reality of the plant or animal: our mind can perceive it as a creative memory picture and use it in a systematic pattern recognition (Chapter 3). Exact memory pictures become stripped of the more personal aspect of the observer and more exactly in line with the subject. Therefore, the use of the word ‘subjective’ in this context is not synonymous with ‘unreliable’ (see note 3.2.).*

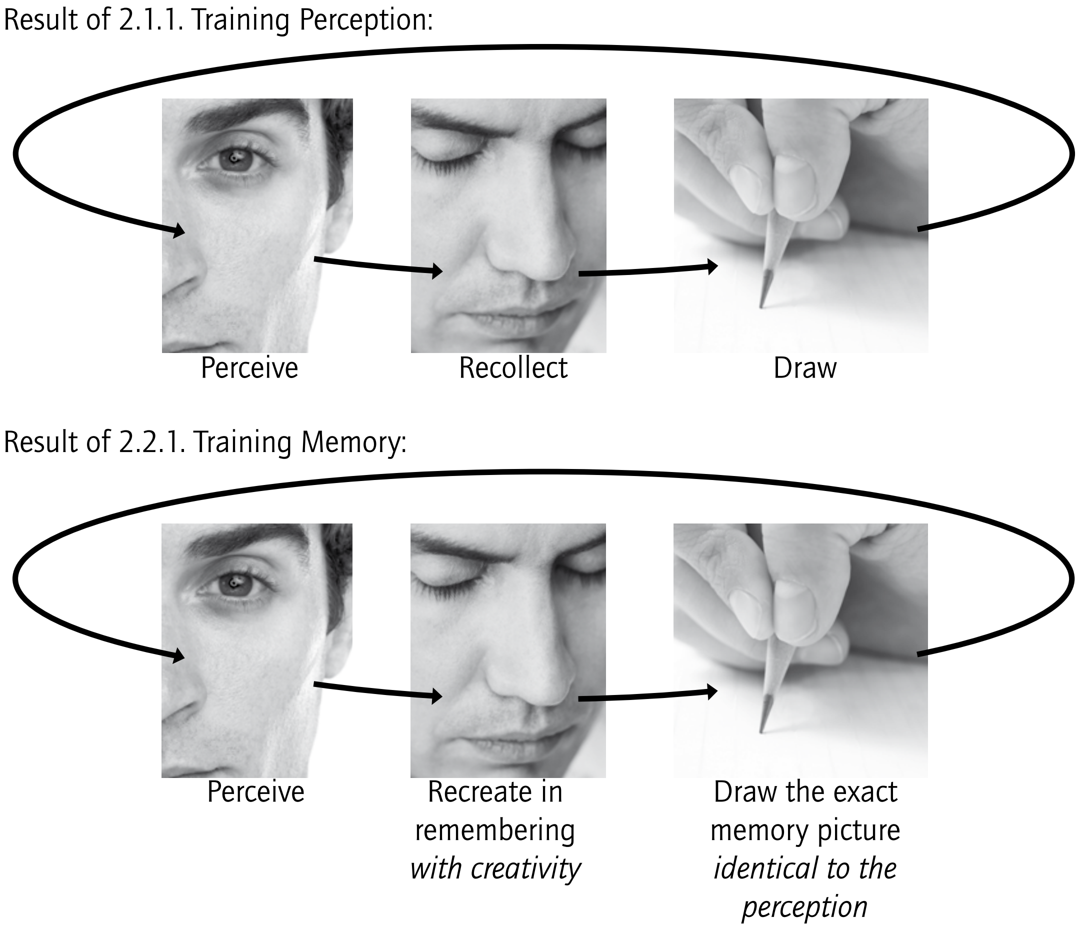


Figure 2.5. Practicing Goethe's scientific method II

2.3. Summary

Human perception can be trained and improved upon through exercise. Through self-reflection people can realize that there is a difference between perception, memory, and assessment. Imagination can recreate the observation in the mind of the beholder in an exact manner by training the recollection process. This generates an 'exact memory picture', an internal memory depiction that has a precise and intimate relation to the observed object.

That means that in the latter process the object of study is experienced in two ways: as a perception through the senses that can be trained on the one hand and also in the mind as an exact memory picture through a trained memory process. These are the two separate paths leading to a conscious experience of studying objects.

The question: "Is human perception reliable?" can be answered with "yes, if ..... ." For when perception and recollection are trained with focused attention, the human capacity for perception and memory can be developed; it becomes an instrument that gives the researcher extended access to the reality of the perceived object. The creative process of generating an exact memory picture transforms the subjective element through exercise into the capability to objectify.

The next chapter further examines our ability to make assessments and form judgments.

3. Recreating Creative Nature - Practicing Goethe's Scientific Method II - Systematic Pattern Recognition and Clinical Intuition

Question: Can perception of the 'Whole' be a sensory experience?

This is the second chapter that includes exercises to become familiar with Goethe's method. In this chapter the process of making assessments or judgments and forming opinions will be considered.

Exact memory pictures, as we discussed in the previous chapter, demonstrate a specific human capacity: Humans can imitate the form of organisms or parts thereof in their minds and then from their non spatial memory again make the organism visible in space (drawing or modeling). In this sense, humans are able to 'recreate' what they have looked at. The precision with which they succeed in the recreation process is simply a question of proficiency in the technique.

The term 'creative' as used in art should be taken literally in this sense. However, we can also apply this term to science when speaking about the creative ability of scientific researchers. In his farewell address as a professor of the philosophy of science, Maso (2009) cites Peirce (1899), who describes the human qualities needed to be a good scientist. The second feature Peirce formulated was imagination for the truth. This is the same creative power of the human mind and is an important skill for the researcher.

3.1. Systematic Pattern Recognition

Studying the development of plants can develop memory and exact memory pictures further.

3.1.1. Development of the Plant Leaf in Space and Time

The example below is taken from author and researcher Jochen Bockemühl (1977). He studied leaf development in corn salad, smock, milk thistle and many other plants (fig. 3.1.).

corn salad | smock | milk thistle

Figure 3.1. Metamorphosis of leaves

Figure 3.2. Metamorphosis of the leaves over time

3.1.2. Exercise

Fourth Exercise

4a Observe the development in the three sets of leaf sequences shown in figure 3.2.

The leaves are arranged according to how they grow on the plant. The leaf that appears first is on the bottom left of the series and the last leaf is on the bottom right. When you pursue the arc from bottom left to bottom right, you follow the development of the leaves over time, as they appear on the stem one after the other.

4b Compare the leaves themselves.

Just as in the exercises in Chapter 2, it is useful to sketch the depicted leaves yourself at least in outline. First draw the three most striking leaves of each leaf sequence: for the sequence on the left: leaf 1, 7, and 14; for the middle sequence: leaf 2, 10, and 14; and for the right sequence: leaf 3, 12, and18. Define a few key features of each of these three leaf sets.

4c Complete the entire series in outline by sketching the main features.

4d Describe the changes in leaf shape in each sequence.

Your description should enable the listener to make an accurate picture of the transition between two successive leaves. You do that by describing, for example, what becomes larger, what smaller, what appears or disappears, what changes shape, etc.

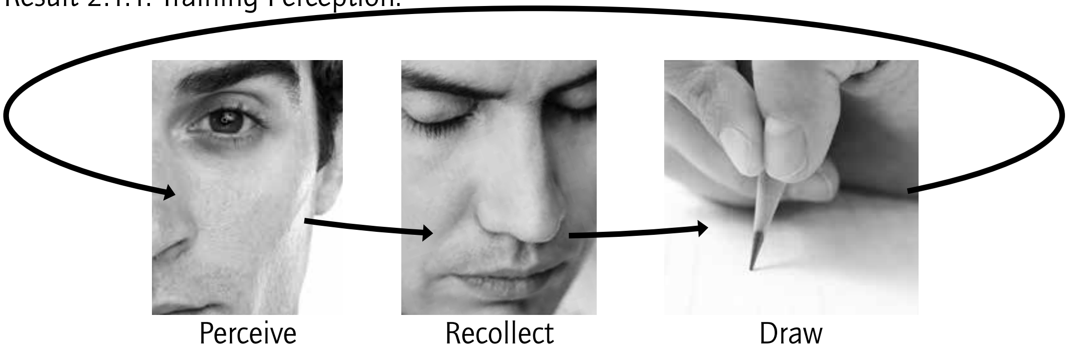
4e Evaluation of the experience.

It is essential to once again reflect on this process. You may note that by systematically perceiving, remembering, and comparing, you have experienced something new: in recollecting how one leaf shape transforms into the next, *the transitions that happen between leaf shapes also come into view. These changes in-between do not appear visibly in the plant but do become visible in your mind, you clearly 'see it in front of you' how the next leaf can develop from the one before.*

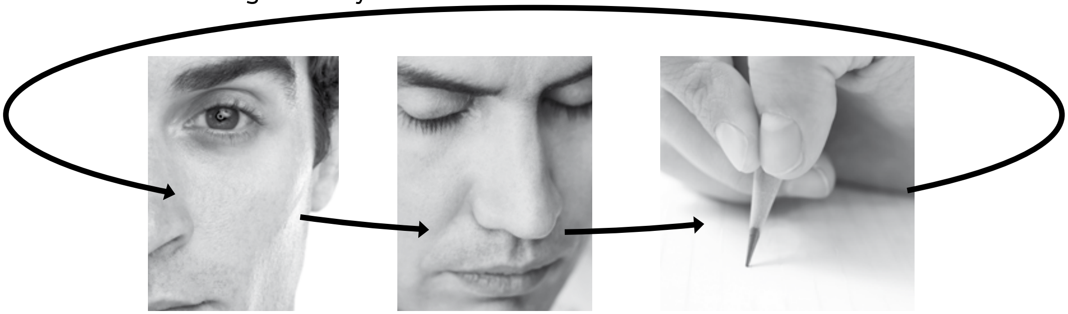
After comparing the three sequences of different plant leaves, it becomes obvious that in each of the three plants the same process occurs, which is called the 'leaf metamorphosis.' The metamorphosis of leaves is profiled in the mind of the researcher as a judgment or insight. It is a 'visible' assessment that arises when you *consciously* reflect on your memory and experience the changing leaf shapes. The reason that Goethe's method is compared to phenomenology shows itself here in the full meaning of the word phenomeno-logy: the experience (Greek: phenomenon) is present and 'speaks' (Greek: logos) in the mind of the researcher who derives an insight from it.

It is important to note that on the level of observation, all plant leaves have different shapes: no two leaves are alike. At the same time, it is true that all leaves undergo the same biological process during growth. There are many intricacies, but there is only one integral process: the leaf formation process and its development in time. This process is not evident from the sum of its parts (leaves) but by an experience in the mind of the observer that ties to the sequence of perceiving, remembering, copying, recreating inwardly, and comparing.

Result 2.1.1. Training Perception:



Result 2.2.1. Training Memory:



Result 3.1.2. Systematic Comparing:

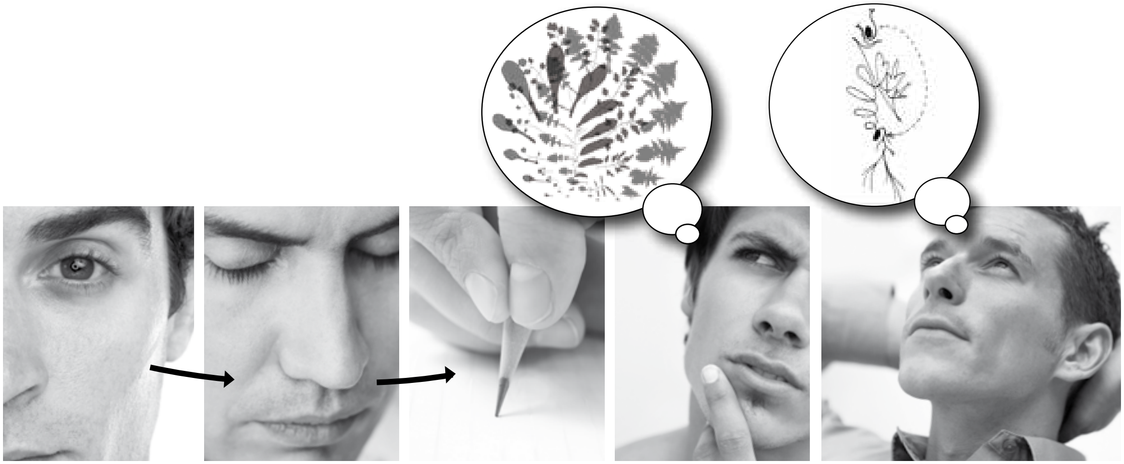


Figure 3.3. Practicing Goethe's scientific method III

3.1.3. Observing the Reflecting Self

Something new may strike you when you describe the metamorphosis of various plant leaves. In previous exercises (fig. 2.1., 2.3., and 2.4.), we considered shapes that exist *in three-dimensional space*. Presently, however, attention is focused on the results of a process *over time*, with the presence of various leaves that grow next to each other spatially, but that appear consecutively in time on the plant. An element of time comes into the exact memory picture. In the mind, it is not only shapes in space that appear, but also a development that takes place over time. This process in time cannot be captured in a still image; it is an evolutionary progression in itself. You experience it as a *dynamic* sensation that spans a certain amount of time. The capability to make exact memory pictures has fostered the mental ability to recreate the plant's natural growth and development. A

Result 3.1.3. Recreating Creative Nature:

Figure 3.4. Practicing Goethe's scientific method IV

conscious perception of a process in time occurs when you 'see' leaf metamorphosis. Time processes are characteristic of life processes; they create changing forms in matter. When they appertain to a living whole, such as a plant, they have a characteristic *pattern in time* and can be experienced as an integral whole.

The discipline of life sciences, which deals with emergent plants, animals, humans, and diseases is incomplete without this dynamic aspect of investigating perception. At this point natural science broadens to become genuine life science. Goethe described this process and called it: "re-creating creative nature" (fig. 3.4.).

When you come to this stage, examples from medical practice may come to mind again. Many diseases show a typical 'course', which means that the symptoms appear and disappear over time. Everyone knows this from personal experience, for example when you have the flu. The distinction between an acute illness that goes away by itself, that is 'self limiting', and chronic disease rests solely on the difference of its course over time. Diseases such as asthma, hay fever, rheumatic disease, and eczema have an innate course in time with exacerbations (episodes of increased symptoms) and remissions (episodes that are symptom-free or low in symptoms). Illnesses, like plants, have a pattern in time, not just characteristic symptoms.

Another example: In clinics for infants, the growth and development of young children is watched closely. The growth chart is structured as a combination of growth phenomena as well as steps in maturation and psychomotor development. In this sense, all of human development is also a time-bound phenomenon that concerns the whole course of development from embryo to old age.

Changes over time are frequently a distinctive element in diagnosing disease. Depression often occurs with daily fluctuations: in the morning, the depression is deeper than in the evening. Fever generally presents an undulating course throughout the day: lower in the morning and high at 6 or 7 pm. Fever may demonstrate a course specific for a certain disease as in Bang's disease, which is also called undulating fever (febris undulans). Malaria shows large temperature differences between day and night. The course of measles displays temperatures in two phases (biphasic): fever for a few days, a break in the fever, and then a reoccurrence with the appearance of the characteristic red spots. In all of these examples, the doctor distinguishes the disease based on its specific pattern in time - a pattern that manifests as a 'timeline' or 'structure in time'.

Going through an illness is an organic process in time; the 'recreated pattern' of the timeline exists in the awareness of the physician who is familiar with the disease.

3.1.4. Further Differentiation in Leaf Metamorphosis

When you have observed your activities during the last part of the fourth exercise (4d and 4e), you may have noted an analogous development in the shapes of all three leaf sequences of figure 3.2. This development can be divided into stages and the stages named according to characteristic processes for each given stage. The differentiated stages of the whole process are indicated in figure 3.5.

The Next Step

Goethe's approach enables you to assess universal phenomena, such as leaf metamorphosis. It may strike you that this assessment is based strictly on what you experience in perception, recollection, comparison, imitation, self-reflection, and contemplation. Goethe's method demonstrates that the researcher can objectively read into a phenomenon. Indeed, by allocating a meaning through this particular thought process you can transcend 'subjectivity'. Subjectivity should here be understood as the 'personally tinted' opinion.

The essential feature of Goethe's scientific method is to transform personal bias, and as a result, discover what is generally applicable. The researcher gains access to the 'objective, unbiased' result carried by systematic but 'subjective' activity. This unbiased result is an objective, inherent reality, independent of the investigator, even if it was realized through personal effort and experience.

Figure 3.5. Stages of leaf metamorphosis

Remark

It is important to note that the successive stages of leaf metamorphosis change one into the other. Thus, every developmental stage has a starting point, a maximum, and a vanishing point, as shown in figure 3.6.

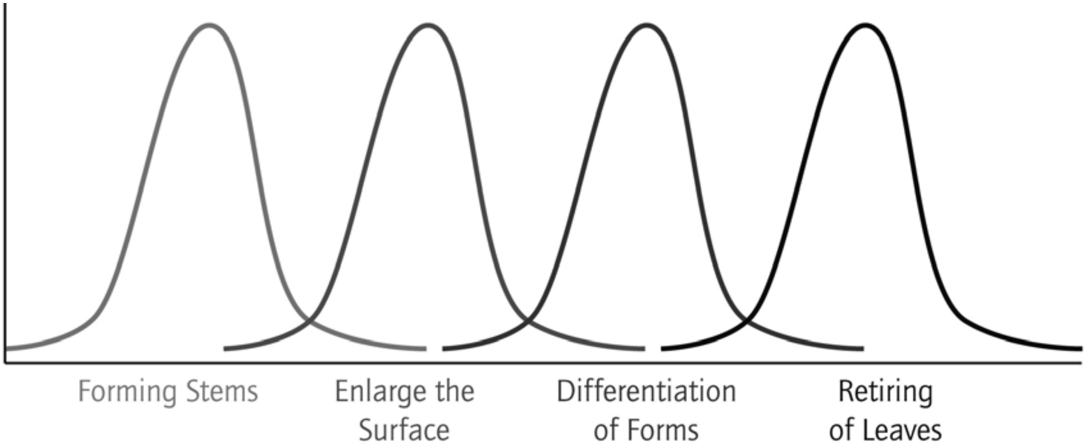


Figure 3.6. The coming and going of stages of leaf metamorphosis

Note 3.1.: Constructivism and Ontology

In light of this part of the discussion, you might wonder the following: does leaf metamorphosis genuinely exist (ontological argument) or is it a concept humans have constructed themselves through rational activity (constructivist view)? The most important component of a concept is, after all, that which arises from rational activity of human beings. The same applies with regard to the concept of disease such as of mononucleosis mentioned in 1.1.

The debate between 'ontologists' and 'constructivists' concerns the real time existence of thoughts and ideas. Do physical laws, diseases, and something like the metamorphosis of leaves have a genuine existence outside the human mind and are they entities independent of human thinking (ontology)? Or do we assign meaning to something that seemingly exists (constructivism) as a useful hypothesis to explain certain phenomena? It is left to the readers to determine their own position. This author believes that the ontological view does more justice to reality. But is not constructivism self-annulling since it is itself a construct? A construct can, by its very nature, not pertain to genuine existence or reality.

The ontological approach acknowledges the real time nature of things. Based on what we 'envision in thinking' on the one hand and the 'reality' of sensory impressions of plants on the other, the ontologist recognizes leaf metamorphosis as a biologically active and authentic process with its own genuine form of reality. This is not because he thinks it up, but because he bases his assessment on what he actually sees before him and can also envision in his mind, which genuinely feels like truth to him. The systematic steps that lead to recognizing leaf metamorphosis as a pattern in time can further accentuate this sense of truth (see also the introduction to this chapter).

Goethe called this moment of intuitive assessment in conducting research the stage of 'Systematic Pattern Recognition' (German: 'Anschauende Urteilskraft'). Systematic pattern recognition occurs in an organic way in practice-based research. As an investigator you experience it as an activity *of the object* in your mind. The investigated object itself, in this example the plant, generates the intuitive concept of leaf metamorphosis in the mind of the researcher when he/she systematically perceives the leaf patterns (fig. 3.4.).

The experience in studying leaf metamorphosis is analogous to the way in which diseases (mononucleosis or depression) are experienced in clinical intuition. The (ontological) existence of these diseases is not questioned in medicine, however difficult it is to understand when they begin, how they run their course, and however varied they are in their symptomatology. Intuitive skills such as systematic pattern recognition and clinical intuition are the capability to perceive the ontological side of disease.

The analytic approach of EBM implies a constructivist way of looking at disease symptoms. Disease becomes 'nothing but' an error in the genes, organs, or physical processes. The reductionist needs a science of wholes to place the phenomena in context and understand them. A science of wholes needs the analytic approach to get to the phenomena in the first place.

Note 3.2.: Subjective and Objective

The exercises in Chapter 2 and 3 elucidate the concepts 'objective' and 'subjective' more precisely than is usual in science.

In the plant or in a disease a process of outside nature manifests itself. The chosen examples of plants, organic processes, and diseases speak for themselves: they are phenomena independent of our person. The investigator does not cause these phenomena; they have their own innate existence. If we would not be present, they would still be there in identical form.

Through personal effort, the investigator can gain insight into a particular natural phenomenon, such as a disease. When he is successful, the researcher can not only recognize and identify the substantial plant, natural process, or disease outside himself but the same natural phenomenon appears in his mind as a personal process: it is the subjective appearance of the object that is also visible as plant or disease. In gaining insight and understanding of things, the subjective aspect of consciousness changes in an objective sense, not objective as in outside nature, but objective in terms of knowledge and understanding (Steiner 1894, Buber 1996.). Any conversation about plants, processes in nature, or disease would be unworkable if the participants each had their own biased knowledge. Misunderstanding and confusion would be inevitable. However, because the parties to some extent share a common understanding, they can have a meaningful conversation about the 'same' subject.

Conventionally, the term subjective is understood as 'personally biased' and is thought to be unreliable and useless to scientific investigation. As a consequence, people overlook the fact that thinking and systematic pattern recognition can actually overcome personal bias. Objective insight may then appear in terms of understanding and knowledge.

3.1.5. Systematic Pattern Recognition

We studied the processes that result in understanding leaf metamorphosis in this chapter. We used a clear methodology in studying how the leaf shapes develop over time: starting from observation and comparison, we recreate the subject(s) in our minds, assess the experience, and possibly discover patterns. The result of this entire process leads to an inner experience that Goethe called systematic pattern recognition (German: Anschauende Urteilskraft). In practice-based learning, pattern recognition occurs naturally, for instance as clinical intuition or the skill of the seafarer or farmer. Systematic pattern recognition occurs when we recreate creative nature with introspection.

Result 3.1.5. Systematic Pattern Recognition:

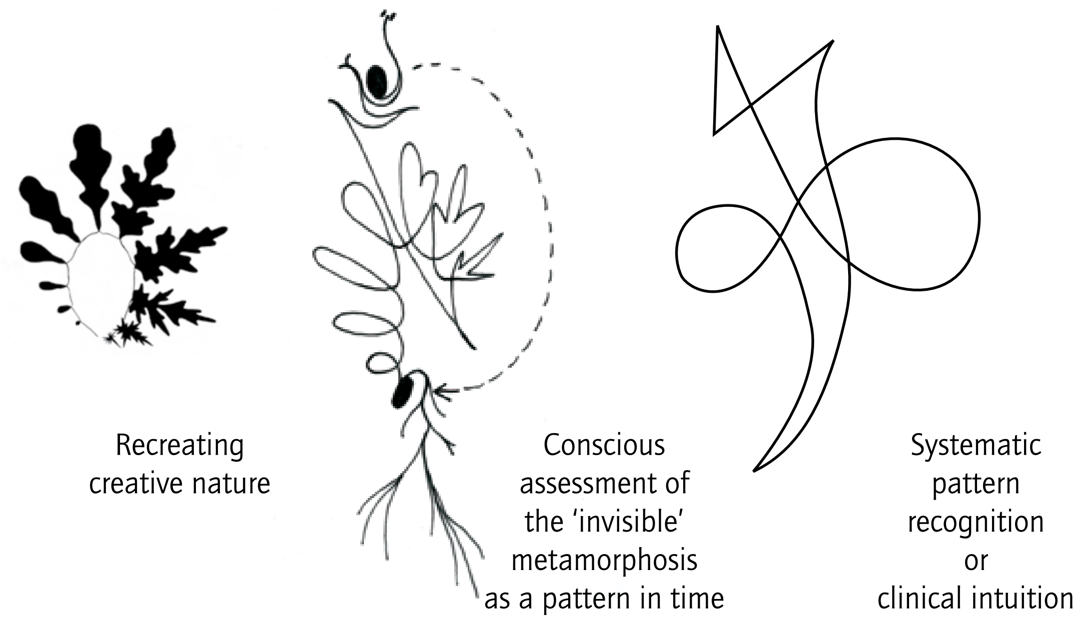


Figure. 3.7. Practicing Goethe’s scientific method V

Systematic pattern recognition gives the experience of a process in its entirety, in this case leaf metamorphosis. It is an intuitive inner experience, an insight (see note 3.2.). This experience takes place as a feature of 'the Wholeness of Nature.' In his book with the same title, Bortoft (1986) uses the term Intuitive Perception to indicate that Goethe's approach results in the experience of processes as an integrated whole. The metamorphosis of leaves can be experienced as a generally practicable principle of the plant world. To realize this, you did not first formulate a hypothesis to be verified through an experiment, you did not design a theory about leaf metamorphosis nor did you analyze any section of the leaves without immediately restoring the detail to the context of the leaf series.

The systematic comparative study of visible phenomena has led to an 'inwardly visible' experience of *the* leaf metamorphosis that brings all present leaf shapes in a comprehensible context. A purely analytical examination of plants will not convey such insight.

Goethe calls the inner experience of 'leaf metamorphosis' an *empirical* sensation (see section 5.1.). He implies that the experience relies on direct and irrefutable evidence: systematic pattern recognition. In the same way healthy persons or animals when seeing a tree, hearing a sound, or smelling an odor feel this as a direct reality: these sensations are indubitable experiences. The only difference with the experience of leaf metamorphosis is that the sensory experience is tied to the physical presence of sensory stimulation by light, sound, or chemicals. Systematic pattern recognition is similarly bound to the existence of the mind. Both these forms of awareness may be described as practical, or 'empirical'.

Sensory perceptions are universally recognizable empiric experience because sensory stimulus and perception have a qualified connection. The intuitive assessment in systematic pattern recognition is not instantly recognizable empiric experience for everyone since it must be attained by a concerted personal effort. Goethe called its understanding 'delicate'; he meant to reflect that the experience is gentle, subtle, and not substantial. When you use self-reflection to examine Goethe's result, it will probably be easy to confirm his experience: sensory impressions are of a coarser nature, and appear immediately after sensory stimulation; systematic pattern recognition is delicate and is experienced only after some effort in self-reflection and thought.

Systematic pattern recognition is delicate, sophisticated, and distinct compared to sensory impressions.

Leaf metamorphosis is a whole, integrated process. It is a gratifying study subject and an educational means for becoming acquainted with a 'science of wholes.' The development of the leaf shape over time is always a variation on the same theme and this theme is a process that never manifests as a direct sensory experience. The experience turns out to be very similar to the concept of disease that we came across in 1.1. We know the disease by pattern recognition and clinical intuition. Every sick person with *the* disease will show *a* variation on the disease theme, just as each plant demonstrates its own variation of leaf metamorphosis. Each concrete example of *a* visible leaf metamorphosis is a specific single perceptible example of *the* leaf metamorphosis as a whole. Thus, each stone that falls down is a prime example of the generally applicable law of gravity. The difference between leaf metamorphosis and gravity is that leaf metamorphosis (or disease) is related to phenomena of life while gravity relates to lifeless functions. They are alike in that both *the* leaf metamorphosis and *the* law of gravity are invisible to the human eye, but 'visible' to systematic pattern recognition.

3.2. Summary

On the basis of observation and comparison of changes in leaf shape, the law of leaf metamorphosis in plants becomes evident. This law represents a development in time and space with its specific character and staging. *The* leaf metamorphosis is detected using a 'Science of Wholes.' Even though it is not quantifiable, measurable, or ponderable, for the purposes of **systematic pattern recognition** it is an **obvious** feature of plants.

Leaf metamorphosis is not perceptible to the senses. The perception of leaf metamorphosis occurs as an intuitive insight when we examine and compare plant leaves and 'recreate creative nature.' In the systematic reflection of human consciousness, the process in nature becomes recognizable as an assessment of specific existing patterns. Systematic pattern recognition starts from observation and comparison, then recreates the subject in the mind, assesses the experience, and possibly discovers patterns.

Systematic pattern recognition shows natural processes as an integral unity.

Similarly, experienced physicians have expert knowledge about diseases (see section 1.1.). Such disease concepts are self-evident to doctors including the potential variability in the course of the disease in the same way that leaf metamorphosis is a reality. In this way, leaf metamorphosis as an ontological unit may be compared to disease. The disease concept evolves to clinical intuition through practice-based learning and is what physicians need for understanding the specific pathogenic and biological activity of a disease. Pathology is essentially a 'Science of Wholes' from this perspective. Clinical intuition can evolve through the practice of systematic pattern recognition.

Goethe's scientific method provides the basis for developing an intuitive and scientific understanding of organic processes.

Part 2 The Complementary Relation between Analytic Science and Goethe's Methodology

4. Fundamental Attitudes Underlying Science

Question: What is the difference between current scientific methodology and Goethe's method?

4.1. Introduction

The two previous chapters were intended to give the reader an experience of Goethe's methodology. Goethe himself lucidly characterized his scientific endeavor in a letter to Knebel (August 18, 1787), in the following way:

> *"My interest is not about discovering new facts, but to look upon the already discovered facts* ***with my own technique****". (emphasis GvdB)*

This statement puts Goethe's scientific method *alongside* the analytical Newtonian form of science that was becoming popular in his day. History can teach us that analytical methods have an irreplaceable value in bringing facts to light. This includes facts that become known to us using microscopes and other visualization equipment. Facts, however, do not speak for themselves and never have intrinsic meaning. Connections between facts, meaning, and insight arise as a result of human *thinking about* the facts. That is what van Melsen meant when he was quoted at the very beginning of this Companion:

> *" ... Variation in scientific specialties occurs when a given specialty uses different methods to investigate, describe, and understand the facts". (from Melsen 1964)*

In the two previous chapters on Goethe's method, the actual information we used consisted of well-known facts in analytic science, but we arrived at new insights about them. This clarifies a fundamental difference in methodology between science building upon Newton's method and practice-based science. Goethe's methodology is different in *the way it thinks* about the facts. We already mentioned as a further difference that Goethe's method is an inherently ontological approach, while Newtonian science fits a constructivist's view. How can this way of thinking be further characterized?

4.2. Fundamental Attitudes

A different approach to the facts confers a different experience of their context, which in turn leads to different insights into the data's meaning. Please, note: the different approaches present the researcher with a *choice*. Each of us can decide for ourselves whether an approach other than analytic science gives satisfactory answers to our questions. In particular, the answers analytic science gives regarding questions of life, human experience, or psychology are often felt to be inadequate.

For such areas of life, scientists could choose to use other methods that provide more rewarding outcomes than the analytical approach. This implies that they would deliberately select the *fundamental attitude* with which they look at scientific facts. In our culture, investigators are more prone to opt for just an analytical methodology due to education and training.

4.2.1. The Onlooker's Attitude

The fundamental attitude of the analytical approach was once characterized as the attitude of the one-eyed colorblind onlooker. When we try to conceptualize this, we may realize the following: a one-eyed person sees no depth or perspective, and a color-blind person, when the colorblindness is profound, sees the world in gray tones. Being an onlooker is important for analytical science. Onlookers remain aloof, do not immerse themselves in the experience, and do not feel connected with what they see or hear. Yet the very experience of depth and perspective, and appreciating the colors in things gives a much richer and more differentiated picture of reality - a picture that is more true to reality. In the example of the leaf metamorphosis in Chapter 3, we tried to create such a connection to the observed leaves that *we could move along with the leaf process and feel what it was like.* When you simply describe the leaves and limit yourself to the details, your understanding remains rather ‘flat’ and you gain little insight into the context of leaf growth.

The onlooker does not want an empathetic relation with the things around him; he keeps his distance. This detachment brings on the one hand the opportunity to collect an infinite number of details; on the other hand it does not accept or tolerate a relation of our feeling life with the phenomena.

In medicine, the exclusive utilization of this attitude has led to the need to establish medical ethics committees. The onlooker’s attitude prevents the physician’s professional empathy towards the patient to arise. It eradicates the normal, personal ethical attitude of the physician. You can see the symptoms of the onlooker’s attitude in public discussions on the right to the protection of life, on assisted suicide, and on the limits of meaningful medical action. Physicians can no longer determine the limits of professional conduct in individual situations and act accordingly. Medical ethics committees set generally applicable rules and what these committees come up with becomes ‘good’ medicine, regardless of the individual situation.

This creates a certain paradox. *By nature*, when one tries to comprehend things in everyday life, one does so based on understanding coupled with a feeling. For example: when someone holds up his fist in your direction you immediately perceive it as a threat. For the onlooker’s consciousness, this phenomenon means only that the person in question tightens all flexor muscles of the forearm and hand. The onlooker may not attach a meaning to it, because this would imply that he would engage his emotions, which, in line with their alleged ‘subjective’ character, can never lead to ‘objective’ knowledge. But what would human understanding of everyday life amount to if people were only to employ the

analytical mindset of the onlooker? Humans derive precisely the most valuable insights from their feelings towards other people and towards their environment! Disastrous accidents would occur in everyday life if a person were to not be able to read from the other's attitude in terms of what to expect or to fear. Does not mainstream science actually compel people to annul their natural ability of empathy - the very empathy that gives so much meaning to the world? All of this is done in support of a 'purely scientific' onlooker's attitude: the analytical approach.
The question arises: can we extend the learning attitude that we know and appreciate from everyday life scientifically?

4.2.2. The Participatory Attitude

Goethe's methodology practices another key attitude - one that consciously educates the natural ability to give meaning to things by *educating empathy* and making it more suitable for understanding the reality of life. The aim, then, is to be involved and empathize with the phenomena by means of a targeted use of our *faculty of feeling*. When empathy is deliberately extended, it can work to broaden our insight. The examples in the two previous chapters attempted to clarify that the idea is not to replace detailed descriptions, but to see the detail's *context and depth.* In systematic pattern recognition as practiced in Chapter 3, you had a dynamic experience of leaf metamorphosis based on the inner ability of empathy, of *being involved with the object*. The researcher (and who is not?) can then connect and pursue thoughts with feeling. In this way we *participate* in the process to be investigated. This attitude is an active inner attempt to not remain exempt from the observation as an onlooker, but to engage in it and experience what participation in the processes can bring to you. This participatory attitude *connects* you to the observed object and *through this experience* you recognize its meaning. Goethe's method practices **empathic thinking.**

In the above example of a person clinching their fist, you recognize his anger or aggression, because you can identify with a similar internal experience of making the same gesture when you were angry or felt aggressive. What you have come to know as experience of inner self you may recognize in its outward appearance in other humans or in animals. It is obvious that a *recognizable inner experience* is the basis for understanding the *external appearance* of the clinched fist in the person before you. This immediate experience is self-evident and has the character of a truism. The transition from the inner experiential *process* to its external *appearance* is equally self-evident - as is the self-evidence of any axiom in mathematics. The axiom requires no proof because it is, after all, obvious.

Empathic thinking in research can help us recognize patterns when we identify the concordance of the outer appearance with an inner experience.

The boundary between subject and object is neutralized by the participating attitude of the investigator in Goethe's approach to nature. The process of 'recreating creative nature' when the researcher revives the organism under study in his mind and understanding, is the methodological step to bridge or even abolish the distinction between subject and object (see section 3.1.3. and fig. 3.4.).

At this point by utilizing empathic thinking, Goethe's methodology distinguishes itself explicitly and most obviously from current science. Scientists cannot bridge the boundary between subject and object with the methodology that is currently used (fig. 5.1. upper part).

In comparing the plant leaves, we experienced that the details of plants are embedded in their context. You may realize that the awareness of the image or process as a whole is more comprehensive than the (analytical) awareness of the details. The same applies to the participatory attitude. It is also more comprehensive than the onlooker's attitude: *it includes the view of the onlooker*. It may be emphasized again that no one method replaces the other, but we find another aspect of the relation between Goethe's methodology and Newtonian scientific methodology: what is more comprehensive includes the less comprehensive. In a diagram this can be indicated as follows (fig. 4.1.):

Systematic Pattern Recognition
includes
The Details

The Participating Attitude
includes
The Onlooker's Attitude

Fig. 4.1. The inclusive relation of Goethe's methodology and current science

4.3. The Role of the Mind in Goethe's scientific Method

Another area where Goethe's approach differs from analytic science is in the way in which the mind is used in integrating sense perceptions.

In daily life, sensory stimuli overwhelm the observer with experiences in which no a priori correlation exists: visual impressions, sounds, smells, tactile experiences, etc. For pure perception, the world is chaotic and inconsistent in its objective phenomena. Goethe's scientific method teaches the researcher to experience the unifying aspect through an *empathetic comparative methodology*. It orders the chaos of sense impressions by appreciating the connection between them, as in the example of leaf metamorphosis. This gives coherence and meaning to the fragmented sensory perceptions. We experience leaf metamorphosis as an integral process. Leaf metamorphosis becomes an aspect of the 'Wholeness of Nature' (Bortoft 1986).

The mind is applied in Goethe's method for comparing various phenomena and giving them meaningful relation. Empathetic comparative thinking orders observations into a coherent whole (fig. 5.1. upper part). When diagnosing an illness, this translates to recognizing 'the' illness as an integral process (see section 1.1.). The symptoms can vary in different patients, but the disease that these patients suffer from is still 'the same' disease.

In the analytical approach, for example in molecular biology, the mind is used to hypothesize possible explanations and causes for observed phenomena in plant, animal, or human. The organism - an organ or a tissue - is dissected to examine its composition and operation on a cellular and sub cellular level (Roitt 1995, Robbins 2007, Harrison 2012). Researchers explain the phenomena under study by considering details found by *dissection* (Greek: analysis) as cause (Latin: causa) of the phenomenon. This is the reason why this method is called the causal-analytical research method. In a causal-analytical approach, thinking is used to formulate (preliminary) conclusions and hypotheses. Ideas and hypotheses on molecular structures, functions, and their diversions are put together, which investigators then take to be the 'cause' of the illness (fig. 5.1. lower part).

Disease genetics is probably the best example of this approach. Genes were thought to be the cause of many illnesses, including schizophrenia. But while genetics explains the origin of substances such as muscle proteins, nerve tissue, or plant chlorophyll, genes have not been found to code for (‘cause’) the shapes that determine the context of these substances on a macroscopic level. You can find the same muscle proteins in many differently shaped muscles, and the same chlorophyll will be present in all green leaves, yet they do not decide the shape of these structures. To this point, it is thought that epigenetics, or environmental factors, play a key role. The study of epigenetics finds, for instance, that the rate at which genetically predisposed individuals contract schizophrenia is reduced to the rate of the general population when they grow up in a healthy environment (McGowen et al 2009, Swets et al 2009).

The role of the mind in Goethe’s methodology is to find the *coherence* of the organization by describing details in their environmental context, comparing them, and systematically coming to recognize the inherent patterns. During this process, thinking leads to a vivid insight, which prevents the mind from making assumptions. On the contrary, preliminary judgments and conclusions are actively held back; hypothesizing is not a primary goal. The meaning of the word ‘intellect’ that comes from Latin is significant in this context: "what can be read (Latin: lectus) between (Latin: inter) the lines". Focused attention and its training as practiced in the previous two chapters plays an important role in systematic pattern recognition.

Neuropsychological Aspects of Pattern Recognition

Research has demonstrated that motivation, attention, memory activity, and training functionally organize neuronal activity in the brains of animals and humans, which creates integration of diverse neurons and brain areas that are involved in these specific observations. On the basis of focused attention, neurons in different areas of the cerebral cortex of humans or animals simultaneously become operative in so-called intra cortical synchronization. Synchronization refers to a spatial and a chronological order (Engel 2006). This process is essential for sensorimotor integration.

The phenomenon is best studied in humans through the processing of visual sensory information, but also applies to many other stimuli. It has led to the following conclusions:

> *"...these findings suggest that discriminative processes in the human occipital cortex begin to operate within 150 ms post stimulus and are influenced by both the overall intention to perform a discrimination and by spatial attention". (Hopf et al 2002)*

Other authors speak of 'zero-time lag synchronization among cortical areas' on the basis of their records (Roelfsema et al 1997).

In figure 3.2., fifty differing leaves are visible, yet the mind empathically 'perceives' one integral process - leaf metamorphosis. The particular integral process is generator of all the different shapes. Leaf metamorphosis is an integral whole, the leaf a component of the whole.

The integral whole generates all the parts.

In the following chapter, the role of self-evidence in Goethe's methodology will be investigated before the relation of the integral whole to its parts is further explored (see section 5.3.).

4.4. Summary

In science, we need to clearly distinguish the facts and the meaning that was allotted them. In doing so, our fundamental attitude and way of thinking about the facts play a decisive role.

The ‘onlooker’s attitude in analytic science means that the researcher deliberately remains aloof to objectify the findings. Goethe practices the participatory attitude and objectifies his findings through a systematic procedure. The participatory attitude includes the methodology of the onlooker in its process.

Analytical methodology uses the mind to hypothesize possible explanations and causes for observed phenomena. Details found by dissection or analysis are considered as cause of the phenomenon. The mind is applied empathically in Goethe’s comparative methodology to find the coherence of organizations by describing details in their environmental context and systematically coming to recognize the inherent patterns. Preliminary judgments and conclusions are actively held back.

The integral process of leaf metamorphosis generates all the different leaf shapes. The integral whole generates all the parts.

5. The Intellectual and the Intuitive Scientific Method - The Concepts of Laws and Types

5.1. The Integral Process: the Role of Self-Evidence in Goethe's Methodology

If Goethe's method uncovers an integral process, how does this integral process enter the mind? When we examine how the experience of such a process arises, self-reflection can teach us the role of the mind.

In experiencing leaf metamorphosis (Chapter 3), you focus your attention first on perception and observation, then on recall and remembering until you have an exact memory picture. Then you give attention to comparison and consciously recreating nature, which leads you to systematic pattern recognition (fig. 5.1.). Any natural tendency to reach a causal explanation about what you see is suppressed in this process. You move along and practice 'recreating creative nature.'

When you do a comparative observation of the different leaf shapes (fig. 3.2.), a vivid insight gradually lights up as the systematic recognition of the pattern of leaf metamorphosis. This is a *self-evident* experience.

The Experience of Self-Evidence: The remarkable Relation between Sight and Insight

The Latin word 'evidens' means 'visible'. Self-evidence is experienced as the perception of an insight that generates an integral understanding.

This suggests that in many cultures the experience of evidence and insight is qualified as a light perception, without the light being 'physically present.' Vision is a sensory function that totally depends on physical light. Evidence and insight are a conscious experience of the mind akin to the sensory *experience that occurs when perceiving.*

Words and phrases like 'insight', 'to see through something', 'I feel enlightened,' and 'this sheds a different light on the matter,' or 'a transparent view' indicate that there is a connection between the sensory experience of light to the inner light that causes insight or self-evidence. In the same way, when you are 'in the dark about something' understanding of a given situation is lacking.

Everyone appreciates these terms as referring to the experience of 'insight.' You could take the examples here as culturally determined phraseology, not to be considered scientifically viable. However, they refer to empirical evidence that presents itself every day. These examples refer to the generally accessible, self-evident and deliberate inner experience of the quality of 'evidence.'

The experience of 'self-evidence' is an event in the conscious human mind. It presents itself as an integral unity, as the 'experience of a totality.' The integral whole of the process becomes graphically 'visible.' Integral processes enter the mind as a self-evident experience. They are the organizers that generate and steer all details and their reciprocal links. *The experience of self-evidence that allows the integral whole to occur in the mind, is a central feature of Goethe's scientific method.* This 'insightful' perception of dynamic processes, to paraphrase Bortoft, is an **'intuitive methodology'** (see section 3.1.5.). This intuitive method of insight is holistic in nature and is the foundation of a 'Science of Wholes' (fig. 5.1. upper part).

Goethe says the following about the experience of self-evidence:

"*A delicate impression/sensation can be experienced empirically. It identifies with the object most intimately and in this way becomes its ultimate theory*"
(Goethe, Maximen und Reflexionen).

The word theory here can also be seen in the context of its original Greek *'theorein'*, meaning *beholding*. An 'empirical' scientific methodology such as clinical intuition exists alongside analytical methodology, which is discussed below.

5.2. The Isolated Parts: the Role of Evidence in Analytical Methodology

Analytical thinking disassociates the mind from the phenomenon and its perception. It focuses often on *(help) representations*. These are usually hypothetical in nature and often involve quantifiable spatial (molecule) and material (atom) features. Bohr’s molecular model is consequently called a ‘space-filling model.’

Analytical thinking deduces abstractions. It withdraws from the act and experience of perception. It does not recreate creative nature. It is ex-act thinking (act = action). Goethe's re-*en*acts the processes of nature as his mind meets the creative process of developing organisms as a participator. In ex-act thinking, the mind abstracts itself from the creative process in nature. Abstract representations disconnect from the sensory experience by hypothesizing about the experience (fig. 5.1. lower part). They often show no recognizable association with the perceptions from which they were derived. Examples include the concept of electrical nerve activity representing the will, or hormonal activity as the cause of the emotions between two people that are in love.

This is Sheldrake’s so-called ‘nothing butterism' (Sheldrake 1981). It happens when a certain phenomenon is represented as if it is ‘nothing other than’ what we found by analysis. From this perspective, feelings are ‘nothing but neuro-endocrine circuits,’ perceptions are ‘nothing but a visual neural circuitry,’ and human mating is 'pheromone-driven behavior’ (Swaab 2010) (Pheromones are odorless substances that stimulate sexual behavior in animals.)

The aforementioned causal-analytical way of thinking is characteristic of conventional scientific thinking. In the end, the details found in analytical science such as genes, neuronal circuits, cytokines, or messenger substances are considered the *cause* of behavior, perception, and growth, or even of an emotion or insight (fig. 5.1. lower part). This threatens to exchange the condition for the *cause* of something. The body’s ability to produce epinephrine in anger does not prove that epinephrine is the cause of anger. It does however suggest that epinephrine production could be a condition for angry or aggressive behavior. Bortoft (1986) specifies how causal analysis in analytic science fails to keep apart the perceptive content of observations and the significance the mind attaches to them (meaning). It creates confusion about cause and condition.

The importance of analytical methodology has been unequivocally proven in the field of inorganic sciences. It is less suitable for understanding organic processes. The analytical pathway has not led to insight into phenomena such as organic self-regulation or health (Huber 2011).

The following diagram is derived from a scheme of Bortoft's 'The Wholeness of Nature.' It has been altered to show systematic pattern recognition and sensory phenomena, intuitive methodology and analytical methodology in their mutual connection.

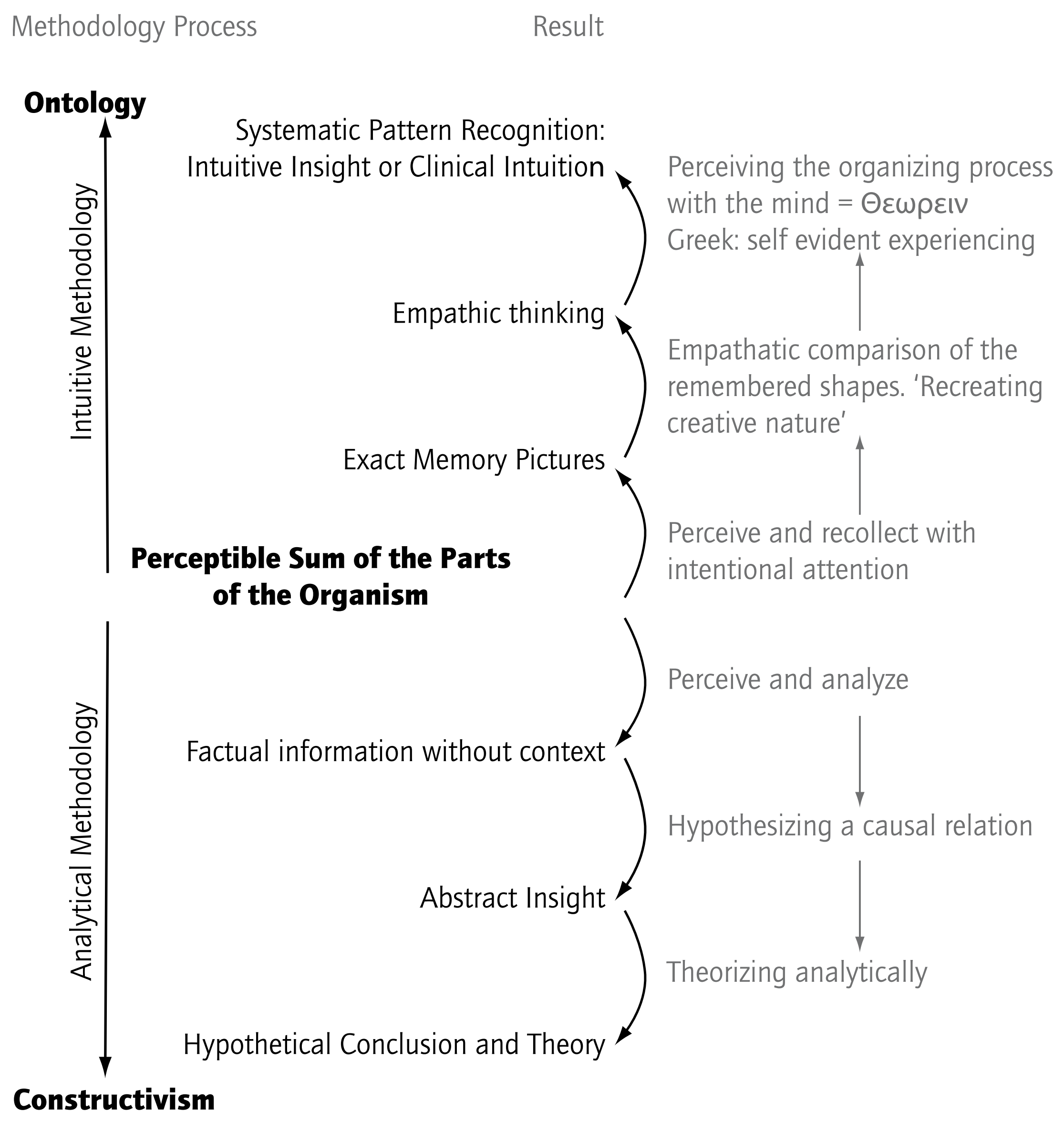


Figure 5.1. The mutual connections between intuitive methodology and analytical methodology

5.3. The Parts and the Whole in the Visual Arts

In the arts, the relation of the whole and its parts can be demonstrated as a self-evident experience that can give us more insight into the difference in thinking between analytical and empirical science.

Theorem: the whole is greater than the sum of its parts. (Aristotle)

Ursus Wehrli humorously but unmistakably demonstrates the difference between 'the' whole and 'the' parts in the visual arts. To do this, he expressly approaches paintings by famous artists with a 'wrong attitude.' In his booklet 'Tidying Up Art,' Wehrli reorganizes the components of paintings in a 'tidy, orderly' manner. At A (fig. 5.2.A), you can see a meaningful picture: the figure of a woman's torso. You recognize the figure based on pattern recognition and an empathic, intuitive way of looking. The components are ordered in a meaningful way and make sense as the image of the torso of a woman.

We can take the components of the painting and arrange them in a different, analytical, more mathematical way –a way that makes Wehrli feel like he has 'tidied up the painting.' We create order in what that Wehrli felt was rather messy.

The parts of B are exactly the same as in A, but in B they are arranged according to height/ length by means of a quantifiable, analytical method. Both in A and B, the parts have a recognizable relation to each other: in A by virtue of the picture's *meaning* through the *image* of a woman's torso; in B because of the relative *size* of the parts.

This example shows that order is created on the basis of a fundamental attitude (see section 4.2.) and way of looking: in A, order occurs based on a self-evident meaningful pattern, in B according to one quantifiable feature of the separate components. The two different views show two forms of order and logic. In 'Tidying Up Art', Wehrli shows that both methods should be considered legitimate, but lead to a totally different connotation. The intuitive and analytical methodologies are not mutually exclusive but complementary.

A

B

Figure 5.2. A. Torso of a Woman. B. Rearrangement of the parts of A according to size.

Without a reminder of A, we are incapable of arriving at the picture of a woman from the parts of B. Direct self-evident experience shows us that the whole picture is not the sum of its parts; the meaning is not hidden in the visible parts. The artist was constantly aware of the wholeness of the human female figure and then visualized it on a sensory level in his particular way. This way of picturing created the typical image elements of painting A. These picture elements are meaningless on their own as in B. The conclusion must therefore be that

the whole generates its parts.

It is highly unlikely that any artist first painted all parts as shown in B and then attempted to assemble them to symbolize the figure of a woman's torso as shown in A of figure 5.2. The artist has certainly been aware of 'the' figure to be painted during the creative process and created the painting after that image.

5.4. Laws and Types

When you study and compare living organisms you will find differences and similarities. All animals that have a spine in one form or another are considered 'vertebrates', a

characteristic group of animals. In contrast, the 'invertebrates' are classified as another group precisely because of the lack of a spine. Other groups with characteristic common attributes and features include amphibians, reptiles, fish, and mollusks. In plants, we know of similar characteristic groups of organisms based on certain features. Examples are the labiates, umbelliferae, algae, mosses, ferns, and trees.
Biological classifications are established by comparison. 'Typical' characteristics of certain groups of plants or animals play a distinctive role in the classification process. Goethe formulated that each group of animals or family of plants belongs to a certain 'type' based on specific attributes that represent characteristic patterns in the type. The picture of a woman's torso (fig. 5.2. A) demonstrates how Goethe's concept of type can be identified with pattern recognition.

The type is a self-evident inner experience as described in Goethe's scientific methodology.

All vertebrates have some form of spine that is not present in any of the invertebrates. However, the form in which the spine appears could be completely different in various vertebrates and also changes during their growth and development. For example, it could change shape due to malnutrition, disease, climate change, or poisoning of the environment. The trait of the vertebrate spine is not 'lawful' as in inorganic nature, but is 'typical' for characteristics described with intuitive methodology. The type is experienced more as a fluid domain of developmental opportunities and, as stated above, as the generator of various interrelated forms.

Art history shows that 'the' figure of a woman as seen above in the picture Torso of a Woman can be visualized in many ways. This is a good example of the plasticity of types: 'the Type' is visible in many forms yet is always 'the same' (see section 1.1. or 3.1.5.).

The developmental opportunities within the type can manifest in various outward appearances in organisms. At the same time the type preserves certain distinctions such as in the vertebrae in the vertebrate animals. During the life span of an organism the typical design originates from and is maintained by self-regulation. The forces of type and heredity, and its natural context *determine* the organism's material components in terms of their physical location and spatial shape. The integral whole sets the stage for its parts. The shape is retained while the material ingredients are replaced through diet, metabolism, and daily excretion (Tellingen 2001 Chapter 2). The Greeks spoke in this context of 'panta rhei:' 'everything is flowing movement'. Yet all substance is arranged in the type-specific order, limited in expression and organizational capabilities, and is embedded in the spatial form and development of the organism over time.

This translates to recognizing 'the' illness as an integral process and as a type when making a diagnosis (see section 1.1.). The symptoms can vary in different patients, but the disease that these patients suffer from is still 'the same' disease. If patients were to simply have their 'own' illness, it would be impossible to understand illness in general, because the generalized aspects of individual situations would not be seen.

You can develop a sense for this phenomenon when you study a vortex or 'standing' wave in water (fig. 5.3.). Where running water is forced to form a vortex or a standing wave, a permanent form is created for some time. The vortex or standing wave remains present as a form, while the water flows on. At no time was the vortex or standing wave made up of the same water. In a similar way, organisms hold on to their typical body shape, while through metabolism, matter flows through it in a steady stream.

The type appears as the integral whole that orders the material parts.

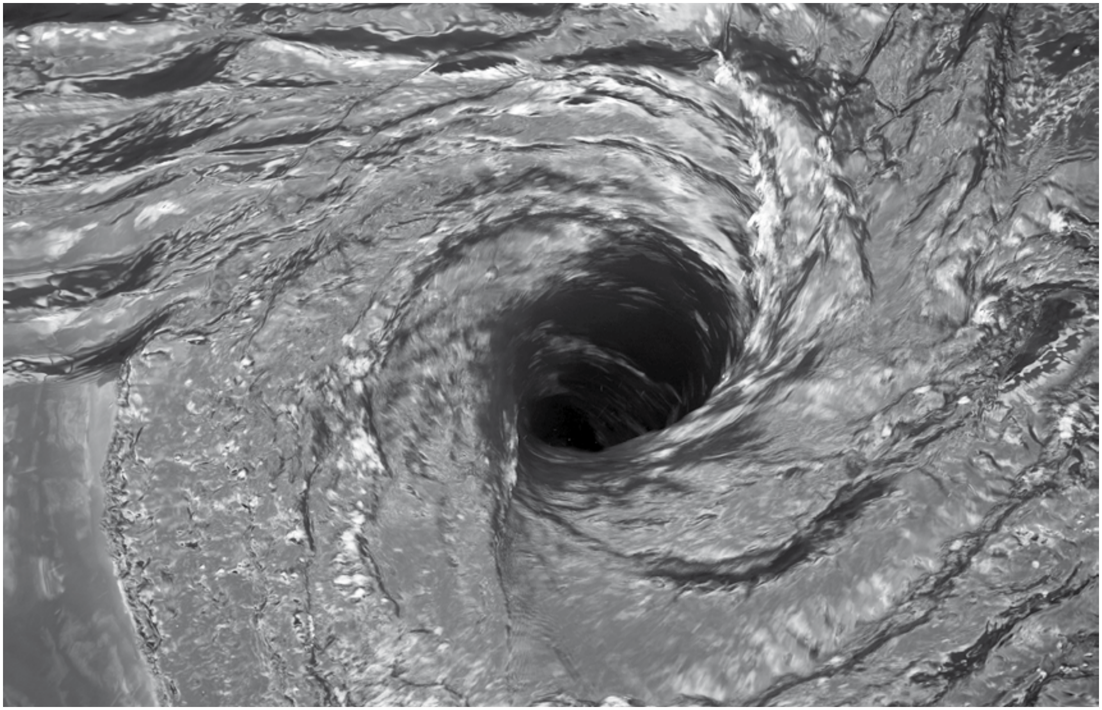


Figure 5.3. The vortex in water

The laws in the field of inorganic nature are very different from the organic laws described above. The law of gravity, the laws of mechanics, and the laws of inorganic chemistry do not allow for the variability that exists in the field of organic nature. In the field of inorganic nature, precision in predictions is possible that will never be achieved in the realm of living organisms. The inorganic laws have general applicability and extreme reliability. The achievements in physics, mechanics, astronomy, aerospace engineering, and information technology are evidence of this.

However, these laws are imperfect in terms of general validity. The mechanical laws of hydrodynamics enable people to precisely calculate and predict flow effects, evaporation, and condensation of water. However, at the level of weather forecasts this kind of predictability and accuracy fails us. Meteorology is about predicting weather development in the short term, but the exact circumstances surrounding the weather with respect to the prediction have a high level of local variability.

When we want to measure water flow in organisms that manage their fluid streams through self-regulation, the applicability of hydrodynamic laws is rather limited. And just like meteorology uses inorganic laws that apply in the atmosphere so does medicine make use of exact science, which cannot solely explain or classify a disease *process*.

In medicine, *lawful* and *typical* effects work together. One further example is the refraction of light through the lens of the eye. The latter occurs according to (inorganic) *laws* of optics. The effects of variation in refraction through eye muscle movements that change the curvature of the lens or the effects of increasing rigidity of the lens with age are based on the *typical* attributes of the individual organ or organism. For medicine, this means that diseases and their progression in terms of predictability seem more like a weather report than a scientific calculation of predictable events based on particular laws. That is an essential difference between diagnosing and predicting the course of a disease. A correct diagnosis by pathological anatomy, bacteriology, and clinical symptoms has a limited predictive value in determining the degree to which a patient will be sick. The prognosis of a patient is assessed clinically or 'intuitively' and expertise can make it highly probable that the assessment is correct; the diagnosis has a much higher confidence rate and is quantifiable to a degree. It has a greater 'analytical' component.

The healthy organism incorporates lawful inorganic functions within its vital processes, reserving for itself the role of the formative principle that assigns the inorganic functions their place.

Both disciplines, the organic and inorganic, each require an appropriate research methodology of their own.

- **The type** is recognized with an intuitive practice-based methodology that is suitable for comprehending **organic nature.** Goethe’s thinking in terms of typologies is a dynamic practice and includes development opportunities for the type within the limits determined by the type.

- **Lawful inorganic functions** can be recognized with an analytical methodology that is suitable for comprehending inorganic nature. Thinking in terms of laws is exact in nature and has 'sharp clear contours.' It has fixed formulas that can be recognized as a causality principle.

The function of a Law for the inorganic world is analogous to the function of the Type in the organic world.

5.5. Summary

Pattern recognition and the experience of natural processes as a self-evident integral whole are derived from an intuitive use of the mind. The experience of self-evidence that allows the integral whole to occur in the mind is a central feature of Goethe's scientific methodology. Analyzing, theorizing, and producing hypotheses are based on an analytical use of the mind. The visual arts allow a humorous representation of these very different methodologies and shows that they are complementary.

Recognizing a type or species is an example of the results of intuitive scientific processes. The type is characterized as a dynamic and plastic domain of ways to generate similar but not identical forms of living organisms. The type itself sets the boundaries for the plasticity of the possible shapes of various constituents and determines their significance within the integrated whole. The type functions as the active designer in morphogenesis, which ultimately expresses itself in the final form of the organism.

In the genetic make-up of organisms, the principles of heredity join with the laws of the inorganic world. The hierarchal order dictates that the organic incorporates the inorganic in a characteristic and type-specific way. In health, life processes are the determinants of the physical make-up and the shape of organisms.

6. Research Methodology and Research Area. The Concept of Type-Shifts

Question: Can people examine any area in nature, such as lifeless nature, living nature, or the mind, with the same techniques and methodology?

6.1. The 'Pars pro Toto'

In Chapter 3, we looked at the relation between the separate leaves and leaf metamorphosis. We characterized leaf metamorphosis as an integral and universal process that we could 'perceive' to be the generator of the different leaf shapes. Leaf metamorphosis can therefore be seen as an integral whole and the leaf as a component of the whole. We could conclude that the integral whole generates all the parts (see section 4.3.). We also saw the wisdom of Aristotle's theorem: the whole is greater than the sum of its parts (see section 5.3.). The type in terms of animal species or plant family represents such an integral whole (see section 5.4.); the single animals or plants are its components. In order to answer the above question, we must further specify the relation of the parts to the whole.

Each visible single plant or animal is the expression of its type. Its type largely determines the shape of each component. Can a single component of the type, such as a single dandelion, have properties that are not defined by its type: the sunflower family? Formulated differently:

Does each 'component' have features that are typical of the 'whole' to which it belongs? Can we recognize the 'whole' from its 'parts?'

To answer these questions, paleontology (the study of fossils) provides us with an instructive example. Paleontology is concerned, among other things, with skeletal fossil remains of previously living humans. It is therefore an important discipline through which to study evolutionary issues. From a phenomenological point of view, the study of fossils is interesting in relation to the above questions.

The fossil remains of humans that are found were rarely of a full skeleton. They are mostly just parts of a skeleton: a portion of the skull, a mandible, a few limb bones, some teeth, or other skeletal parts. However, the paleontologist can reconstruct the entire skeleton of the organism in question with reasonable accuracy based on the recovered fossil part (fig. 6.1.).

Figure 6.1. Reconstruction of Neanderthal skull. The black part is the fossil discovery by which the entire skull is reconstructed (Photo: NHM, London).

Comparative anatomical studies of hominids and humans have revealed that all body parts of a specific type have a relation to each other in terms of shape. A certain skull shape goes with certain shapes of the vertebrae and limbs, for example. Likewise, a particular cranial volume or a specific molar belong to a distinctively shaped mandible skeleton, rib cage, and limbs. Thus, the chimpanzee not only has characteristic forms of humerus, radius, and ulna, all parts of the hand are also shaped accordingly (fig. 6.2.). In all hominids, the hands and feet are relatively long compared to the long bones of arm and leg. Their specific form of the hand or foot also implies a particular shape of the skull or the spine (fig. 6.2. and 6.3.).

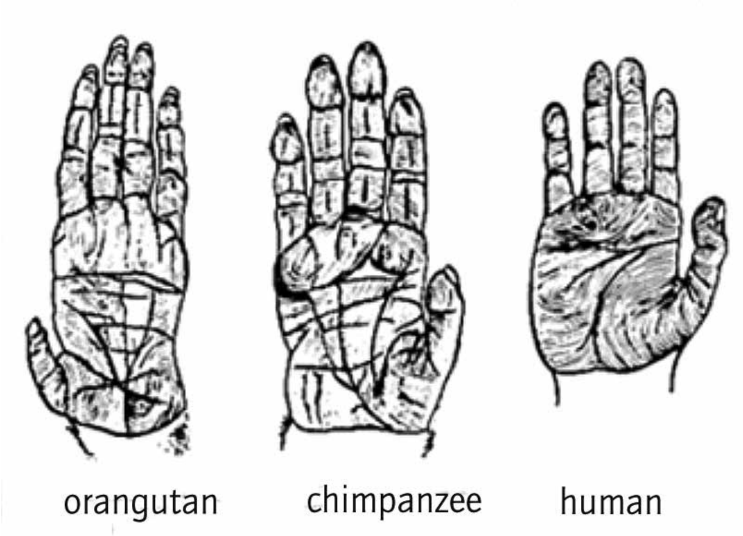


Figure 6.2. Ape versus Human Hands

Not only the skeleton but also the shapes of muscles, tendons, and ligaments have a relation to the whole built. It is even possible to draw some conclusions regarding the structure of the internal organs and the feeding habits of the animal or human based on discovered fossil bones.

Paleontology teaches us that all parts of an organism have a direct relation to the whole and to each other, both in form and function. There will be no part of the organism whose shape does not 'belong' in its organic layout. The type is the organizer of and pervasively shapes all its 'components.' There is a *type-specific relation between all parts of an organism*, including the internal organs. The Companion Immunology demonstrates, for instance, how the evolution of the immune system keeps pace with the shape and the organizational level of the organism to which it belongs (Bie 2006).

Figure 6.3. demonstrates this principle for the skeleton. Specifically, it means that the type is expressed in *every* detail, or conversely, that each detail can verify the type as a whole just as it is practiced in paleontology. The component serves as a model for the whole that has shaped it and it thereby reflects the whole. This phenomenon is called 'pars pro toto,' meaning the part stands for the whole. Consequentially, the organism in all its variety of detail must morphologically be considered an entity unto itself.

In the diversity of its parts, each organism represents a morphological unity.

6.2. The Type-Shift

The type-specific relation of the parts concerns not only the shape of the skeleton and body as a whole, but also the form of locomotion, bipedality, upright gait, hair cover, use of limbs, reproductive behavior, shape of the larynx, speech, communication, and organ physiology such as that of the genitals, intestines, or liver. This prompted the evolutionist Lovejoy to say:

"It is far more likely that our unique reproductive behavior and anatomy emerged ***in concert*** *with habituation to bipedality and elimination of sectorial canine complex."*
(Lovejoy 2009, emphasis GvdB. The sectorial canine complex is a specific form of dentition in some hominids.)

For Lovejoy, it is self-evident that evolutionary variations in morphology, physiology, and behavior have not developed one by one sequentially, but *in concert*. Evolution was almost certainly not a sum of detail changes but a shift of type, in the same way that an orchestra goes through a complete synchronized change the moment a harmonic shift takes place in the music. The harmonic type as a whole determines each voice and its contextual harmony in the orchestra. That is not to say that each voice does not also have its own uniqueness (see section 7.3.). The composition embodies the *unity in the diversity* of separate voices and different instruments.

Any subsequent (harmonic or organic) type is created by a *type-shift* through which organisms or groups of organisms change their proportions as a whole - a total metamorphosis. This leads to a detailed differentiation of shapes on all levels (Bolk 1918, Schad 1971, Verhulst 1999, Chapter 10).

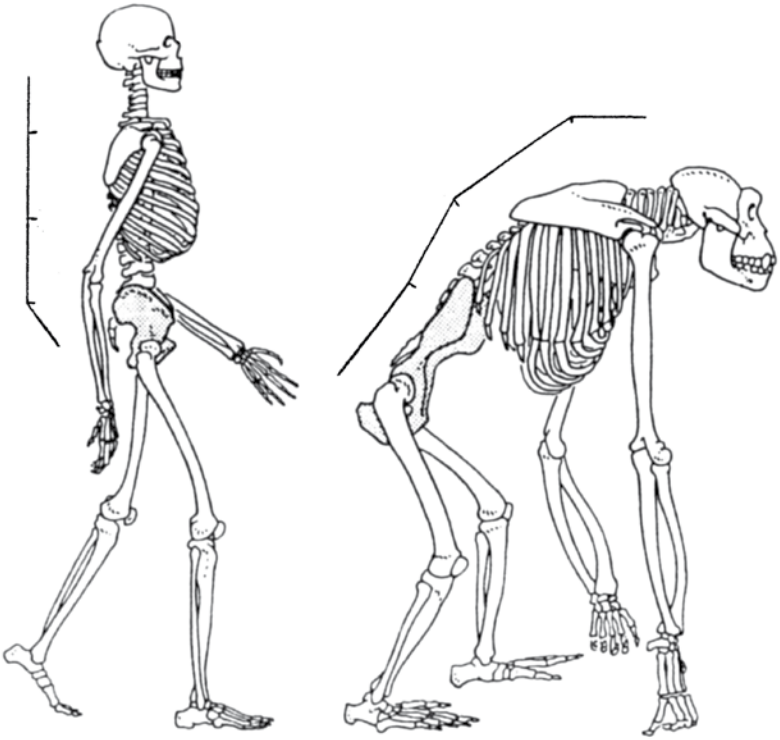


Figure 6.3. Man and Ape: all details are interrelated within the type and different between types

The type-shift is a textbook example of Goethe's insight into the world of organic forms.

Organic forms and species-specific changes can be understood as metamorphoses of types, as transformation of the entire pattern or the total picture, encompassing all the details. The thought that isolated parts could evolve separately and outside the context of an organic unity would seem very unlikely and unnatural based on research by authors such as Portmann, Schad, and Lovejoy and on the basis of daily perception.

If the type is so pervasive in its expression that type-shifts can be identified, then different principles may be at work in different types. In the above examples the type is an organism. But also groups of organisms can belong to a specific type, such as the vertebrates, the hominids, or humans. The question whether a type-shift is relatively gradual within a species for instance and when fundamental type-shifts occur between species, classes, or even domains such as plants and animals will be investigated in the following chapters. It needs a characterization of different types.

Reflecting back to the question at the beginning of this chapter, there are specific areas of nature that seem to correspond to fundamentally different types, such as the current taxonomic classification of lifeless nature, living nature, the animals, and humans (Gould and Keeton 1996). There are fundamental and characteristic differences between these areas in nature, as related to our above question, indicating that a fundamental type-shift occurs between them. This, in turn, may necessitate different techniques to examine the different types.

Each research area may need to be investigated with its own techniques.

6.3. Analytic Science: Fact and Necessity

In current science, researchers limit themselves to particular areas of research. It has proven to be a fertile and necessary methodology to bring facts and details to light. The attention both in biology and in medicine is primarily focused on components of the body such as organs, tissues, cells, and submicroscopic structures. It is tricky to investigate the 'whole' as such directly. Where should you start? Our human abilities do not allow us to study the ‘whole’ a priori. Therefore in analytic science, narrowing the area of interest is a necessary standard principle.

The study of leaf metamorphosis (see section 3.1.1.) was no exception. Leaf after leaf was carefully studied and described. Without this narrow, reductionist study of individual leaves there would be no material for comparison and no further study of leaf metamorphosis as a whole.

Our way of expanding knowledge and insight makes the narrowed down reductionist start a necessary first constituent of investigation.

6.3.1. The Detail and the Whole: Syndromes

History has shown that many well-understood isolated details have not been appreciated in their context. In medicine, this has led to tragic mistakes. The narrowed down approach has repeatedly been shortsighted in terms of the overall effects of newly developed medicines. The catastrophic outcome of the premature use of drugs such as Softenon (thalidomide) and Eraldin (practolol) are undeniable. Many embryos were deprived of normal limb development due to thalidomide use and the affected children were born maimed. Several Eraldin patients died from an unusual but fatal peritonitis. Until very recently, discovering new drug side effects was based on trial and error.

Every fact or detail that comes to light by narrowing down one’s view must be replaced and understood again in the original context. This is necessary to do justice to the organic coherence of the organism. At this point, the question arises: what methods are there to study and understand the detail’s original context? Below is an example from Evidence Based Medicine.

Several risk factors for cardiovascular disease such as hypertension, smoking, obesity, diabetes mellitus, and lipid disorders have all been known since the mid 1900s. Each of these factors in and of themselves may have a negative effect on one’s health. Not until many years later did it become evident in medical practice that the interdependence of these risk factors and their significance in context was important. For example, smoking or being overweight both increase the risk of cardiovascular disease. Smoking and obesity together increase the risk of disease much more than 'the sum of risk factors' would suggest at first glance. Only years later did people discover the significance of how these risk factors interact and how they can mutually reinforce their negative effects. The risk level for multiple risk factors was not the mere numerical sum, but appeared to be dependent on specific combinations of risk factors. This led to the discovery of what was called metabolic syndrome. Aristotle's theorem proves correct here as well (see section 5.3.).

Metabolic syndrome is a disease state that constitutes a 'typical' process of organic changes. It is not a lifeless 'mechanism'; it points to a dynamic self-regulation of the organism that creates a new balance (allostasis) divergent from the healthy biological state. Each of the risk factors for cardiovascular disease in metabolic syndrome creates a potential risk. Occurring together, the potential risk is multiplied and can be greatly influenced, both negatively and positively, by contextual aspects such as social values and behavior. Drug treatment also influences the outcome. Patients with metabolic syndrome are not subject to a predetermined downhill process, but rather to a malleable and changeable trajectory. This has been adequately demonstrated by lifestyle interventions.

This example shows that studying the details in the original context of the patient leads to a revaluation of individual risk factors. Consequently, metabolic syndrome has the character of what we previously referred to as a 'type.' The type refers to a field of organic development *opportunities* within certain limits.

There are many well-known syndromes in medicine. They are characterized by a variety of symptoms, often with an ambiguous common cause. Syndromes are models for getting to know the effect of types. In many areas, medicine bumps up against Goethean methodology and integrates it silently into its clinical practice. Especially in professional clinical scholarship, pattern recognition is a valuable skill to be trained for developing clinical intuition. This Companion deliberately focuses on the scientific development of this empirical capability.

6.4. Research Methods

Systematic pattern recognition leads to a *fundamental insigh*t, namely that any change to a part of the organism will effect changes throughout the body. Suddenly it becomes clear that an *exclusive* causal-analytical view of medical treatment cannot be right. The hypothesis that a drug has a specific target and would cause only a single impact must be regarded as outdated and scientifically untenable.

Goethe's scientific method sees every part of an organism as embedded in the whole. Consequently, causal analysis cannot present the organic wholeness of physiology because its research field and technique is related to the domain of lifeless material. Goethe's scientific research method can help to understand the physiological wholeness of living organisms since it does not analyze but rather universalizes and places every detail back in its organic context.
Causal analysis specializes in research of the physical details. This is particularly applicable in inorganic nature (see section 5.4.). Goethean research is appropriate for living organisms. The mind may also need its particular research methods. It will be necessary to eventually describe adequate investigational methodology for studying consciousness and self-awareness.

6.5. Summary

Paleontology can teach us that every body part is related to the type as a whole in terms of form. You may recognize the whole from its parts: 'pars pro toto.'

Evolutionists such as Lovejoy therefore believe that changes must always be understood as happening in a coherent process (in concert).
This phenomenon is described as a type-shift, as a total metamorphosis. The type-shift indicates that differences between types concern all elements of the type.

As humans, we are unable to know the 'whole' a priori. All science must start by narrowing down its object in an analytical reductionist approach. Changes in an organism, however, occur in orderly, mutual coherence. The result is that isolated facts about the organism must be understood in the whole picture. If this process is not followed, then dramatic, adverse effects can be experienced, especially in medicine.

In the examples given in the different chapters so far, it is possible to experience the all-pervasive effect of how the Type comes to expression empirically. The current analytical scientific methodology is the right method for physical details; phenomenology is the right methodology for understanding the organic activity of types.

7. Goethe's Archetypal Plant and Darwin's Species

"... the idea that the evolution of all plant shapes may derive from a single form ...."
(Goethe's Italian travel April 17, 1787)

7.1. A Comprehensive Insight

Goethe performed wide-ranging comparative plant research, in addition to what we know as 'leaf metamorphosis.' He was fascinated with the overall appearance of plants. This led him to a systematic recognition the pattern of what he called the 'archetypal plant.' The archetypal plant is 'the' plant pattern from which each actual and potential plant can be understood - a universal functional unit containing all potential visible specimens.
During his time in Italy, at a stage in his development in which he thought it possible that the archetypal plant could be found in visible form, he conceived of the idea that the evolution of all plant forms may derive from a single form.

7.2. The Archetypal Plant

Goethe's large number of comparative studies across different habitats of plants gradually brought him to develop a systematic method for training pattern recognition (Chapter 3). He also used this in his study of the archetypal plant.

Eventually, Goethe found that even though each plant is a creation of the archetypal plant, the latter never appears as a visible manifestation. The archetypal plant is the universal, ontological pattern of 'The Plant.' Each individual plant embodies one or more aspects that are inherent in the potential of the archetypal plant in the form of a specific concrete pattern, such as in a real dandelion, violet, or oak. For example, all plants have metabolic and reproductive functions, but how these are actualized is specie-specific. Plants may absorb mineral nutrients without the presence of a root system, as seen in silica in plankton. Controvertably, plants can take in mineral substance with a root system as in the case for magnesium in trees and shrubs. Plants may have asexual vegetative reproduction by cell division, without flower or seed production such as in the algae, or generative sexual reproduction that is common in the composites with flower and seed formation.

Goethe's own words illustrate that the archetypal plant was to include all existing and possible plants:

" *...the archetypal plant can produce thousands and includes them all.*"
(Goethe 1787)

This indicates that his inquiry into the patterns of plants in general brought him to the awareness that at every level in nature unique formative principles are at work: the different types and subtypes (see section 5.4.). He came to the conclusion that the type would be the organizer of all its subtypes (see section 6.1.). All individual plant specimens are under the auspices of 'the' archetypal plant: "...it can produce thousands and includes them all." This is an example of how the archetypal plant can be experienced as a concrete and active process; it is an ontological reality with potential that manifests in many shapes and forms with the appearance of each new plant. To systematic pattern recognition, the archetypal plant appears to be a multi-active potential process. This potential materializes as the phenotypic appearance of all growing and developing plants.
On September 27, 1786, Goethe writes from Padua, on the occasion of his visit to the botanical gardens there:

"*In the new plant assortment that comes towards me here the thought becomes more and more real that the evolution of all plant shapes perhaps could derive from a single form.*"

A good half year later, on April 17, 1787, after his visit to the flower garden of Palermo, Goethe wondered:

"*Could I not discover the archetypal plant among all these plants? It must surely* *exist in reality. Otherwise, what makes me think that this or that structure would be a plant, if not all of them were formed after one pattern?*" (Goethe 1787)

At that time, he was obviously not aware that the archetypal plant could not be discovered through the senses or analytic thinking, but only through a systematic pattern recognition. The visit to Padua incited the question of the plant form that lies behind the evolution of *all* plants. In Palermo, Goethe persisted in trying to find this form in a concrete, outward appearance. Goethe's progress towards the cognition of the archetypal plant as a systematically found pattern can be closely followed until he reports to Herder in a letter on May 17, 1787:

"*The archetypal plant is going to be the strangest creature in the world, which Nature herself must 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 the shadowy phantoms of a vain imagination, but possess an inner necessity and truth. The same law will be applicable to all other living organisms*". (Goethe 1787)

Goethe describes the morphogenetic potential of the archetypal plant as a triad of expanding and contracting in space (fig. 7.1.):

1. From the seed the plant expands in root, stem, and leaf formation and contracts again when it progresses toward the development of sepals.

2. The plant expands again in space in the sepals and petals and contracts in the stamens (fig. 7.2.).

3. In the fruit, the plant maximally expands one more time to contract again in seed formation.

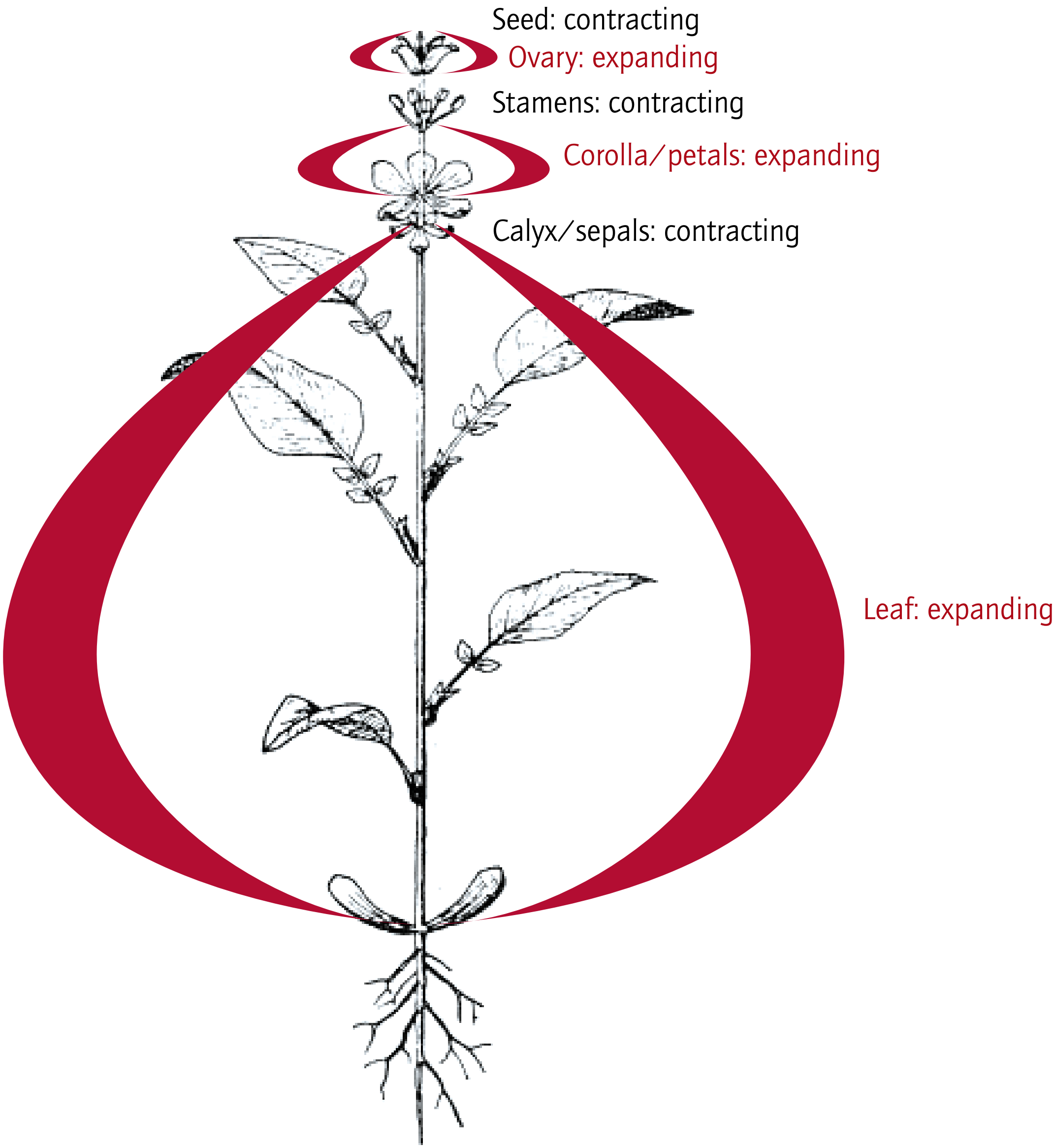


Figure 7.1. The triad of expanding and contracting in the archetypal plant

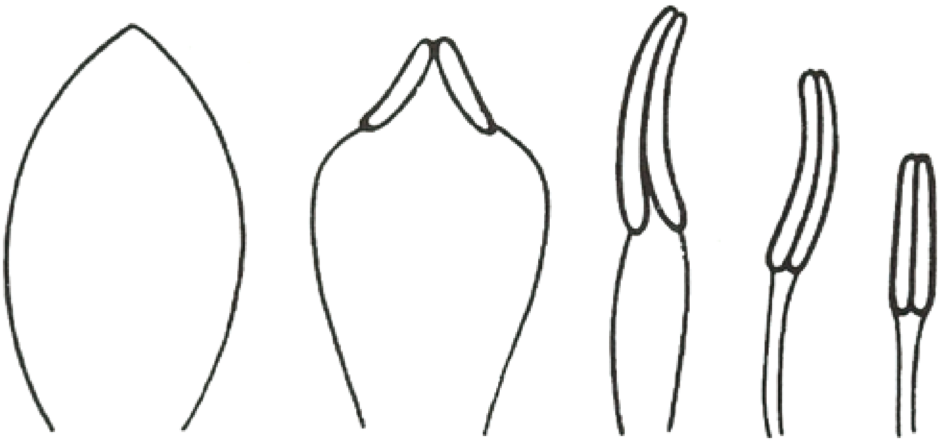


Figure 7.2. The sequential leaf series of the water lily

7.3. Theme and Variations

The relation of the archetypal plant to its visible manifestations is reminiscent of the musical principle of 'theme and variation.' In both plants and music there are two distinctive features: a set but flexible element, which is the theme or the type, and an element that is very differentiated but more tightly structured, which is the variation. There is a direct dependence of the variation on the potential that lies in the theme. Variations cannot expand beyond the creative scope of the theme, if they are to be variations. When the new variation structure goes beyond the organization of the theme, a new theme is created.

As Goethe indicated in the above quote, this logic can be found in other living organisms. In the animal world, you can find the same link: all spinal vertebrae are variations on the theme 'vertebra.' The theme, which you might call 'the vertebra,' is nowhere to be physically found. Just the variations are visible and they all differ in shape. 'Theme and variation' is a basic phenomenon in biology and a key issue in evolution. The real predicament of evolutionary theory is the changes of theme, not the variations on a theme.

Themes have quite specific formative forces working in them. For example, a musical theme could be composed in the form of a sonata. 'The' sonata form is a musical structure that has its own laws but is not perceivable with the senses. There are concrete, composed sonatas that suit the lawful regularity of 'the' sonata. The same can be said about 'the' sonata as about the archetypal plant: it includes all previously created sonatas as well as all specific sonatas yet to be created.

This example from music can also teach us that there is a certain hierarchical order within. 'The' sonata form of our example determines the range of freedom for the composition of the theme. In turn, the theme reflects the musical breathing space in which variations ought to progress.

The archetypal plant can be considered to be the theme 'Plant.' Existing forms, such as plankton, moss, ferns, palms, or plants from the sunflower family are all variations on the theme of the archetypal plant.

7.4. The Archetypal Plant as 'Organizer'

Goethe's view that *all visible* plant forms are elaborations of the one archetypal plant is noteworthy. It means that the archetypal plant carries the potential of all plants in itself. The individual specimen is the consequence of its specific genetic context and habitat. The term 'archetype' indicates a hierarchy that represents the theme of many different *types* in the same way the sonata determines the structure of the themes in music. The archetypal plant is a dynamic active principle that operates in the genesis of each plant.

This process is similar to the physiological phenomenon of wound healing in humans. Each specific wound healing process is controlled by a principle that was called 'The Organ of Repair' in a previous Companion (see Bolk's Companion: The Healing Process). Wound repair always happens according to a certain sequence of biological processes. How wound repair occurs in individual cases and how long and intensive its phases are, is determined by the idiosyncrasies of the wound. The location of the wound on the body, the size of the wound, the type of tissue that is wounded, the type of injury such as cuts, burns, or chemical injury, the health of the individual, the care of the wound are all factors that determine *how* wound healing will take place. All phases of wound repair will be present in sequence when the wound is healing; to what extent and how long the different phases will be active is not easily predictable.

One would be hard-pressed to find a medical doctor who hasn't - from personal experience - found wound healing to be a universal potential. The form in which the healing takes place is entirely context specific and therefore variable. The pathologist Robbins says about the organization of the wound healing process:

"The magic behind the seemingly precise orchestration of these events under normal conditions remains beyond our grasp...." (Robbins 2007)

Again, wound healing as a theme is self-evident as a recognizable pattern, but the actual form (variation) it takes is determined by the context. Robbins also reaches for the metaphor of the orchestra to clarify this. His text suggests that the organizer will probably be found in some substance; however, this has not yet been confirmed (Robbins 2007).

The archetypal plant can be seen as the organizing principle or the organizer of all plants' self-regulating processes. Similarly the 'Organ of Repair' can be seen as an organizer of wound healing. Steven Rose articulates this universal principle of organic unity in his book Life Lines:

"It is both the dancer who dances as well as the choreographer who creates the dance form." (Rose 1998)

Visible plants do not express all potentials of the archetypal plant. However, the visible phenomena that we see in plants can all be understood from the organizing principle of the archetypal plant.

7.4.1. Regular and Irregular Metamorphosis as Functions of the Archetypal Plant

Goethe describes three types of metamorphosis. Two will be presented here. They will help you to experience the plasticity of the archetypal plant.
Goethe called the 'normal' healthy and progressive development of plants, from seedling to mature seed-bearing plant specimen, **regular** or **progressive metamorphosi**s (Goethe1807). It is the normal development of the annual plant in the course of an entire year.
A second type of metamorphosis he calls **irregular** or **regressive metamorphosis**. In that case, plants regress in their development. One example happens with the cutting of shoots. Mature twigs do not normally have roots while the twig is on the plant or tree. Twigs that are cut off and well cared for with water and nutrients, will form roots again. This root formation is a step back in time for plant development. Regular metamorphosis will grow these roots early on in plant development during germination. The potential 'root formation' is clearly a specific activity that also can occur in space and time independent of the regular growth pattern. This ability can be seen as an *ever-present pursuit of wholeness* in living organisms. Another good example is the revitalization of growth in plants after pruning.

7.4.2. Developmental Regression in Medicine

In medicine, irregular or regressive metamorphosis is easily observed in pathology as developmental regression. During a period of embryonic development, the liver has blood-forming properties. That property is lost before birth at the moment other organs such as the bone marrow take over blood formation. In certain situations such as in anemia, the adult organism is able to reactivate the blood-forming properties of the liver and cause a regression in development. The liver is active again in an 'embryonic' way as a blood-forming organ, even though the patient has reached adulthood. Again the pursuit for wholeness of the organism prevails.
Another example in medicine is found in leukemia. In certain types of leukemia but also in acute inflammatory conditions, 'young blood cells' are found in the blood. This means

that cell types appear in the blood that were 'normal' blood cells at an earlier stage of development, but are not normal in adult blood because the organism has matured. These examples demonstrate the plasticity of the organism's functions in space and time.
A second phenomenon that is little known in plants but quite common in medicine should not go unmentioned. The human body can also become morbidly accelerated in its progressive development. Examples include arteriosclerosis and osteoporosis. In pathological arteriosclerosis the vascular system shows early signs of aging, and in osteoporosis decalcification of the bones occurs too rapidly and too early. Sexual maturation can occur pathologically early (precocious puberty).

The comparison of phenomena in plants and human medicine gives support to the view that Goethe not only is the pioneer of the archetypal plant, but may also have discovered how to study and understand 'the organism' as a functional unity.

7.5. Theme and Variation in Evolution

It may seem far-fetched to comment on the issue of evolution. However, the immutability of visible specimens of a species - be it plant, animal, or human - and the plasticity of organizational principles such as types or themes create a tension that invites a discussion on this issue. It is indeed considered one of the key problems in evolution, to understand how one class (type or theme) could be transformed into another class (Gould 1977, Gould & Keeton 1996).

This question concerns both macroscopic phenomena as well as the genetic code. It is evident that evolution is to be based on plasticity and on metamorphosis to produce the natural phenomenon of form variation. Goethe's description of the archetypal plant and the associated notion of the 'organism' convey a new thought in evolutionary theory.

One of Darwin's models, which examined different finches on the Galapagos Islands, used specimens that were all classified as belonging to the same species: the finch. As such, they are not an example of an evolutionary step, but are variations on the type or theme 'finch.' Darwin's later evolutionary considerations are also inspired largely by observed variations within a species. When unraveling the problem of natural selection, for instance, Darwin describes in 'On the Origin of Species:'

"As has always been my practice, let us seek light on this head (i.c. natural selection, GvdB) from our domestic production." (Darwin. On the Origin of Species. Facsimile 1981 p.111-112).

He then gives the example of the breeding methods of pigeon fanciers and the choices they make in their trade. This instance shows again that Darwin looks at variations within a species, in this case doves. In all of 'The Origin' Darwin does not report on one single observation of a possible change from one species to another to support his reasoning. His reasoning therefore remains hypothetical in relation to more comprehensive changes beyond the bounds of species.

Under the title of Darwin's book, you would expect descriptions of the emergence of different species. That is not the case. Darwin circumvents the problem of the transition from one species into another in 'The Origin' by not defining what he means by species (Dennet 1991). Darwin's theory of evolution and the vision of neo-Darwinism to date are based on observed *variations* in diverse species. These observations are then extrapolated to an explanatory model, which is hypothetical by necessity: different species arise out of each other in a similar way. This would occur through the same mechanism: genetic mutation and natural selection. Darwin bases his theory of evolution on the extrapolation of what he sees in the variations *within* a species. Darwin himself was quite aware of the problem and tried to solve it by referring to a likely common ancestor of the different species, the "missing link" (Desmond and Moore 1991/2009).

The different species of plants and animals we know today show little plasticity and often appear as an endpoint of the evolutionary process. One example to illustrate this is in the evolution of modern horses from Eohippus. During this evolution, the five-rayed feet of Eohippus *gradually* changed via cloven-footed extremities of early horses to the specialized whole-hoofed foot of the current horse (equus). The Eohippus foot evolves through differentiation and specialization and at the expense of its developmental potential and plasticity. The evolutionary changes within a species, as do the variations on a theme, result in a decrease of potential and plasticity. That means there are inherent problems when Darwin extrapolates a shift of the type, which still has developmental potential and plasticity, from the way the *limited possibilities in variations* occur within a species. In a shift from one type to another - the type-shift (see section 6.2.) - the potential and plasticity would be similar in the new type; or perhaps it would be increased when there is a type-shift that creates a new (arche)type on a higher echelon.

The plasticity of the archetypal plant, which can also be experienced in very early evolutionary organisms, is lacking the more evolved members of a pedigree. This poses a predicament for Darwin's view of evolution and Darwinists are still looking for the 'missing link.'

To this day, the origin of different species in biology is not understood; species are not clearly defined. Species barriers are indicated by the interface of reproduction: animals or plants of the same species reproduce naturally only within the species.

7.6. Developmental Potential and Plasticity in Types

A convinced evolutionist, Richard Dawkins, indicates that evolution, as Darwin proposed it, has to be believed to be true. Dawkins suggests in 'The Blind Watchmaker:'

> *"One hundred and twenty five years on, we know a lot more about animals and plants than Darwin did, and still not a single case is known to me of a complex organ that could not have been formed by numerous successive slight modifications. I do not believe that such a case will ever be found. If it is - it'll have to be a really complex organ, and, as we'll see in later chapters, you have to be sophisticated about what you mean by 'slight' - I shall cease* ***to believe in Darwinism****.* (Dawkins 2006, p 91. Emphasis by GvdB)

Dawkins has rarely written down his ‘do not know, must believe’ so clearly. Dawkins observes a cumulative series of many successive small changes as the mechanism of evolution:

> "*The theory of evolution by cumulative natural selection is the only theory we know of that is in principle capable of explaining the evolution of organized complexity.*"
> (Dawkins 2006) .

The evolutionist Lovejoy takes evolution as a result of changes ‘in concert,’ simultaneous, and not sequential. He takes the position that no single organ could develop independently outside the context of a shift in type. He considers the development of new type patterns as the cause of changes in individual organs. When can a change be classified as a type-shift, and when is it a variation on the theme?

Goethe perceives types as ontological formative principles that have plasticity. The variations within the type evolve through specialization and differentiation, which eliminates the developmental potential and the plasticity that is inherent in the type (Chapter 9). His idea may support the search for a concrete example of a type-shift where it may be found: at the organizational level or, in other words, at the level of types. In a type-shift the plasticity of the new type is the same as in the previous type or greater, when a new (arche)type appears on a higher echelon.

The way in which Goethe examines and tries to see through nature can add something to the prevailing view. Naturally, the problems first increase when science adopts this view. Recognizing that life processes have not been tackled by research thus far and learning to think systematically in self-evident patterns is an extreme challenge for modern science. Modern science has, in recent times, developed in just a different direction, toward an analytical methodology. Practice-based science as a method has yet to become highly developed in specialties of natural science. Perhaps only then can a practice-based science contribute to additional explanatory models for evolutionary questions.

7.7. Summary

The self-evident experience of the archetypal plant may illustrate a morphogenetic principle with the intuitive methodology of systematic pattern recognition. Within the sphere of influence of the ‘archetypal plant' all plant characteristics are determined by the developmental opportunities it gives, progressively and regressively. On the one hand the archetypal plant exemplifies an organizing biological principle. It also determines the wide range of variations that may exist within the bounds of a type. It allows us to distinguish ‘theme and variation’ in a biological sense.

How different types have developed has to remain an open question in Darwin's theory. The idea of the type-shift that happens ‘in concert’ elucidates that type-shifts are accompanied by the preservation of developmental potential and plasticity, while gradual differentiation and specialization with a loss of plasticity indicate a development within a specific type. When the developmental potential increases significantly, one may expect a new (arche)type to be evolving on a higher echelon.

Recognition of a systematic practice-based methodology as a scientific method and its further development may, in the future, provide an additional perspective on evolution.

8. Did you ever see an Organism?

Question: Why do scientists resort to metaphors or analogies to explain the wholeness of organisms?

8.1. The Organic Organization of Organisms

The life sciences as well as the medical community simply refer to 'the' organism. Its existence is never questioned in the literature. It may seem trivial, but the answer to the question: "have you ever seen an organism?" is more complicated than it first appears. Most people will immediately answer: "yes!" to this question, which makes sense because in daily life, organisms are immediately experienced as a *whole* (see section 1.1.). This approach, however, is somewhat naive because the mere perception of an organism does not reveal what may become evident through thinking and Goethe's method of systematic pattern recognition (Chapter 3). The spontaneous positive answer refers to the outer physical appearance of humans, animals, plants, or a honeybee colony. But is that 'the' organism?

8.1.1. The Visible and the Invisible Organism

The inexperienced observer sees the outer appearance of humans and animals in the form of skin, hair, fur, eyes, ears, or other body parts; he or she might see the plant similarly: stem, leaf, root, or flower. These are the *sensory perceptible component*s of organisms.

Medical practice would be much more straightforward if the *organism as organic organization* were to be visible. Diseases would be directly perceivable and recognizable. Doctors would not be required to collect data from blood tests, genetic tests, X-rays, microscopic examination, etc, and then locate a context of all these components. All these data determined by measuring, weighing, and counting, which represent the organism's state, are sensory perceptible manifestations of the body; they are not the organism itself.

Knowledge of such facts related to the immune system, for example, is initially context-less 'factual knowledge.' The *invisible organization* that organizes and harmonizes these facts and 'puts them in context' is 'the' organism. That side of the organization can only be discovered by an activity of the mind. The organism as organic organization can apparently not be perceived by the senses, which is comparable to the situation of recognizing a disease as described in Chapter 1. In short, the *organic organization of organisms is 'invisible'.*

One can conclude that 'the organic *organization* of organisms' is not perceptible from the way it is presented in various medical texts. In its chapter on wound healing, Robbins Pathology is very clear on this account, to which we referred in section 7.4. (Robbins 2007). The author has to acknowledge the elusiveness of his approach with respect to the organization of organic organisms. As such, he resorts to a metaphor to express that he cannot conceive of the organizer of the wound healing process at the level of visible facts. Robbins experiences the organization as a whole, even if the whole remains "beyond our grasp" and uses the metaphor of an orchestra to point to the invisible organization of this process.

Many authors eventually use metaphors to describe their experience of the wholeness of organisms.

Steven Rose describes his mission in the book *Lifelines* as follows:

> "*[My task is to] offer an alternative vision of living systems, a vision which recognizes the power and role of genes without subscribing to genetic determinism, and which recaptures an understanding of living organisms and their trajectories through time and space as lying at the centre of biology. It is these trajectories that I call lifelines. Far from being determined, or needing to invoke some non-material concept of free will to help us escape the determinist trap, it is in the nature of living systems to be radically indeterminate, to continually construct their-our-own futures, albeit in circumstances not of our own choosing.*" (Rose 1998)

This is the context for the striking fact that Rose strongly opposes Goethe's method and his discovery of the archetypal plant. He holds the archetypal plant for a metaphysical 'non material' concept since it is not empirically verifiable through sensory experience. The question then arises: to what extent is Rose's proposed 'lifeline' as unity of life different in that respect from Goethe's 'metaphysical' approach to the archetypal plant?

The immunologist Cohen wonders how the specificity of antibodies can occur in the immune system:

> *"In short, biologic specificity cannot be reduced to the chemistry and physics of ligand binding, but must be contrived by biologic mechanism. Signals are always circumstantial. Hence, specificity cannot be a given but must be a creation."*
> (Cohen 2005)

This quotation comes from the book *Tending Adam's Garden*. Cohen describes the organization of the immune system using the metaphor of a police department in this book that reads like a detective story. He describes it as follows: An intruder (antigen) enters the organism. Since the intruder has another appearance and does not show 'identity flags' on its surface (MHC molecules), it is 'recognized' immediately by ever-active 'police officers' (the natural killer [NK] cells) that kill the intruder. What if an NK cell does not notice the intruder? Then the 'patrolling police officers' (macrophages and dendritic cells) in the body immediately 'recognize' these intruders.

This example demonstrates the use of the metaphor of the police force. But whereas policemen, detectives, and other police officers are comparable to the perceptible active individual immune cells, the *organization* of the 'police department' remains invisible. After reading the book you understand how well organized the immune system is, but once again, the 'organizer' remains obscure.

Other authors solve the problem of the invisible organizing principle by assigning a human trait to a specific part of the organism, as in Dawkins' 'The Selfish Gene' (Dawkins 1976). Consequently, this makes his whole book a metaphor of gene functions.

One of the most recently developed biological disciplines is Evo Devo. This stands for studies that implicate both EVOlution and embryonic DEVelOpment (DEVO). The evolutionary biologist Sean B. Carroll gives a description of how genes are switched on and off:

"*The genetic switches act like **global positioning system (GPS) devices**.... switches integrate positional information in the embryo with respect to longitude, latitude, altitude, and depth, and then dictate the places where genes are turned on and off.*" (Carroll 2007)

In one experiment a mouse gene that is involved in eye development was transplanted into a fruit fly. An eye developed there also, but it was in the shape of a normal fly's eye, which is very different from the shape of a mouse eye. Carroll comments:

"... so while each gene was similar and had similar effects, the final form depended upon the context of the species of the experiment, not the origin of the gene ... The mouse gene induced the fly program for the eye development." (Caroll 2007)

The role of genes is dependent on the evolving organism that makes use of the genome. This observation, while helpful, is not as novel as it may seem, as witnessed by the statement of the embryologist E. Blechschmidt:

"Genes do not act, they are reactive." (Blechschmidt 1968)

Carroll says explicitly that the form-creating, morphogenetic effect relies on the "context of the species." This context can be nothing else than 'the' organism. It illustrates that 'the' organism is of a higher hierarchical order than the gene.

In the book 'Embryology,' Drews comes up with a similar picture of the activation of this type of gene (homeobox genes):

The activity of transcription factors is dependent on the presence of hormones and induction factors. These are related to the metabolites and chemotactic factors that originally regulated the genes of the ancestral cells. The originally exogenous stimuli are derived from neighboring cells." (Drews 1995)

Again, it appears that local cell differentiation is controlled by its periphery (exogenously).

Epigenetics studies the effect of peripheral influences on the genome. This rapidly expanding field clearly indicates that the genome is passive and epigenetic influences are the active element in the transcription of genetic information (Portelle et al 2010).

These examples serve to illustrate what happens when scientists confront the question: "Who or what really determines what happens?". Robbins says it in a straightforward manner: *"It remains beyond our grasp."* Otherwise, authors resort to metaphors such as an orchestra, or to an analogy such as a GPS device, or to an anthropomorphic image such as the police department. When further research in these areas is done, it reports on compounds in the context or environment that 'cause' the studied phenomenon, often pointing to messenger substances, the acidity of the internal milieu, certain cytokines, (neuro) hormonal substances, or other molecular biological metabolites and milieu factors. But even these ideas overlook the fact that the organic organization of organisms is by definition invisible.

The conclusion that the analytic scientific approach is not suited to answer the demand for an understanding of the organization or the whole of organisms, of a species, or a type seems justified. As we have discussed in Chapters 3- 6, the intuitive approach to science does perceive this and can be amplified and elaborated with a scientific practice-based methodology. It demonstrates that the organic organization of organisms rests on *self-regulation.*

The organic organism as living entity determines its own shape and biological functions through self-regulation. Self-regulation is an archetypal phenomenon that originates from the activity of the whole organization and gives it shape.

8.2. The Inability to find the Organism

The organism as a whole cannot be understood with analytic methodologies (Sheldrake 1981, Gould 2001, Bortoft 2008). This is all the more remarkable because all of us experience living organisms - be it a plant, animal, or human being - immediately and indubitably as a *living whole*. In the direct encounter, nothing indicates that the organism would not be whole. As straightforwardly as we might experience this wholeness, however, it can just as easily run like sand through our fingers when we want to prove that an organism operates as a whole.

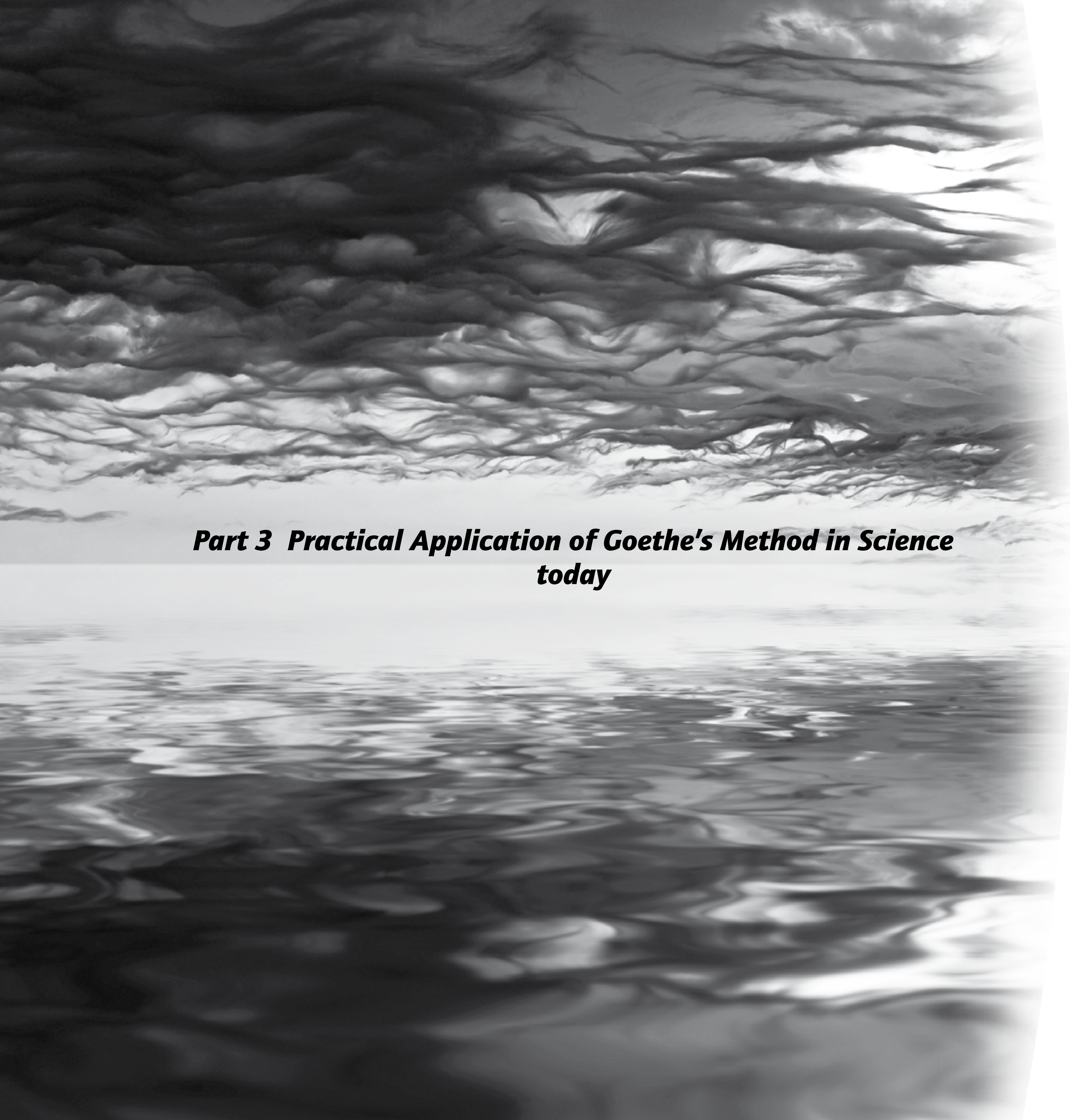
After one and a half centuries of analytical-science based medicine and biology, and after billions of research dollars it is not yet possible to define a *biological organizatio*n, other than to identify the 'outer skin,' within which we should find its effects. This has led many researchers to the conclusion that ontological questions in biology about the real-time existence of organisms are unanswerable (see note 3.1. in section 3.1.4.). Researchers can see from its metabolites what the organism does and how it functions; they cannot show us what the organism *is*. To help solve and overcome this problem, Goethe's practice-based approach may play a significant role.

8.3. Summary

An analytical methodology takes researchers to a boundary of knowing that allows them to think of organic organizations in their minds, but does not enable them to make these physically perceptible. In order to explain the organizing principle to their readers, authors resort to metaphor, analogy, and anthropomorphism.

Visible organisms are controlled by invisible physiological 'organizations.' The organizing principle functions at a higher organizational level than the visible parts. The organizing principle, 'the' organism, coordinates all of its processes through self-regulation.

An intuitive methodology such as Goethe's scientific approach is the method of choice to experience this organizing principle. Exact memory pictures, systematic pattern recognition, and professional empathy can, for a moment, lift the boundary between object and subject, between doctor and patient. At that moment, clinical intuition may perceive the living organism - or the patient or disease - on an ontological level.



Part 3 Practical Application of Goethe's Method in Science today

9. Is there an Archetypal Phenomenon in Animals?

Question: What makes an organism animal-like?
What distinguishes animal organization?

9.1. Plants and Animals

In Goethe's science of wholes, the term 'archetypal phenomenon' is used in conjunction with the concept of the archetypal plant. An archetypal phenomenon is *a phenomenon occurring in nature that distinguishes the appearance of a type or a kind*. The archetypal phenomenon of plants and their triple expansion and contraction in space, was described in Chapter 7 as the archetypal plant. In this chapter we address the question: Do one or more archetypal phenomena exist pertaining to animals? One can also compare this to what was said about types in section 5.4.

Determining the difference between plants and animals is a predicament in life science that has yet to be answered definitively. The borderline that marks the division between plants and animals is populated by various developmental stages of plants and animals, which shows that the confines cannot be clearly delineated. In general you can say that the more primitive the plant or the animal, the more difficult the distinction. There are also organisms, which, over the course of their development express first a vegetative phase and then an animal phase, such as mussels. They exhibit the characteristics of both in their development.

Bacteria are an example of organisms in the grey area between plants and animals where the division cannot be precisely observed. In many ways, bacteria are of both worlds: they could be classified as animal plants or plant animals. They originated at a time when the differentiation between plant and animal apparently had not yet been completed.

On the other hand there are many organisms that must unquestionably be qualified as animal or plant. A lion is an animal, a dandelion a plant, and there can be no debate.

The following chapters in this Companion focus on the question of whether **morphology** of its own nature might shed light on specific biological issues such as the difference between plant and animal. Can we find morphological characteristics that could help answer the above question regarding the specificity of 'the' animal? Is it possible to describe the morphological 'archetypal phenomenon' of 'the' animal? To achieve a general characterization of 'the' animal, the starting point for the following consideration is the study of organisms that are indisputably classified as animals.

9.2. Gastrulation

The typical animal form is rooted in a process of indentation or invagination. Biologists traditionally used the term 'gastrulation' for this, which means 'stomach formation' (Latin gaster = stomach).

9.2.1. The Vegetative Pole and the Animal Pole

In its most primitive form in unicellular animal organisms, the origin of digestion is the ability of 'phagocytosis' (Greek: φαγειν = to devour). In the cell membrane during phagocytosis, a 'primitive mouth' briefly forms that encloses an external nutriment particle, 'swallows' it, after which the latter is consumed in an intracellular vesicle (phagosome). This is the simplest form of digesting nutrients (fig. 9.1.). The 'primitive mouth' in the cell membrane is the most primitive form of oral cavity. The phagosome is the most primitive form of stomach/intestine, and the enzymes that are secreted in it are the precursors of the digestive juices secreted in the intestines such as intestinal juice, stomach acid, bile, and pancreatic juice.

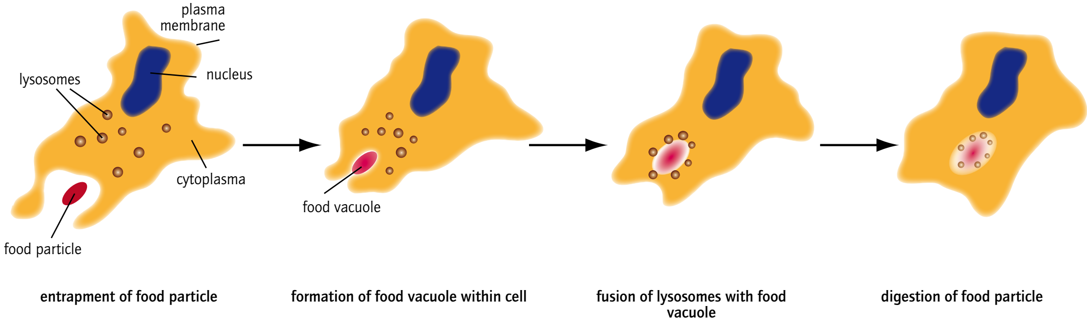


Figure 9.1. Phagocytosis

In the embryonic development of multicellular organisms, the process of phagocytosis shapes *organs* for its use during the gastrulation process, such as a stomach and intestines. One of the simplest forms of actual stomach formation is in *sea anemones* (fig. 9.2.). Basically the same digestive processes take place in the 'stomach' of sea anemones as you find in phagocytosis inside the phagosome.

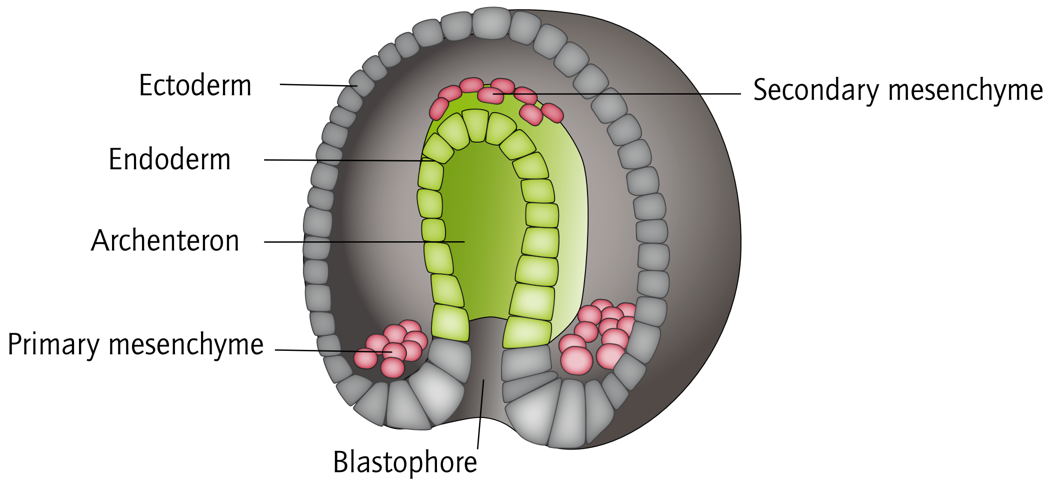


Figure 9.2. Schematic representation of gastrulation in sea anemones

Animal forms that have evolved somewhat further also have more advanced intestinal systems. There is not only an inlet opening (mouth) but also an exit (anus) to the intestines. From the 'primitive mouth,' the intestine extends itself beyond the stomach and grows to the opposite side of the organism. There, on the opposite side of these early animal forms, the primitive gut touches the outer wall of the organism from the inside and on the spot a break out appears, which will be the 'primitive anal opening.' Figure 9.3. shows the development of the sea urchin and the process of creating a primitive gut, the so-called arch-enteron.

A consequence of gastrulation is the *three-folded organism*: an outer skin is the barrier to the environment (ectoderm), the intestine is the organ where the absorption of nutrients and excretion of internal metabolic residues occurs (entoderm), and between them grows a connective tissue (mesoderm) (fig. 9.3.).

In biology, the side where the entrance to the primitive gut, the primitive mouth, is formed is called the *animal pole*, or the 'animal region' of the sea urchin. The opposite side is called the *vegetative pole*, the 'plant region' of the organism. The animal pole displays the phenomenon of gastrulation. Biologically, invagination (gastrulation) is considered an animal phenomenon and growth (proliferation) is a vegetative phenomenon. For Goethean methodology that distinction has great significance. Indeed, it obviates the perception of something 'typical' in the phenomenon of gastrulation, namely an animal characteristic.

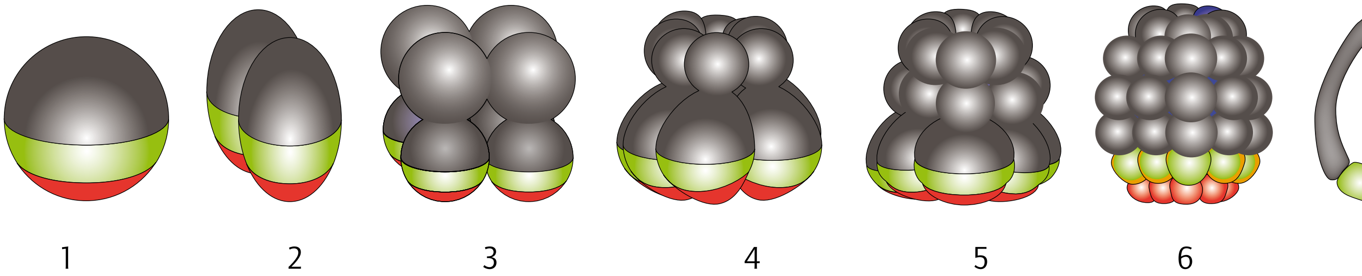


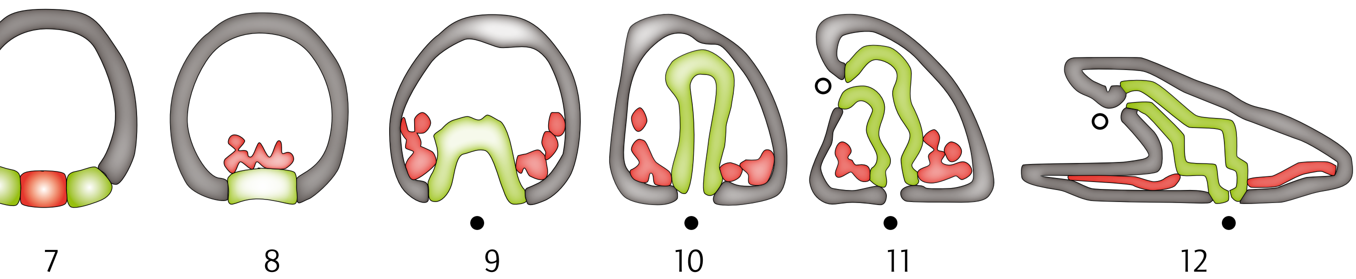
Figure 9.3. Schematic representation of gastrulation of sea urchin development. Stages 7-12 gastrulation and gut development. * = mouth; o = anus (after Wolpert)

With this, the question at the beginning of this chapter finds a preliminary answer: animals are organisms with an invaginated body form; they have a gastrulated body form. This gives them animal characteristics that are different from vegetative components.

9.2.2. Development of the Intestines and Nervous System in Higher Evolved Animals

The expression of gastrulation in even more highly evolved animals has been preserved for the invagination that leads to gut development. The process is more complex than in lower animals. In higher animals, the total body shape takes the form of a gastrulation process. And interestingly, at these evolutionarily higher levels of animal development, intestinal development goes hand in hand with the emergence and development of a nervous system. This process is called neurulation. In addition, organs for transport and movement develop, such as the musculoskeletal system.

It is important to realize that there is an intimate and reciprocal relation between gastrulation and gut formation, neurulation, and the development of the musculoskeletal system (see Bolk's Companions Anatomy and Embryology).



9.2.3. Gastrulation Forms in the Embryonic Development of Animals and Humans

With the help of figures 9.4. and 9.5., you can compare the successive forms that occur during gastrulation in human embryonic development. Gastrulation creates both a doubly folded body shape as well as the intestine. The entire body folds cephalo-caudally (from top to bottom) in the third and fourth week through a gesture of gastrulation (fig. 9.4.).

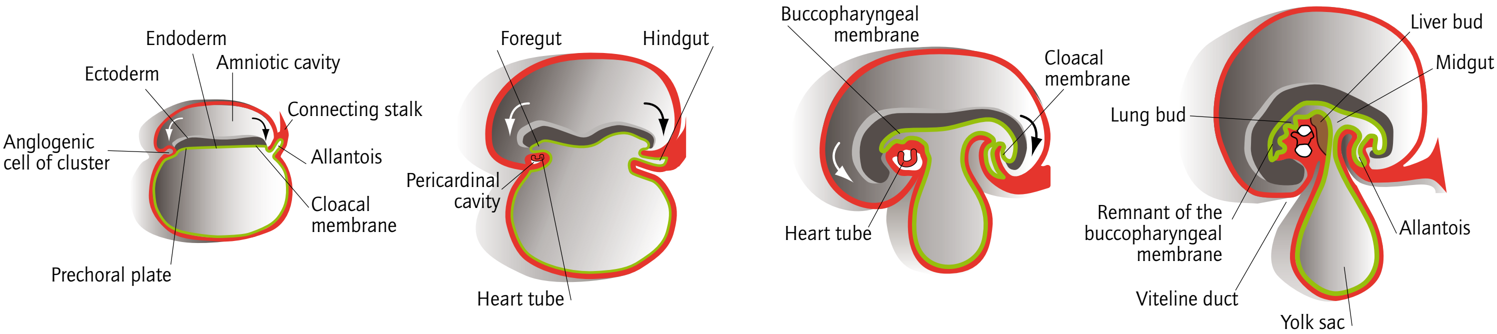


Figure 9.4. The cephalo-caudal folding in the third and fourth week of embryonic development: Gastrulation and neurulation in human embryos (after Langman 1995)

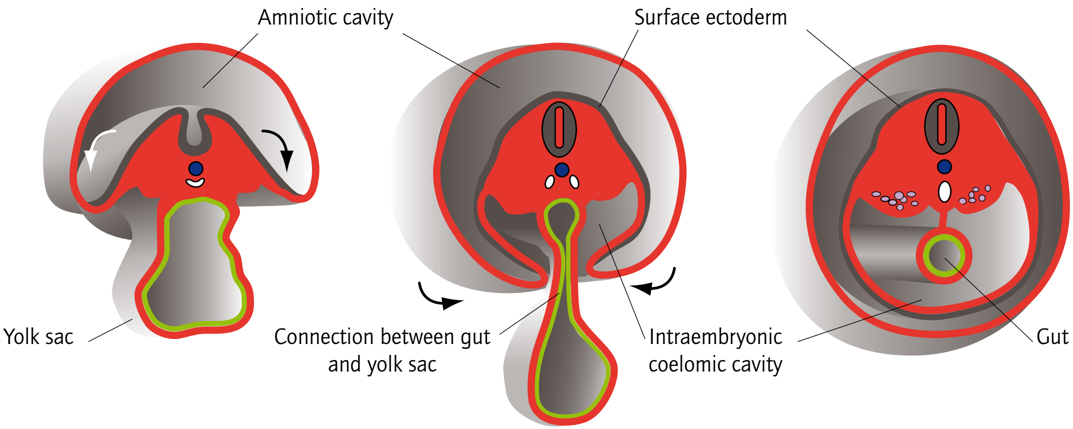


Figure 9.5. Transverse sections showing lateral folding during the third and fourth weeks of embryonic development and the formation of the primitive foregut (after Langman 1995)

At the same time the flat embryonic disc folds laterally on the right and left and when left and right meet in the front they fuse and create the primitive gut (fig. 9.5.). Comparative Zoology shows that gastrulation is a fundamental stage in the embryonic development of animals and humans. Developmental stages of crocodile, chicken, monkey, and humans all show the same folding phenomenon as the gut and nervous system develop (fig. 9.6.). Folded body shapes seem to be specific for 'the' animal, and also, at this developmental stage, for humans.

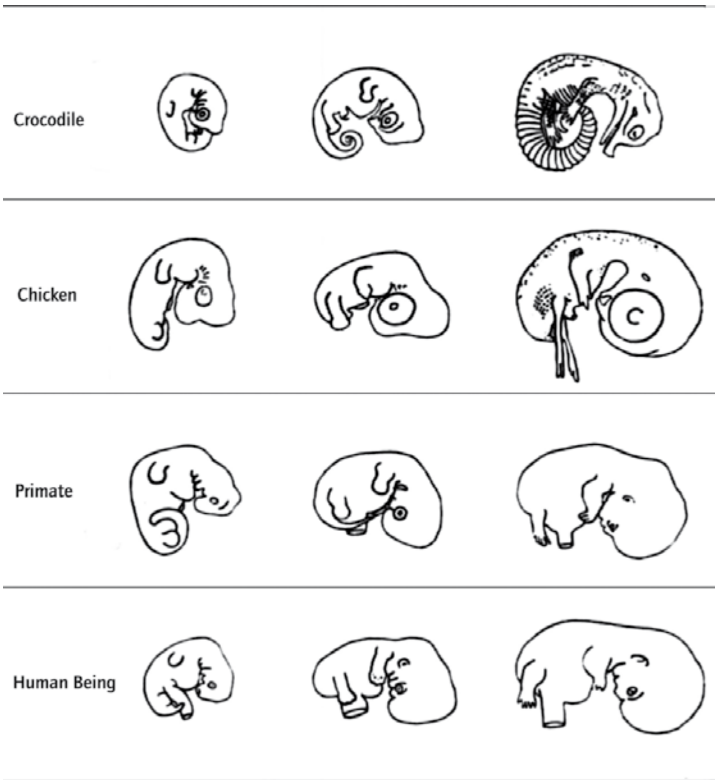


Figure 9.6. The folding phase in crocodile, chicken, monkey, and humans (after Poppelbaum 1956)

9.3. Gastrulation and the Establishment of an Inner World

The folding processes of the entire body of the embryo lead to the formation of an inner space for internal organs like heart, lungs, liver, and kidneys. Organisms that have undergone gastrulation have one or more body cavities, creating their own 'inner world.' Already during embryonic development the animal or human embryo takes some of its environment into itself and with it creates an interior space, which you can later find in structures such as the cranial and spinal cavities, the hollow tube of the intestine, or the hollow structures of eye, vestibular system, and ear. These hollow structures occur in animals and humans through internalization of the environment.

After birth, the outside world is internalized through the senses and the nervous system to become conscious content of the mind; the external material world is internalized through the gastrointestinal tract to contribute to the processes of the physical body. Both processes of internalization are basic characteristics of animal and human life and the accompanying organs are specific to human or animal life forms. People or animals that do not take in nutrients are doomed to die, and likewise an existence without sensory stimulation from the environment - total sensory deprivation - is also not compatible with life.

At the present stage of development, animal and human organisms are conditioned to have separate systems for absorbing the material environment, which leads to the formation of a physical body, and taking in the consciously perceived sensory world, which creates an inner world in the mind. At this stage of development of humans and animals, you could justly see the origin of the mind-body question.

The intestine, nervous system and sense organs, as well as the musculoskeletal system for movement occur simultaneously. How these organs differentiate from the different germ layers is elaborated on in Chapter 10 and is summarized in table 10.1.

9.4. Summary

Taxonomy distinguishes between plants and animals as *distinctive manifestations of living nature*. However, what is the morphological difference between plants and animals? In contrast to plants, animals are organisms whose development includes 'inner space.' In phagocytosis, this process is still a fully functional process. In higher animals it is transformed to create permanent organ systems. The process of establishing inner space, during which the intestine also appears, is called gastrulation. An inner world develops through intestinal and nervous system development, and simultaneously the organs for transport and movement evolve. As the intestinal tract and nervous system emerge, they may at first seem polar opposites at the same time that they are clearly connected to each other in their development and differentiation. They are both related with the organs of transport and movement. The developmental level of these three areas in organisms is related and specific to the developmental level of the specific organisms as a whole (see section 6.1.).

Conscious and unconscious internalizing of the outer world through the senses and the intestine respectively and 'setting foot in the outside world' through movement can be interpreted as archetypal phenomena of animal nature.

10. Goethe's 'Polarity and Enhancement'

10.1. Review of Morphological Similarities in Animals

The previous chapters have described that animals of different evolutionary hierarchy transition through comparable body shapes during their development. Attention was drawn to the development of especially the external body form, the digestive tract, nervous system, and the transport and movement organs (Chapter 9).

Higher evolved animals go through early stages of embryonic development that are morphologically akin to lower animals. Examples include the initial lack of a spine and limbs in the earliest embryological stages (invertebrates), the following development of a primitive spinal cord (comparative to the chordates), the development of pharyngeal arches that are functional in fish as gills, and the development of limbs for movement (amphibians). The early evolutionist Haeckel even considered "ontogeny to be a repetition of phylogeny," meaning individual development repeats the shapes of evolutionary development. This biogenetic fundamental law as it was once called actually appears untenable in light of the fact that higher evolved organisms never complete the development of the lower forms. One of many examples is pharyngeal arch development in humans. Although pharyngeal arches point to a morphology that we might call 'fishy,' functional gills such as fish have do not develop.

Higher animal development indicates that there is a morphological kinship to the less evolved animals. However, more evolved animals hold back on fully developing lower animal morphology and never transit through the finished forms of the less evolved animals. We can speak of a *metamorphosis of formative processes* in organisms during evolution. A detailed discussion of this phenomenon and related questions and problems is beyond the objectives of this Companion. Gould's book 'Ontogeny and Phylogeny' will give the interested reader a thorough update of this evolutionary aspect (Gould 1977).

Goethe recognized specific characteristics in the above-mentioned metamorphosis of formative processes. He formulated the principle of 'polarity and enhancement' from this. The following discussion explains the particulars of this metamorphosis and its significance.

10.2. Germ Layer Development and its Consequences

Development and differentiation of the three different germ layers in the tri-laminar germ disc embryo with endoderm, ectoderm, and mesoderm (see section 9.2.1. and fig. 9.4.), is associated with specialization of tissues and organs (see table 10.1.).

More evolved animals develop specialized organs such as liver, pancreas, lung, thyroid, and immune system from the **endoderm** germ layer (Bie 2008). These progress from the enhancement of primitive gut tissue through differentiation and specialization.

The primitive nervous system evolves from the **ectoderm** germ layer. The final results in more evolved animals are brain, senses, and various types of nerve tissue.

The development of the **mesoderm** germ layer is essential to the functional relation between organs from ectoderm and endoderm origin. From the mesoderm originate internal organs such as heart, spleen, blood vessels, kidneys, and adrenal glands that monitor and regulate the internal milieu of organisms.

The extent to which an organism is *morphologically differentiated and specialized* in the aforementioned tissues and organs identifies its evolutionary level.

Table 10.1. Differentiation of the three germ layers (after Langman 1995)

ECTODERM	Neural tube → central nervous system;
	Neural crest → peripheral nervous system;
	Placodes →
	Surface Epithelium → sense organs outer skin layer
MESODERM	**Axial and paraxial Mesoderm →**
	Somites →
	Dermatome → corium, subcutaneous tissue
	Myotome → musculature
	Sclerotome → skeleton
	Chorda → vertebral column
	Intermediary Mesoderm
	Kidneys, adrenal glands, gonads
	Somatic Mesoderm
	Wall of the body, parietal peritoneum
	Splanchnic Mesoderm
	Layers of intestines, visceral peritoneum
ENDODERM	**Intestinal Tube**
	Gastro-intestinal mucosa
	Gastro-intestinal organs
	Salivary glands, Liver and gallbladder, Pancreas

Differentiation and specialization do not happen haphazardly; they happen according to the principles of *pars pro toto* (see section 6.1.) and what we found earlier and called *type shift* (see section 6.2.). These principles indicate that organisms develop as a whole and in all their parts at the same time. A closer look at the results of germ layer development seems warranted.

10.2.1 Differentiated Form and Function

A first result of the differentiation of germ layers is the formation of *specific tissues and organs.*

A specialized organ such as the eye or a gonad is able to perform a unique *specific, albeit limited function*; in these examples, light perception by the eye and germ cell production by the gonads respectively. However, the uniqueness implies at the same time that by their very degree of specialization both of these organs loose the power to ever do or be anything else in healthy organisms. We speak of 'omnipotent cells' in regard to stem cells in several areas of the body that still retain all of their differentiation potential. Specialized cells of differentiated tissues and organs have lost their 'omnipotence.' Their specialized form and function is acquired at the expense of other development opportunities.

10.2.2. The Relation between differentiated Organs and Tissues

A second result of the differentiation of germ layers is the *relation* that *evolves between variously differentiated organs.*

Organs develop from different germ layers and differentiate in many different ways. They grow apart and their relation to each other becomes ever more remote morphologically and topographically, such as in the example of the eye and the gonads. However, there is a kinship in the *level* of differentiation between all organs of an organism. If the nervous system is highly developed, then the animal will have matching digestive and movement organs (section 6.2. and section 9.4.). Conversely, when we see that an animal has a well-developed motility with highly specialized motor organs, we may also expect to find a highly developed nervous system and sense organs. One example of this is the eye of the eagle and its matching musculoskeletal system: wings, claws, and its beak type.

The differentiation of the various organs and tissues usually falls within a certain

developmental level of the *organism as a whole*. This is consistent and type specific.
A desirable study object in this is the frog. Frogs first go through a more fish-like stage of development as tadpoles. Then they start developing, among others things, lungs and legs, and changes in heart and thyroid take place, which transform the tadpole to a real amphibian: the frog. The various changes during the metamorphosis from tadpole to frog evolve 'in concert' (Lovejoy 2009).

10.2.3. The Reciprocal Relation of differentiated Organs

A third result of the differentiation of organ systems from different germ layers is that the aforementioned relation between them is not random. It is *specific and reciprocal.* The reciprocity creates a potential strain between, interdependence on, and cooperation between different specialized tissues and organs.

A good example in humans is the connection between pituitary gland and adrenal cortex. The frontal lobe of the pituitary that develops from endoderm secretes a hormone (ACTH) that stimulates the adrenal cortex (from mesoderm) to produce its hormones. This obviously only works when the adrenal gland is able to respond appropriately to ACTH and has a developmental level that matches ACTH stimulation. The production of ACTH would make no sense if the adrenal cortex would not respond with the production of adrenal hormones on ACTH-release by the pituitary gland. Similarly, there are many other inter-functional relations between organs of entirely different origin and development that are spatially far apart in the organism.

10.2.4. Polarization

A fourth result is the development of '*polarization*.'

Morphological polarization has also been described in detail in the Bolk's Companion Anatomy. Here the *physiological* aspects will be described exemplarily and briefly.

Comparison with what is said about it in the Companion Anatomy can facilitate an even better understanding of polarization.

A beautiful example of physiological polarization is the development and cooperation between the eye, the brain's optic nerves and optic tracts and the gonads.

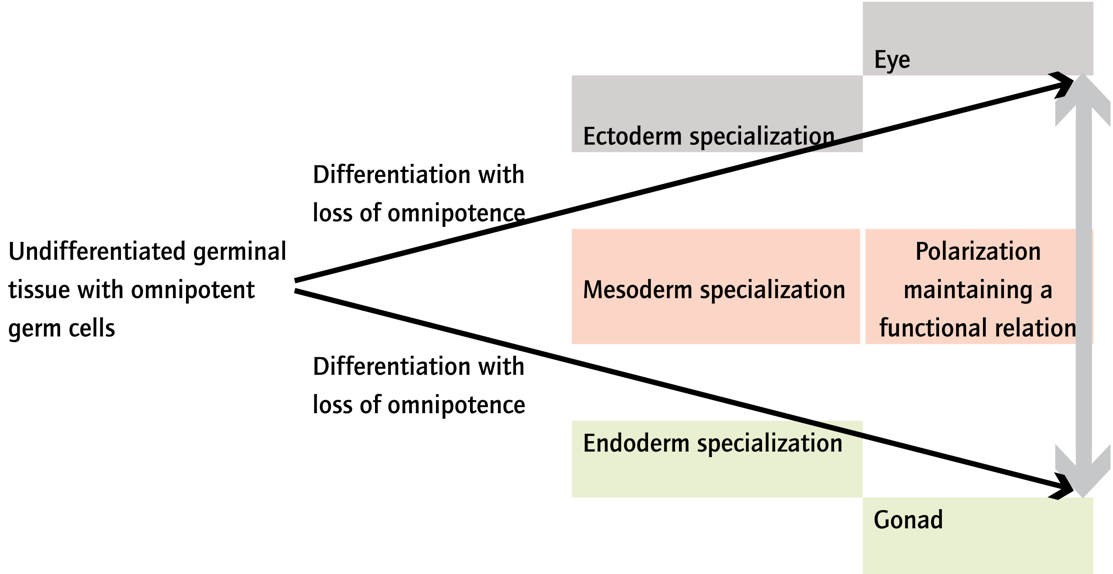
When the days lengthen in spring, the eye gets more light stimulation. This activates certain brain areas to produce neuro-hormonal substances, which in turn affect the gonads. This leads to an increased production of sex hormones by the gonads in animals. These hormones again induce changes in body shape, color, sex organs, and behavior in these animals. They stimulate reproductive behavior and facilitate fertilization. The plumage and singing of the birds in spring, their courtship, migration to breeding grounds, as well as bird migration in general are all influenced by daylight.

On one end a sense organ (the eye) is activated, and successively the gonads are triggered on the other end. Organs and structures that have evolved from a mesoderm origin such as the heart and blood vessels assist the transport and implementation of different hormones.

Eye and gonad arise from germ layers with a polar opposite differentiation: the eye arises from neural tissue (ectoderm), the primordial germ cells in the gonads from primitive gut tissue (endoderm). In this example, specialization causes a polar differentiation. This applies to the morphology and physiology of eye and gonads, it also applies to the topography of the organs in the body: the eye and brains in the head and the gonads and genitalia in the lower abdomen.

A more evolved sense organ such as the eye operates in 'line' with higher evolved gonads, which, in turn, are sensitive to the stimulation and secretions of nervous tissue that is activated by light. Primitive nervous and intestinal tissues develop in polar directions but also maintain an essential functional relation with the aid of mesoderm structures and functions.

Table 10.2. Polarized development in eye and gonad maintaining a durable reciprocal relation



10.2.5. The Role of Mesoderm

The development of mesoderm plays a key role in the polarization process. The heart and circulation, respiratory system and breathing, kidneys and blood filtration, blood, lymph, regulation of extra cellular fluids, as well as the spleen and lymph nodes regulating the red and white blood cells determine the biological balance (homeostasis) of the organism. The mesoderm develops into a highly specialized **mediation tool** between the end products of the evolving ectoderm and endoderm. The organs and tissues derived from mesoderm differentiation secure the possibility of self-regulation as a definitive physiological activity of organisms.

The role of mesoderm is perhaps best characterized as follows: Mesoderm mediates continually between the organ and tissue processes of ectoderm and endoderm. Ectoderm and endoderm strive toward polarization and partiality. Mesoderm is *committed to connecting and reversing the polarity of the opposing processes occurring in tissues and organs from ectoderm and endoderm origin and creates the possibility of self-regulation with this.*

10.3. Polarity and Enhanced Functions

Polarity is the result of an opposing and diverging development in tissues and organs in animal and human organisms. The Bolk's Companion Immunology works this out in relation to the immune system (Bie 2006). Goethe had noticed that more polarized organisms are on a higher evolutionary level, both in plants and animals. When organisms are more polarized, they exhibit proportionally more emergent features and these features concern almost always 'higher' functions. Exemplary of this is the further differentiation of the nervous system, which in the course of evolution, leads to ever more complex functions of the mind. Worms and caterpillars exhibit less polarization, fewer specialized phenomena of the mind, and a simpler behavior than more evolved animals such as lions or dolphins. Animals with a more evolved nervous system have matching metabolic organs and musculoskeletal systems. The enhanced development of limbs, heart, kidneys, and circulatory system are consistent with this as well. As Lovejoy (2009) puts it: they develop "in concert."

The degree of polarization of an organism's tissues and organs is a measure of its ranking in the evolutionary hierarchy and of the complexity of its mind, movement, and digestive processes.

10.4. Humans and Enhancement

The forthcoming may further clarify the concept 'enhancement.' Increased differentiation leads to increased potential strain and polarity in organisms, which in turn enhances the maturity of organisms *as a whole* in evolutionary ranking and *enhances their self-regulation*. This shows itself in the evolving germ layers and the resulting tissues and organs.

A rewarding study object for understanding and recognizing Goethe’s ‘polarity and enhancement’ principle is the limb development of primates and humans in relation to brain development.

When you compare different monkeys and humans morphologically, all apes appear to have opposable big toes on their feet. This makes monkey feet into organs to grip with and less specialized for walking. Monkey feet have in broad outline the same function as their hands. They are ideal for climbing trees. When you study the monkey’s gait, it will soon become obvious that their feet are not suitable for bipedal walking or standing.

The monkey hand has a thumb that has limited opposing ability due to its relatively small size. Fine motor skills by way of an opposable thumb are needed in performing skilled crafts or music. The monkey's hand is used to lean on in walking and thus also has 'foot' function. Chimpanzees lean on their fingers when walking on the ground, keeping them bent so that they can support themselves on their first phalanges (fig. 10.1.). Monkeys walk on their four limbs, which in pairs are a mixture of hand and foot or arm and leg. Classical quadrupeds such as hoofed animals, rodents, and ruminants have even less differentiated specialization of the front and hind limbs. Forelegs and hind legs are even more similar to each other.

Figure 10.1. The chimpanzee's gait

When we compare this to the development of hand and foot in humans we may note that humans have a 'complete' polarization of hand and feet. The foot is so constructed that a minimum of material makes an optimally balanced standing and walking on two feet possible. Pronation of the foot and its parallel position relative to the earth's surface turns the foot towards the earth, matching it to the ground. The opposability of the big toe is absent, which optimizes bipedality. The human foot and leg are designed purely and specifically for walking and supporting limbs.

The human hand is completely polarized relative to the foot. It is in a supine position with the palm freely movable in space. The human hand is not suitable as a limb to lean on; it only serves the free expression and movements such as those needed in skilled craftsmanship. The bipedality further supports free hand movement. Hand morphology is ideal for creative human cultural capabilities.

In relation to the apes, humans are maximally polarized. This applies not only to the arm/hand relation to the leg/foot, it is a general feature of the entire human build.

The morphological polarization and enhancement goes hand in hand with the emergence of higher mental faculties in humans, which are reflected in our cultural products.
Phenomenologically, the intuitive concept of the connection between the two phenomena of enhanced mental faculties and increased polarization in body morphology is understandable and illustrative for the principle of polarity and enhancement. Analytic methodology interprets this as a coincidence.

Exercise

Compare the two skeletons of figure 6.3. at this time from the perspective of polarization. The difference in build of limbs and trunk is visible in the two frames and you may now also note the increased volume of the neuro-cranial part of the skull and the upright posture of humans. This is again a coherent image of polarization: a smaller brain size is associated with less polarization in the limbs. All of the details have differentiated 'in concert.' You may also try to remember how you looked at this figure when studying Chapter 6 and compare that to how you look at it now. Which intuitive concept gave you a sense of self-evidence then and which now?

10.5. Summary

A comparative study of animal embryological development points out a consistent differentiation of the three germ layers ectoderm, mesoderm, and endoderm. This evolving development leads to the formation of more specialized tissues and organs. It has a polarizing dynamic, while ensuring a functional connecting network of mesoderm tissues and organs between the polarities. All this is related to the developmental level in its degree of differentiation and polarization. The mesoderm and its evolving tissues and organs are the connecting link between ecto- and endoderm. They ensure self-regulation.
The degree of polarization of the organism's germ layer evolvement is related to the evolutionary level of the organism's development as a whole: a greater degree of polarization implies a higher rung on the evolutionary ladder. Goethe called this phenomenon "polarity and enhancement." It exists through the combination of the principle of type shift (see section 6.2.) and germ layer differentiation.

In humans, polarization and mesoderm evolvement reach a (temporary?) peak, which leads to a most complex three-folded organization and the highest prospect for mental development.

11. Gradual and Fundamental Changes in Evolution

Question: How do changes take place in evolution?

11.1. Humans and Animals

The discussion regarding whether humans represent a separate domain in nature seems obsolete. Since Darwin formulated his theory, the predominant view has been that humans should be regarded as highly developed mammals. Specifically, investigation that focused on the similarities between humans and apes lead to this opinion. However, the question seems justified whether the existence of homologous organs and tissues and analog functions are proof of the animal-like nature of humans? How do we define ‘animal-like?’ How do we define what is ‘human?’

The reality of evolution is self-evident. But how the evolution of one species or type to another proceeds is difficult to prove, especially if type-shifts happen ‘in concert’ (see section 6.2.). So far, it remains a hypothesis, a theory (see section 7.5.). The usual requirement of repeatability of experiments and replication of results is not yet realizable for evolutionary issues. Is it possible to differentiate between changes that occur gradually within a species and a fundamental type-shift? This requires a broader view on the question.

11.2. Gradual and Fundamental Changes

An accurate description of the anatomical details of the skeleton of humans and apes shows that no comparable (homologous) bones are built identically (fig. 6.3.). Homologous bones of humans and hominids have different shapes. Of course, this also applies to homologous bones between the various types of great apes since species and subspecies always differ in *each* detail. This addresses the above-mentioned issue of gradual changes and fundamental differences: what quality can we assign to a variation? When do you consider differences as gradual within a species and when must they be appreciated as fundamental changes, distinguishing between species and demarcating the border between one species, class, family, or even domain and another?

The distinction between gradual and fundamental differences can be studied by looking at the type-shift that occurs between the domains of the plants and the animals. We found earlier that on the borderline between plants and animals in-between simple life forms exist, such as bacteria (see section 9.1.).

Chapter 7 describes the distinctive features of plants in connection to Goethe's Archetypal Plant. The Archetypal Plant is the morphogenetic 'organizer,' the theme of all visible plants, a theme upon which every plant is a variation. The characteristic theme of plants is the triple expansion and contraction that occurs in their organ formation, from seed to leaf to bloom to seed, even in simple plant forms such as mosses. In the evolution of the plant type, more *gradual* changes in the form of enhancements (Chapter 10) happen along with increasing polarization. The most highly evolved plants, for example the rose or sunflower families, are completely polarized in their root/leaf/blossom difference.

Chapter 9 researches the characteristic phenomena for animals. Animals typically develop gastrulation. In early animal forms, phagocytosis in unicellular organisms develops as the simplest form of gastrulation. Within the type, increasingly specialized animal properties evolve *gradually* along with enhancement and specialization. This finally leads to specialized organs such as the digestive system in higher evolved animals, along with nervous system and musculoskeletal system. It also leads to specialized tissues such as muscle, bone, nerve tissue, and the specialized tissues of the inner organs (see section 10.3.). The *gradual* changes that bring about enhancement of the type occur 'in concert' and happen in conjunction with increasing polarization.

The *fundamental* change from plants to animals occurs under the influence of gastrulation and its effect on the whole morphology and physiology of animals. It first becomes visible in rudimentary life forms, such as the unicellular flagellates, sea anemones, and sea urchins. During animal development, under the influence of polarization, the gastrulation process itself also develops, from phagocytosis in unicellular organisms to the formation of highly specialized and polarized organs.

This chapter provides an overview of the *differences* in organs, tissues, and functions in hominids and humans. An attempt will be made to differentiate between *gradual* differences, such as those between hominids themselves, and to research if there are also *fundamental* differences that demarcate different species, such as those between animals and plants or possibly between hominids and humans. Methodical pattern recognition and skilled intuition are of decisive importance in this exploration for a discriminating assessment of the facts.

11.3. Research Results in Relation to Human Evolution

11.3.1. Human Finds in Paleontology

The most important paleontological finds of the last 50 years have not unequivocally confirmed Darwin's evolutionary concept.

It should be stressed again that recognizing the existence of evolution is distinct from the *concrete depiction of its particulars*. The insight that evolution exists as a phenomenon is sufficiently substantiated by science on the basis of kinship in form and metamorphosis in morphology. The specifics of *how* evolution has actually taken place, is a different matter. The present criticism of Darwin focuses on this latter aspect. Comparative morphological and biological research has not yet confirmed the specific steps that were designed as hypotheses to validate Darwin's theory. In particular, the discovery of Australopithecus boisei and Ardipithecus, and the timing of Homo habilis and Homo erectus have not substantiated the Darwinian pedigree for humans. The main predicament is that the various Homo-types seem to have lived simultaneously instead of consecutively.

Another stated difficulty is the *simultaneous* change of multiple attributes and organic forms (Poor and Leaky 2007, Lovejoy 2009), where Darwin explicitly assumed a development of one property after another. However, the simultaneity of changes in the patterns must have kept pace with the changing relations of sub-features as described earlier in this Companion in relation to type-shifts (see section 6.2.). Simultaneity and a physiological relation between changing aspects are two main characteristics of development in general. This is reflected in the development of a human child. That simultaneity and a physiological relation between changing aspects also apply to evolution highly complicates thinking about *how* evolution took place.

11.3.2. Human Finds in Genetics

11.3.2.1. Genetics and Human Evolution

The genetic similarity between hominids and humans, as well as unexpectedly large phenotypic differences, incites a number of questions. From the viewpoint of taxonomy (the science, laws, or principles of classification; the division into ordered groups or categories), these questions imply that humans are not necessarily a higher type of animal. According to calculations by various authors, at least 75 million 'correct' mutations would have been necessary to create modern humans and chimpanzees from a common ancestor (Britten 2002). Even if one advantageous mutation had been added in one of these populations each year (!), a total of 75 million years would have been needed to reach our present level of development according to Darwin's theory. However, human evolution is said to have lasted only 2 million years. This is in sharp contrast to what genetics pioneer JBS Haldane estimates could require at least 2.5 billion years (Batten 2005). The dilemma is further complicated by the fact that virtually no qualities of man or ape or any other higher evolved organism appears to be determined by just one gene (monogenetic). It is not only the number but also the right combination of mutations 'in concert' that counts. The metamorphosis of the curved spine to the spine of bipedality (fig. 6.3., fig. 10.1., fig. 11.1.) must in itself be due to a whole series of underlying genetic changes. Mutations that could play a role in human evolution are therefore widely expected to not be so-called point mutations, but to lead to exchange, doubling, or disabling of entire sections of a gene (Bauer 2008).

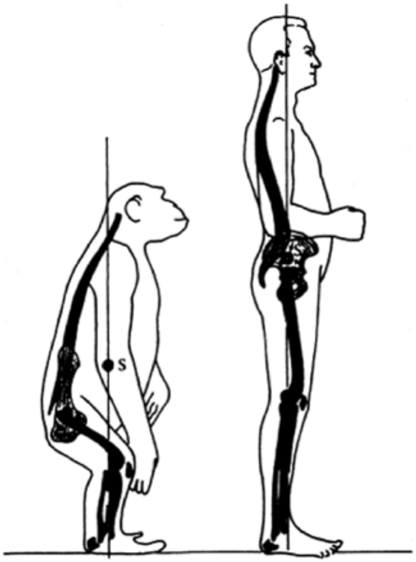


Figure 11.1. Bipedality and the polarization between the cranial and caudal skeleton. The following human joints are in the same frontal plane: atlanto-occipital joint, cervico-thoracic joint/shoulder joint, thoraco-lumbar joint, lumbo-sacral joint/elbow joint, hip joint, wrist, knee joint, ankle joint.

The above information regarding the simultaneity of Homo-types, the number of attributes that has changed, and the number of genetic mutations that is required for the change from hominid to human in relation to the time-span needed for them to take place merit further research into the question of a fundamental type-shift between animals and humans.

11.3.2.2. Humans and Epigenetics

Much to the surprise of the scientific community, genetics research found that humans have far fewer genes than originally expected. Geneticists now progressively focus their research on external factors that influence the genome. These so-called epigenetic factors 'play' the human genome in an ever-changing way. They allow a wide range of possible expressions of a limited number of genes to be generated by different combinations of active and inactive genes (Portela et al 2010 , Kelly et al 2010 Watters 2006). Epigenetics increasingly appears to be a central factor, influencing genome function from the periphery and creating a variety of effects. A textbook example of continuing genetic flexibility is the malleability of the adaptive part of the immune system. Genes are rearranged or can mutate regularly in this part of the immune system (genetic rearrangement in T-cells, somatic mutations in B-cells). Organisms are not first and foremost genetically determined, but are the expression of a minimum of combined genetic factors with epigenetic influences, which often have their origin outside the organism (Roitt 1995, Cohen 2005, Carroll 2007). Already in 1968, the German embryologist Blechschmidt came to the conclusion:

"*Genes do not act, they react.*" (Blechschmidt 1968)

With that statement he was nearly half a century ahead of his time.

Epigenetic factors can be attributed to part of the reason that hominids and humans have nearly the same number of genes and yet are so different in build, development, and biological function. It is mainly epigenetic factors that determine the plasticity of the human genetic disposition. Genes are a necessity, but by themselves, are insufficient provision for the genesis of the typically human organisms. Epigenetic influences on the genome are the more creative element. Continuing malleability in the face of multiple epigenetic factors is a typically human characteristic. Research indicates that even mental capabilities of humans are subject to epigenetic factors (Portela and Esteller 2010).

In animals, epigenetic factors are determined largely by the animal's natural habitat. The 'survival of the fittest' as Darwinian leitmotiv relates to the evolution of animals in connection to changes of their biotope. The 'survival of the fittest' is technically an epigenetic evolutionary model: changes in the environment generate evolutionary progress.

What is the habitat of humans? How do they adapt to a changing environment?

Humans may survive in any biotope with the aid of their mental and cultural abilities without having to rely on genetic changes. Humans are not determined by their biotope; rather, they are highly independent of it. With technological innovation, humans can even travel in space.

Humans are the only world citizens able to survive anywhere. They are not physically adapted to their environment, but can make the necessary social, cultural, or biographical changes to physically survive in any habitat.

At the same time humans are the only life form in nature that can destroy its habitat on a large-scale. Since the industrial revolution, this threat has transcended local effects and currently appears on a world scale. Nature no longer changes people, but humans change nature: a one-time phenomenon in evolution that emphasizes the way humans can deal with genetics and epigenetics.

11.4. Summary

Studying the transition between plants and animals can teach us the difference between gradual and fundamental changes in evolution. Gradual changes happen within a type and are accompanied by increased specialization of organisms. When a fundamental change happens, such as from the domain of plants to the animals, a new phenomenon, in this case gastrulation appears. We see multiple rudimentary animal forms that first develop the new property. Under the influence of polarization, the gastrulation process itself develops from phagocytosis in unicellular organisms to the formation of highly specialized and polarized organs in highly evolved animal organisms (Chapter 10).

The question regarding an archetypal human phenomenon may seem obsolete. However, paleontological finds have not yet confirmed the specific steps that were designed as hypotheses to validate Darwin's theory. The specifics of how evolution has actually taken place, has not been not solved in this study area. In addition, a number of questions remain unanswered in the field of genetics. This merits further research into the question of a fundamental type-shift between animals and humans.

The study of epigenetics demonstrates that genes are a necessity, but are, by themselves, insufficient provision for the genesis of organisms. Epigenetic influences on the genome are the more creative element in evolution. For animals, epigenetic factors are determined by their natural habitat. Humans may survive in any biotope with the aid of their mental and cultural abilities.

12. Is there an Archetypal Human Phenomenon?

Question: Do human archetypal phenomena exist?

12.1. Complete Polarization in Humans

We may readily observe two parallel processes in the course of human evolution: the development to bipedality and the tendency toward polarization of body structures (Chapter 10).

Polarization becomes ever more enhanced in animals (Chapter 9). However, 'complete' polarization such as that of the human hand and arm in relation to leg and foot as described in 10.3. does not occur in animals. ‘Complete’ polarization and specialization can be rediscovered in the spatial organization of the human spine and large joints (fig. 11.1.). Bipedality requires the upright human structure of the skeleton. Apes remain tied to the bent body shape of gastrulation. In humans, the defining joints for the skeleton shape lie in one plane: the frontal plane (fig. 11.1.). From the joint between the skull and cervical spine (the atlanto-occipital joint) to the ankle joint, the final vertical shape of the human skeleton is visible.

12.2. Growth Patterns

The developmental biologist Portmann from Basel has, among others, done pioneering work on comparing growth patterns in hominids and humans. The philosopher Hegge says about him:

> *"The work of the Swiss biologist and anthropologist Portmann (1897-1982) both directly refers to Goethe's research and uses the same methods. Thus Portmann brings Goethe's science of nature into a modern context."* (Hegge 1996)

Portmann points to three characteristic distinctions between hominids and humans (Portmann 1969). He describes characteristics of human growth patterns. Portmann's use of the term 'growth pattern' also includes people's social, cultural, and biographical development. For him, each person's growth pattern is epigenetically determined (see section 11.3.). Since each individual's environment is different, everyone's growth pattern is also individual, which would mean that each person has his or her own 'ontology.'

1. *"Human attributes are system properties and it is not possible to separate one part from another for investigation by biologists, for instance a 'vital' from an 'animal' part. When you try to grasp human typology in its wholeness, then a characteristic individual human growth pattern appears as each human's personal 'ontology.' This reveals human 'ontology' in its explicit individuality."*

Portmann then compares postnatal growth curves of hominids with those of humans (fig. 12.1.). Hominids have comparable growth patterns, whereas the growth pattern of humans is essentially different. Growth in the first year of human life is 'embryonic' compared to hominid growth in their first year of life. Human growth in the first year continues along the intrauterine pattern that hominids and humans have in common. Hominids experience a developmental slowdown immediately after birth that in humans only occurs after the first year of life. Humans have a longer period of 'embryonic growth.'

2. *"The system of ontological correlates belonging to human life also includes the time structure of intrauterine and extra uterine growth and maturation. The intrauterine phase of humans is short, the extra uterine phase is 'retarded' for a whole year when you compare it to mammals that have a similarly high level of cerebralization."*

According to Portmann, postnatal development in humans could be considered an epigenetic phenomenon. Body development, brain maturation, language development as a means of communication, comprehension, and the slow growth to maturity depend on each human's 'social habitat.'

3. “Shaping of decisive body parts and structures is completed before birth in mammals, and newborns enter the world as a small image of their kindred. In people, individual posture, movement patterns, and communication are, however, shaped and embedded in social life in a way that is unique for humans.”

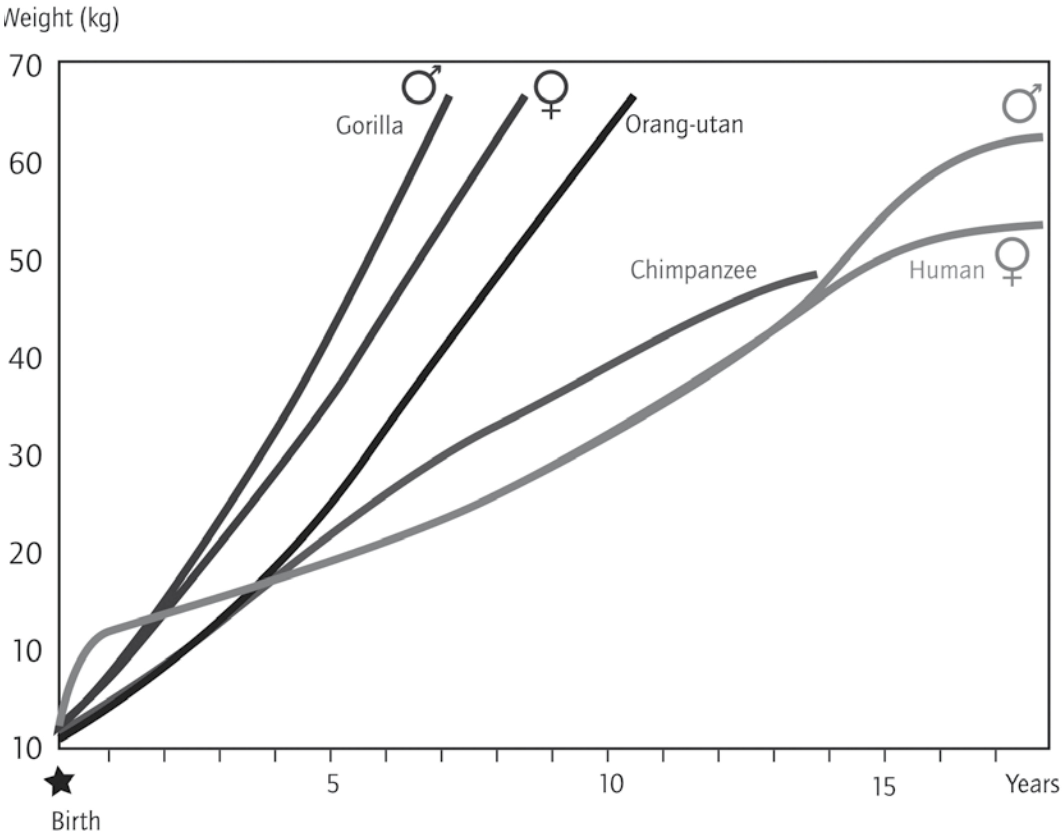


Figure 12.1. The growth pattern of humans compared to different hominids (after Portmann 1969)

The human growth curve of figure 12.1. is also unique through its prolonged period of growth as well as the puberty growth spurt. Full maturation of human organisms takes a singularly long period of 18-20 years; compared to this all hominids mature very rapidly.

Do these differences reflect gradual variations on the animal theme or is there a fundamental change that demarcates the decisive borderline between types - between humans and animals?

The Dutch anatomist/embryologist Louis Bolk in particular has called attention to the unique phenomenon of "*retarded development of humans*" (Gould 1977 Ch. 10, Verhulst 1999). The 'retarded' growth and maturation in humans is called *neoteny* (see sections 12.3 and 12.4.). The issues raised by Bolk (1918), and subsequently also by Poppelbaum (1956), Portmann (1969), and Verhulst (1999) regarding the retardation that exemplifies human development are valid to this day and call for a discussion of humans as a separate type. Indeed, the borderland of the fundamental type-shift between plants and animals is inhabited by rudimentary ('retarded') life forms (see section 11.2.).

Neoteny, retention of body forms from a younger phase into adulthood (Gould 1977 Ch. 9), occurs alongside the complete polarization that is found in human organisms. In the following paragraphs, neoteny will be further explicated.

12.3. Neoteny in Humans: Postnatal Persistence of Embryologic Phenomena

Embryologic development goes through different phases. Figure 12.2. depicts early embryologic development of the human body shape. The images are corrected for relative size: the final drawing of set B is in reality many times larger than the first of series A.

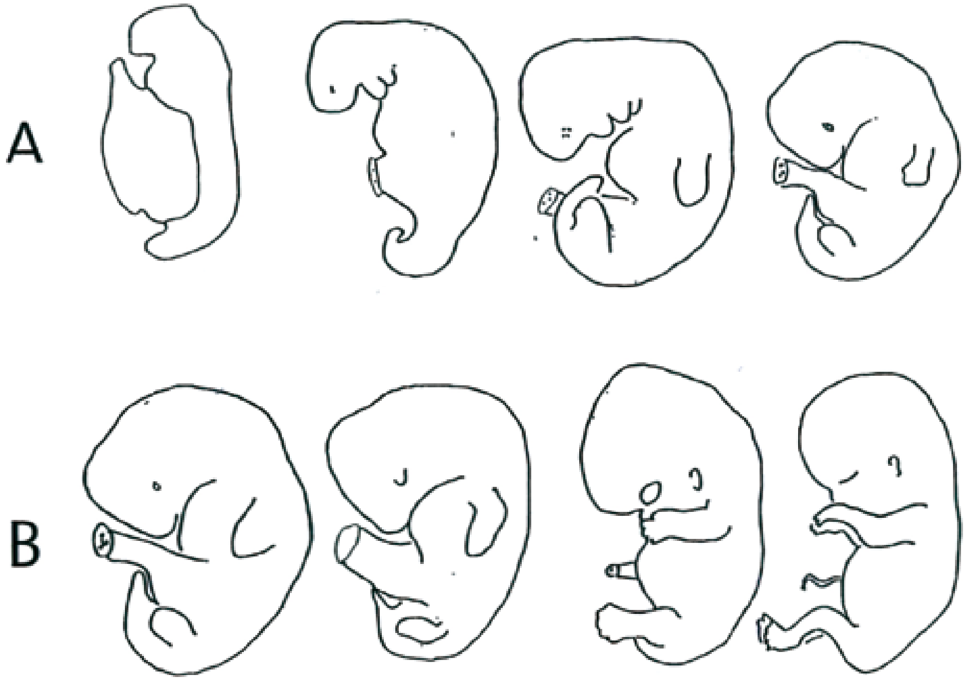


Figure 12.2. Gastrulation (A) and subsequent stretching (B) of human embryos

Series A portrays evolving ‘gastrulation shapes’ of early embryonic growth as a dynamic folding process - the so-called ‘head to toe folding' (craniocaudal folding) (fig. 9.4.). Through growth, the head and the tail end bend towards each other until both hit the umbilical cord.

Series B depicts how human (and hominid) embryonic growth creates an opposite gesture after gastrulation. Dynamically, this growth can be characterized as a growth ‘towards uprightness.’ This part of embryonic growth is preparatory for the complete polarization, the bipedality, the upright gait, the shape of the spine, and the skull shape of humans that are so characteristic.

Hominids and humans grow toward *uprightness* in two phases: a prenatal and a postnatal phase. Hominids experience the same embryonic stretching towards uprightness, as can be clearly seen in newborn chimpanzees (fig. 12.3.). However, hominids retreat to the curved body shape after birth. Postnatal hominid growth leaves the stretching gesture behind. Their spine 'returns' to the previous bent form of gastrulation. In contrast, human newborns further explicate the upright tendency into adulthood and develop bipedality.

We see a similar phenomenon in *skull developmen*t. Hominids are born with a relatively dominant neuro-cranium (the part that is situated around the brain), not much protrusion of the supra-orbital ridge above the eyes, and a relatively small facial skull (splanchno-cranium). The head of a newborn chimpanzee or bonobo looks ‘human’ (fig. 12.4.). Postnatal hominid development brings a dramatic change to this. The relative volume, round shape, content, and span of the neuro-cranium decreases significantly and the facial skull with upper and lower jaws develops considerably. On the forehead impressive orbital ridges develop. The typical monkey countenance of the adult monkey becomes visible (fig. 12.4.).

Hominids do *not* demonstrate the phenomenon of neoteny. Their postnatal shape differs significantly from newborn hominid appearance. Bipedality cannot develop and their cranial capacity, including the expansion of their brain, takes a dramatic turn and remains small compared to humans. The facial skull and snout and the entire body shape become monkey-like.

In human postnatal skull development, the neuro-cranium keeps its round shape and the facial skull stays true to its shape in the newborn (fig. 12.5.). Consequently, the typical hominid snout does not appear in humans. This is a phenomenon of neoteny.

Figure 12.3. Newborn bonobo (© Eric Gevaert - Fotolia.com)

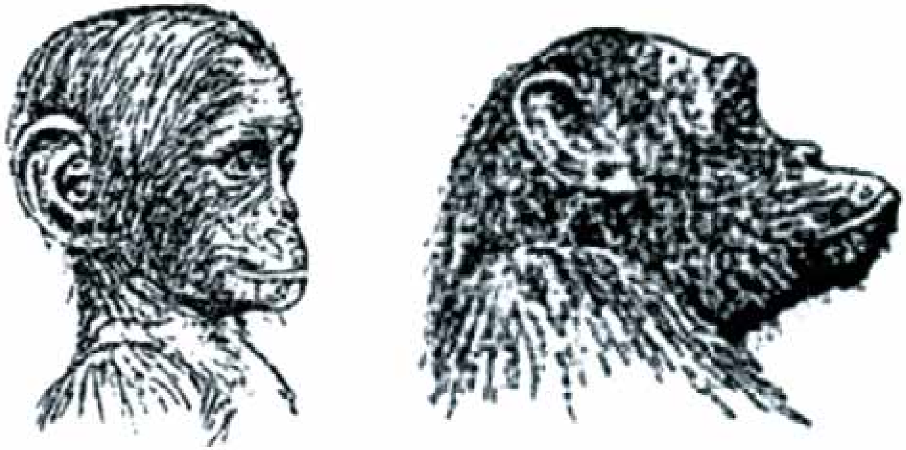


Figure 12.4. Skull shapes of young and adult chimpanzees

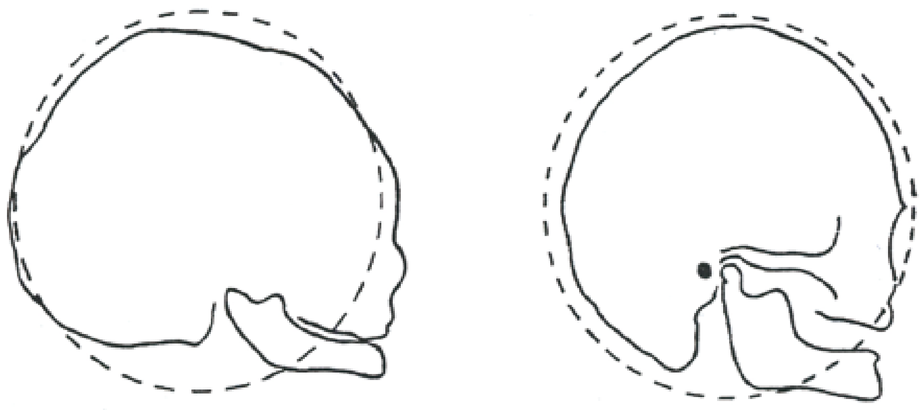


Figure 12.5. The skull shape in young and adult humans

Limb development also exemplifies the embryonic character of the human form. Here, too, neotenic development applies. The five rays of hand and foot, the two bones of forearm and lower leg, and the single bone in upper arm and thigh are also present in the limbs of different animals. Many animals have limbs with five rays similar to humans early on in their embryonic life. Subsequently, however, the limbs specialize to become specific tools for swimming, digging, running, or flying (fig. 12.6.). The homologous body parts remain clearly recognizable. In animals the limbs become specie-specific and specialized for their survival task in adulthood. In humans the embryonic arm and leg bones and the five rayed hand and foot are retained (fig. 12.6.).
Human extremities develop forms that are not related to the survival instinct, but serve the mental capacities of humans and their ability to use them for such activities as highly specialized crafts or music.

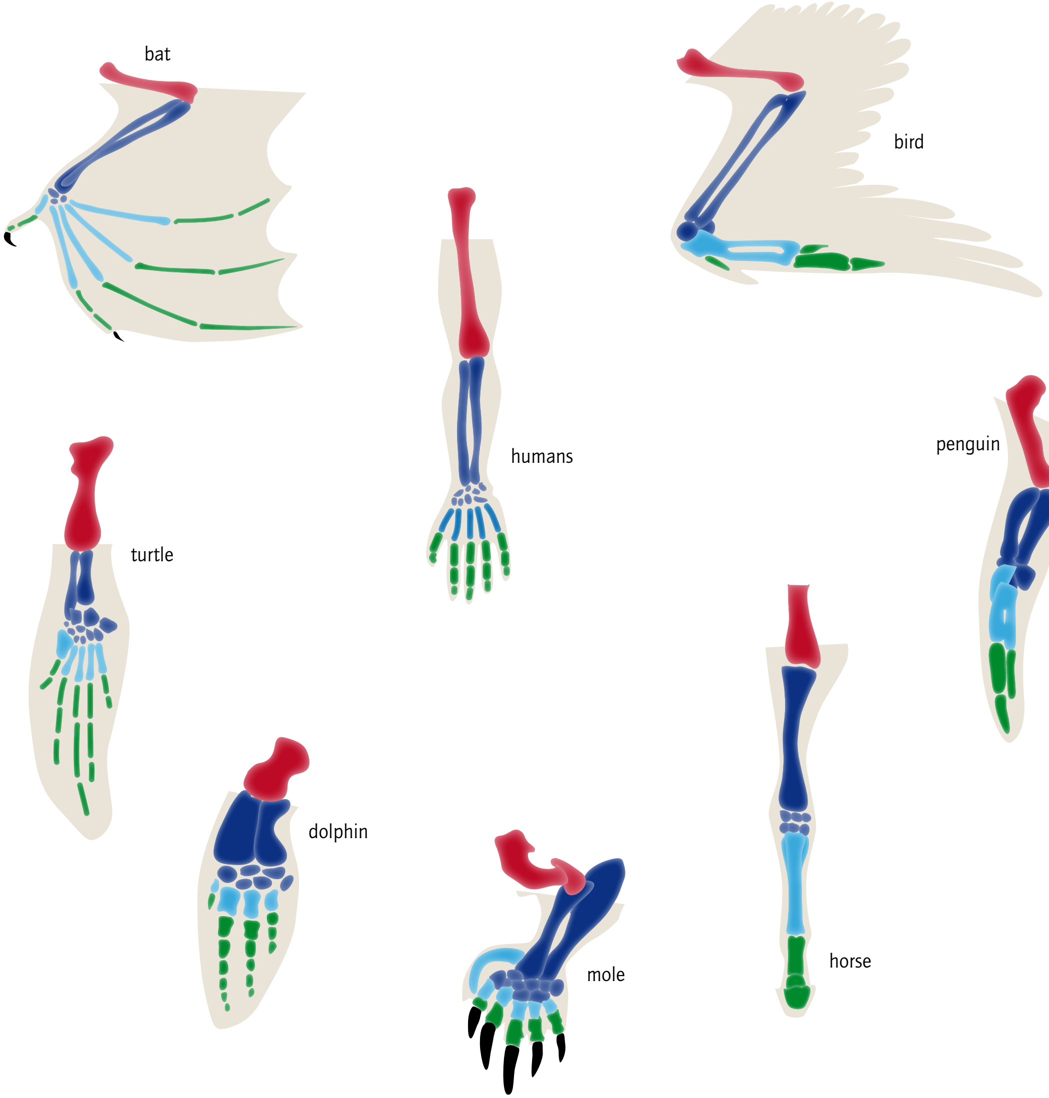


Figure 12.6. Limb development and Neoteny. Homologous organs appear in the same color: a. humans b. turtle c. dolphin d. mole e. horse f. penguin g. bird h. bat.

12.4. Neoteny and Complete Polarization

Human development substantiates the embryonic gesture of stretching with postnatal uprightness and bipedality. The human skull retains the shape it had at birth. Human limbs preserve the bone structure of embryonic development. Mature humans retain many characteristics of their newborn profile, such as also the central localization of the foramen magnum (the opening in the lower skull that allows the connection between brain and spinal cord) and tooth shape. The phenomenon of neoteny is also known as pedomorphosis in developmental biology: it stands for the retention of body forms in adulthood from a younger phase (Gould 1977 Ch. 9).

Does the phenomenon of neoteny point to a fundamental type-shift between the domain of the animals and humans?

Neoteny as seen in many aspects of the human form is accompanied by complete polarization of human morphology. In previously discussed fundamental type-shifts, such as from plant to animal, the complete polarization of the earlier evolutionary type (the plant) was lost at the appearance of gastrulation in early animal (unicellular) organisms. In humans, the enhancement and advantages of complete polarization are not lost but carry on and support the newly emerging phenomenon, which is the neotenic features of uprightness, bipedality, a large cranial volume, and the five-rayed hands and feet. This augments the enhancement of the type and is a unique phenomenon.

At the same time, their various neotenic features make humans more susceptible to epigenetic influences (see section 11.3.2.2.). Properties that are less differentiated keep a developmental potential. This again makes humans able to continue their individual development on different levels, morphological, social, and intellectual during their lifetime.

12.5. The Polarities' Balance and Organs of the Mesoderm

Goethe found the evolutionary principle of 'polarity and enhancement.' This relates to the ongoing development of types and emphasizes its significance. All of plant and animal evolution can be described by studying the differentiation of tissues and organs from this point of view. The polarization principle has frequently been described in the Bolk's Companions.

In human organisms, polarization reaches a (temporary?) culmination. Organs that develop from ectoderm are completely polarized to endoderm organs. The strain between the limbs and the head is maximized. In the mean time, the strong polarization is accompanied by the development of a mesoderm region that brings the polar principles in balance so that they can exist in one organism and be the bearer of the new phenomenon of 'holding back.' At the point of greatest polarization, the typically human feature of neoteny - holding back - can be incorporated in the human organism alongside the severe polarization. Human evolution consists, in large part, in holding back the differentiation and specialization that occurs in animal postnatal development.

Mesoderm organs create space between polarized regions in which both are brought in relation to one another (see section 10.2.5.) This can be seen as a phenomenon of balance. Goethe's way of empathic study of the human organism allows us to recognize that humans are the first to realize this amount of polarization and balance in evolution along with a new trait. It is reflected in a balanced body shape, a balance between 'head and toe,' and a balance of all internal processes, control loops, and feedback mechanisms. Illness occurs when this balance is disrupted, as described in the Companions The Healing Process, Respiratory Disorders, and Depressive Disorders. Humans are the first and so far only ones in nature that embody this harmonious balance in a complete polarization, at the same time carrying a new impulse of holding back, neoteny. This balance is further supported by the way the human heart and circulation as mesoderm organs find equalization in their rhythmic function. Rhythmic alternation is also present, albeit to a somewhat lesser extent, in lung function and morphologically in the alternation of the ribs in the rib cage. Rhythmic function and morphology are the expression of the harmonious balance within the human organism.

The human organism is the first to maintain a healthy balance between extreme morphological and functional polarities in three-fold form and function in conjunction with carrying a new potential.

12.6. The Mathematical Aspect of the Human Form

In the early 1500's, Agrippa of Nettesheim, noticed that the human build has mathematical qualities and drew these in his now world-renowned mathematical depictions of the human being, published in1531 (fig. 12.7.). These mathematical proportions apply specifically to the human body. In these drawings he shows that the human build can be considered as mathematically harmonious in multiple aspects. This is a consequence of human growing proportions and represents the complete harmony between polarized aspects and neotenic aspects of the human form.

Attempts to fit hominids into such mathematically harmonious relations fail. The uniqueness of this phenomenon exclusive to humans is visible at first glance and is unmistakable.

12.7. Discussion and Conclusion

At the beginning of this Companion (see section 1.1.), the following questions were introduced: How does a physician gain knowledge about disease? How do you develop clinical intuition? Is there any practical use in exploring additional forms of science? What does Goethe's scientific methodology provide that other scientific methods cannot offer? This paragraph closes the circle pertaining to methodology questions in this Companion.

The Companion started with examples of clinical intuition and pattern recognition and their role in daily medical practice. At first we noted and described different patterns; in this last chapter we assessed pattern variation in connection to the subject of individual human types. This process leads to new queries and new insights.

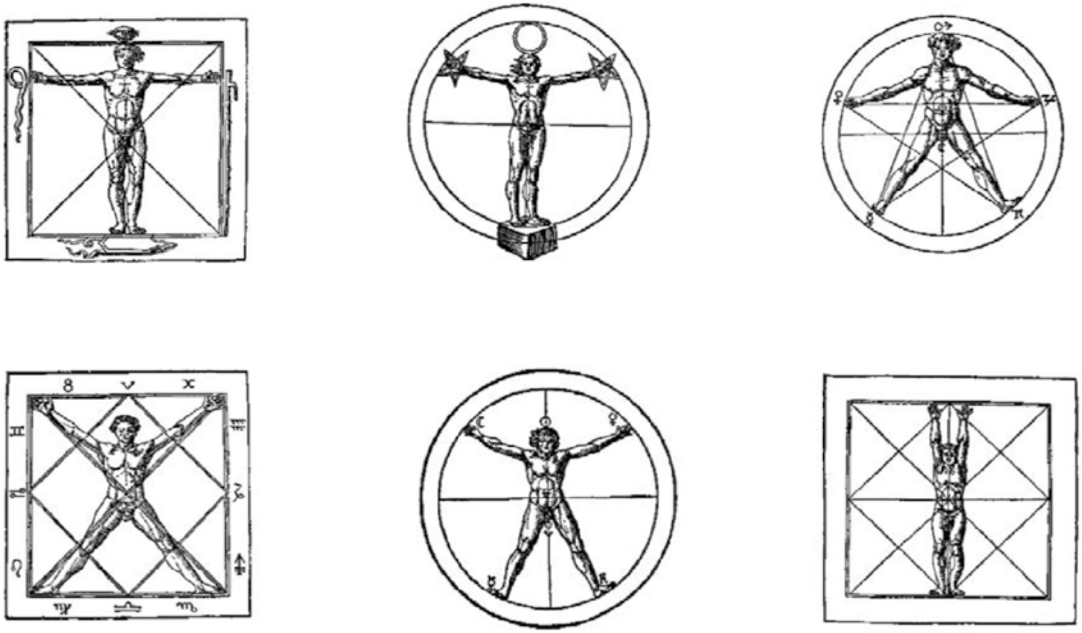


Figure 12.7. The drawings of Agrippa von Nettesheim of around 1531, as arranged by R. Steiner. In the third form on the top right with the depiction of the pentagram you can also find the proportions of the golden section between different human body parts.

A reflection on human perception and memory (Chapter 2) and the development of methodical pattern recognition and skilled intuition (Chapter 3), show that a systematic development of phenomenological knowledge is possible. The repeatability of the process, the reproducibility of the results, and the transferability of the method, classify Goethe's approach as a scientific method. The insight hereby acquired is complementary to the findings of current science (Chapter 4 and Chapter 5). It has added value to the specific issues relating to life and to the understanding of organisms as a whole. It also sheds new light on additional issues of evolutionary nature. Organisms typically evolve as a whole and all their attributes evolve 'in concert' (Chapter 6). This is also how limits of 'types' are exceeded. Thinking in evolving types is an addition to thinking in evolutionary features, which is outlined by mainstream evolutionary theory (Chapter 10).

Herein lies the fructifying element of the phenomenological approach for the causal-analytical form of science. The details that the latter method brings to light become comprehensible by the first in their context and meaning.

The above questions are especially vital for medicine. Each disease recreates the life of the patient as an individual and does not merely heal a partial defect. Richard Horton, former editor of The Lancet, says to this:

"Doctors tend to recoil from these more holistic matters ....Instead, I am trying to find a way to make sense of what it is that disease does to us , not only as human bodies but also as human beings, it is a question of ontology as much as it is one of pathology." (Horton 2003)

Goethe's science of wholes is a methodology that can provide useful answers to such scientific, practical, and everyday questions. For medicine, this means an additional explanatory model for pathogenesis and a further rationale for therapy. The diseased individual can be understood as having an unbalanced system. The therapy consists of restoring the balance and reverting to the body's natural and proper functioning (Bie 2008, Tellingen 2009, Gerven 2010).

The skilled intuitive approach that Goethe introduced can be developed consistently. It gives self-evident insights that compliment current scientific views of organic nature and humankind, and also shows how many details can be rendered comprehensible in context.

Literature

Batten D. Haldane´s Dilemma has not been solved. Technical Journal 19/1, 2005, S. 20-21.

Bauer J. Das cooperative Gen. Abschied vom Darwinismus. Verlag Hoffmann und Campe, Hamburg, 2008.

Benedetti F. Placebo and nocebo effects: how the doctor's words affect the patient's brain.

European Psychiatry, Volume: 22, Supplement 1, March 2007.

Benedetti F. Placebo enhances sport performance. New scientist, Volume: 196, Issue: 2628 (November 3, 2007), p:20,

Benedetti F., Lanotte, M, Colloca L, Ducati A, Zibetti M,. and Lopiano L. Electrophysiological properties of thalamic, subthalamic and nigral neurons during the anti-parkinsonian placebo response. Journal of physiology (Cambridge), Volume: 587, Issue: Pt 15 (June 22, 2009), pp: 3869-3883

Bie G van der. Embryology. Louis Bolk Instituut, Driebergen, 2011.

Bie G van der. Immunology. Louis Bolk Instituut, Driebergen, 2006.

Blechschmidt E. Vom Ei zum Embryo. Die Gestaltungskraft des Menschlichen Keimes. Deutsche Verlags-Anstalt, Stuttgart, 1968.

Bockemühl J et al. Die Erscheinungsformen des Ätherischen. Verlag Freies Geistesleben GmbH, Stuttgart, 1977.

Böhme/Schiemann. Phänomenologie der Natur. Frankfurt am Main, Suhrkamp, 1997.

Bolk L. Menschwerdung. Hersenen en Cultuur. Scheltema en Holkema. Amsterdam, 1918.

Bortoft H. The Wholeness of nature. Goethe's Way of science. Floris Books Edinburgh, 2008.

Bortoft H. Goethe's Scientific Consciousness. The Institute for Cultural Research, 1986.

Britten RJ. Divergence between samples of chimpanzee and human DNA sequences is 5% counting indels, Proc. Nat. Acad. Sci., 99, USA, 2002, S. 13633-13635.

Buber M. I and Thou. New York, Touchstone, Simon and Schuster, 1996.

Carroll S.B. in Endless Forms Most Beautiful. The New Science of Evo Devo p.116. London: Phoenix Paperback, 2007.

Cohen I. Tending Adams Garden p: 148. Elsevier Academic Press, 2005.

Colloca L. Benedetti F. Placebo analgesia induced by social observational learning. Pain, Volume: 144 Issue: 1-2 (July 2009), p. 28-34

Darwin C. On the origin of species. Harvard: Harvarhd University Press. Facsimilie of the first edition, 1981.

Dawkins R. The blind watchmaker. London: Penguins Books, 2011.

Dawkins R. The blind watchmaker: Why the Evidence of Evolution Reveals a Universe without Design. London Penguin Books, 2006.

Dawkins R. The selfish gene. Oxford: Oxford University Press, 1976.

Dennet DC. Darwin's dangerous idea. Evolution and the Meanings of life. New York: Simon and Schuster, 1995.

Drews. Color Atlas of Embryology. New York: Thieme Medical Publishers, 1995.

Dijksterhuis EJ. De mechanisering van het wereldbeeld. Amsterdam University Press, 2006.

Enck P, Benedetti F, Schedlowski M. New Insights into the Placebo and Nocebo Responses. Neuron, Volume: 59 Issue: 2 (July 31, 2008), pp: 195-206

Engel A.K. Neuronale Grundlage der Merkmalsintegration, in Neuropsychologie I. Karnath H-O, Thier P (eds) Neuropsychologie (2nd ed). Springer, Heidelberg: 55-65, 2006.

Friedenberg J. and Silverman G. Cognitive Science. An introduction to the Study of Mind. London: Sage Publications, 2006

Gerven M. van, Tellingen C. van. Depressive Disorders. An Integral Psychiatric Approach. Bolk's Companion 2011.

Goethe J. W. von. Italian Journey (1816-17), trans. W. H. Auden and Elizabeth Mayer (1970), 310-11.

Goethe JW von. Maximen und Reflexionen Nr. 509, HA Bd1 12, S. 435

Goethe JW von. Schriften zur Morphologie I . Die Metamorphose der Pflanzen. J.G. Cotta'sche Buchhandlung Nachfolger; Stuttgart 1817

Goethe JW von. Materialien zur Geschichte der Farbenlehre, HA Bd. 14, S. 91.

Gould S.J. Ontogeny and Phylogeny. The Belknap Press of Harvard University Press. Cambridge, Massachusetts and London, 1977.

Gould S.J. Goed nieuws van het genenfront. Interview NRC 20-03-2001.

Gould and Keeton. Biological science (Ch. 19). New York: W.W. Norton&Company, 1996.

Greef J van der. Perspective: All systems go. Nature Volume:480 (22 December 2011) p. 87

Green R E, Pääbo S et al. A draft sequence of the Neandertal genome. Science, Vol. 328. no. 5979 (2010), pp. 710 - 722.

Harrison et al. Principles of Internal Medicine 18th Edition

Havi C. Phenomenology and its application in medicine. Theor Med Bioethics, 2011; 32: 33-46

Hegge H. Theory of Science in the Light of Goethe's Science of Nature. Philpapers.org. Inquiry 15 (1-4):363 – 386.

Hegge H. Transcending Darwinism in the Spirit of Goethe's Science: A Philosophical Perspective on the Works of Adolf Portmann. Newsletter of the Society for the Evolution of Science. Summer 1996 issue, Vol. 12, No. 2, pp. 1-26

Heusser P. Anthroposofische Medizin und Wissenschaft. Schattauer GmbH 2010.

Hopf J-M. et al. Localizing Visual Discrimination Processes in Time and Space. Journal of Neurophysiology October 2002, Vol. 88 No IV; p. 2088-2095

Horton R. Second Opinion; Doctors, diseases and decisions in modern medicine. Granta Books 2003.

Huber MAS. How should we define health? BMJ 2011; 343:d4163

Kelly KK, Carvalho DD Jones PA. Epigenetic modifications as therapeutic targets. Nature Biotechnology Vol 28 Number 10 pp. 1069-1078, 2010.

Lovejoy CO et al. Re-examining Human Origins in Light of Ardipithecus ramidus. Science (2009) Vol. 326 p.74

Margison FR, and McGrath G, FRCPsych. Measurement and psychotherapy; Evidence-based practice and practice-based evidence. The British Journal of Psychiatry (2000) 177: 123-130

Maso I. Het streven naar voortreffelijkheid. Afscheidsrede Universiteit voor Humanistiek, Utrecht, 2009.

McGowen P, Sasaki A, D'Alessio AC et al. Epigenetic Regulation of the Glucocorticoid Receptor in Human Brain Associates with Childhood Abuse. Nature Neuroscience 2009; 1342: 342-348

Peirce C S. The scientific attitude and fallibilism (1896,1897,1899) In: Philosophical Writings of Peirce (1940). New York:Dover Publications p: 42-59, p: 42

Poor F, and Leaky MG. Implication of new early Homo fossils from Ileret, east of Lake Turkana, Kenya. Nature 9 August 2007

Poppelbaum A. Mensch und Tier. Dornach (Schweiz): Philosophisch-Anthroposofischer Verlag am Goetheanum, 1956.

Portela A. and Esteller M. Epigenetic modifications and human disease. Nature Biotechnology, Vol 28 No 10. October 2010.

Portmann A. Biologische Fragmente zu einer Lehre vom Menschen. Basel: Schwabe & Co, 1969.

Roelfsema PR, et al. Visuomotor integration is associated with zero-time lag synchronization among cortical area's'. Nature vol.385 Jan 1997.

Robbins. Pathology, by Vinay Kunar. Saunders/Elsevier. 2007.

Rohen J.W. Functional Morphology. The Dynamic Wholeness of the Human Organism. Edited by Cathy Sims-O'Neil, Adonis Press 2011.

Roitt et al. Immunology. London: Mosby, 1995.

Rose S. Lifelines; Life beyond the gene. Oxford: Oxford University Press, 1998.

Sadler T.W. Langman's Embryology. Lippincott Williams&Wilkins, 2009.

Schad W. Säugetiere und Mensch. Zur Gestaltbiologie vom Gesichtspunkt der Dreigliederung. Stuttgart: Freies Geistesleben (Menschenkunde und Erziehung 26), 1971.

Schäfer M. and Oeltjenbruns J. Clinical significance of the placebo effect. Anaesthesist, Volume: 57, Issue: 5 (May 1, 2008), pp: 447-463

Sheldrake R. A new Science of Life. London: Blond and Briggs, 1981.

Shorter E. The history of the doctor-patient relationship. Companion Encyclopedia of the History of Medicine/cWF Bynum & Roy Porter eds. 2009.

Smulders Y. Hoezo bewijs? Inaugurele rede (Oration) VU Amsterdam, 2008.

Steiner R. Goethes naturwissenschaftliche Schriften, in Deutsche National-Literatur, edition Kürschner, parts 114-117, Berlin andn Stuttgart, 1883-1897.

Steiner R. Grundlinien einer Erkenntnistheorie der Goetheschen Weltanschauung. Dornach: Rudolf Steiner Verlag Rudolf Steiner Gesamtausgabe 2,1886.

Steiner R. Wahrheit und Wissenschaft. Dornach: Rudolf Steiner Verlag Rudolf Steiner Gesamtausgabe 3, 1892.

Steiner R. Filosofie der Freiheit. Dornach: Rudolf Steiner Verlag Rudolf Steiner Gesamtausgabe 4, 1894.

Stolper E et al. Gut Feelings as a Third Track in General practitioners' Diagnostic Reasoning. J Gen Intern Med 26(2): 197-203.

Swaab D. Wij zijn ons brein (We are our brains). Amsterdam: Uitgeverij Contact, 2010.

Swets M, Middeldorp CM, Schoevers RA. Heredity and Environmental Influences in Psychiatric Disorders (Erfelijkheid en omgevingsinvloeden bij psychiatrische stoornissen) . Tijdsch Psychiatrie 2009; 9: 651-655.

Sijmons J. Phänomenologie und Idealismus. Thesis. Basel: Schwabe Verlag, 2008.

Tellingen C van, Bie G van der. Respiratory System Disorders and Therapy. Bolk's Companion 2009.

Verhulst J. Der Erstgeborene. Stuttgart: Freies Geistesleben GmbH, 1999.

Watters E. DNA is not destiny. The new science of epigenetics rewrites the rules if disease, heredity, and identity. Discover Vol. 27, No. 11; November 2006.

Wehrli U. Tidying Up Art (Kunst aufräumen). Prestel Publishing 2003.

Witte B. u.a. (Hrsg.): Goethe-Handbuch, Band 4/2 Verlag J.B. Metzler, Stuttgart/Weimar 1998.

Zajonc A. Catching the light. The Entwined History of Light and Mind. Oxford University Press, 1995.

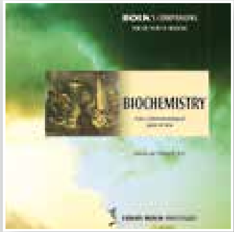
BOLK'S COMPANIONS FOR THE STUDY OF MEDICINE

Other publications in the series:

Embryology
Early Development from a Phenomenological Point of View

Guus van der Bie, M.D.
Publicationnumber GVO 01

Can we give a scientific basis to our feeling that humans have unique human features? Are the human mind and the human organism 'nothing but' another variation of animal life? Can we find answers for the questions that satisfy both head and hart?
How these quetions are answered depends on the scientific method we use: the current scientific method to learn about biological facts and the phenomenological method to understand more about the meaning of these facts.
Early embryological development can teach us about the unique and characteristic qualities of the human being.
The result is, for example, a possibility to understand the relation between consciousness, psychology, and behavior and the shape of the body.



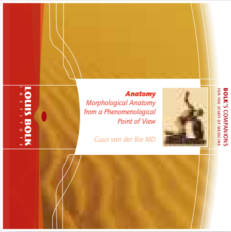
Biochemistry
Metabolism from a Phenomenological Point of View

Christina van Tellingen, M.D.
Publicationnumber GVO 02

Biochemistry offers insight into the continuous changes within the human organism. But can we maintain awareness of the coherence of the (changing) organism as we study the details? How can the many processes be understood as prototypical aspects of a unique organism?
The scope of the answers to these questions can be enhanced by using a combination of the current scientific method and a phenomenological method developed specifically to research the coherence of processes within living organisms. The current scientific method is used to discover biological facts. The phenomenological approach helps us in finding the meaning of the facts.
What emerges is a new grasp of the interrelations between biological processes, consciousness, psychology, and behavior.

BOLK'S COMPANIONS FOR THE STUDY OF MEDICINE

Other publications in the series:



Anatomy
Morphological Anatomy from a Phenomenological Point-of View

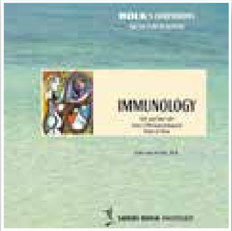
Guus van der Bie, M.D.
Publicationnumber GVO 03

Can we give a scientific basis to our feeling that the human being has unique human features? Are the human mind and the human body 'nothing but' another variation of animal life? Can we find answers for these questions that satisfy both our head and our heart?
How these questions are answered depends on the scientific method we use. In this publication two methods are used: the current scientific method to learn about anatomical facts and the phenomenological method to understand the meaning of these facts.
Human morphology can then be understood as an expression of the unique and characteristic qualities of the human being.
This results in new possibilities for understanding the relation between consciousness, psychology, behavior, and morphological aspects of the body.

Physiology
Organphysiology from a Phenomenological Point of View

Christina van Tellingen, M.D.
Publicationnumber GVO 04

Can physiology give more insight into the living human organism than the mere facts reveal at first? Is the level of activity the same for all organs? Are the vital qualities at work in organs unique for organisms and limited to biological activity? Can we find a scientific basis to research the coherence between organ systems?
By enhancing the current scientific method with phenomenological points of view we can find meaning in the facts and understand them as an expression of life itself. The phenomenological method makes the relation between organs visible and comprehensible. It approaches scientific facts from the point of view of their coherence and can give totally new insights this way.
What emerges is a grasp of the interrelations between biological processes, consciousness, and nature.



Immunology
Self and Non-self from a Phenomenological Point of View

Guus van der Bie MD
Publicationnumber GVO 05

Why write this new booklet on immunology when there are already so many excellent texts on the subject? This Companion is about questions such as: why is it that the immune system functions as one organ? What coordinates the immunological functions?
Here, an attempt is made to develop a viewpoint to answer these questions. By using a phenomenological approach, the factual knowledge obtained through reductionism is placed in a larger perspective.
The concept that is presented in this Companion is derived from the functioning of organisms, observed in the way that was introduced by Goethe in his phenomenological method. This also includes the acquisition of insight into the holistic concept behind the immune system. Moreover, the organism as a whole can then be seen as an expression of the same concept.

Pharmacology
Selected Topics from a Phenomenological Point of View

Christina van Tellingen MD
Publicationnumber GVO 06

Pharmacology gives us insight into the way organic processes change when foreign compounds are introduced into the organism. Pharmacology is a changeable subject, depending on the needs and knowledge of the time. Can we find an inner coherence in the manifold ways compounds influence organisms? What should such a framework be based on? How can we understand the effect on human consciousness that most compounds have?
We can enhance the scope of the answers to these questions by using a combination of the current scientific method and a phenomenological method. It illuminates the known facts about the activity of compounds in organisms, and provides the means to find their significance.

The Healing Process
Organ of Repair

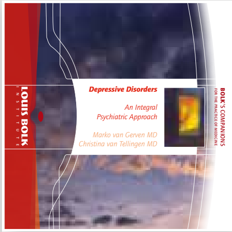
Guus van der Bie MD
Tom Scheffers MD
Christina van Tellingen MD
Publicationnumber GVO 07

After finalizing the series BOLK'S Companions for the Study of Medicine for the moment, this module on The Healing Process introduces a new series of BOLK'S Companions that studies the Practice of Medicine. In it, we research the healing process itself. There proved to be an enormous volume of scientific literature on the subject. It is easy to loose oneself in the countless details included in the descriptions of this process.
The phenomenological method of systems biology makes it possible to examine physiological and pathological processes in terms of the processes themselves. This results in a characterization of the various phases of the wound healing process. Out of this, new insights into the origin of health and disease emerged that also offer possible leads for medical practice.

Respiratory System
Disorders and Therapy
From a New, Dynamic Viewpoint

Christina van Tellingen MD
Guus van der Bie MD (eds.)
Publicationnumber GVO 08

In this Companion, the experience of three of our own patients with asthma and pneumonia is used as backdrop for our study of airway disorders. Nearly all of us have had some experience with respiratory disease, given that colds, flus, sinusitis, and bronchitis are so common. Most physicians and therapists know people with asthma and pneumonia from own experience and will readily recognize the descriptions we provide.
The experience with these patients leads us through a study of airway disease which eventually opens up to a wider view with new insights and innovative avenues of treatment for respiratory disorders in general.
Our research has alerted us to the part rhythm plays in the healthy respiratory tract and in the treatment of its disease. Rhythm, consequently, is the subject of the final paragraphs of this Companion.



Depressive Disorders
An Integral Psychiatric Approach

Marko van Gerven MD
Christina van Tellingen MD
Publicationnumber GVO 09

The treatment of depressive disorders is increasingly under scrutiny. We classified the risk factors of depressive disorders according to the scientific method applied in systems biology and phenomenology. The ordering in four biological levels that resulted from this, helps clarify the causes of the disorder. Together with the developmental history, it can lead to an individualized treatment of the patient, tailored to his or her specific situation. The treatment aims at restoring the deficient forces of self-healing.
This Companion presents a working model based on this methodological approach, as well as a variety of case histories to illustrate how applying this model can aid diagnosis and treatment in practice. Tables are added ordering well-researched regular and integral treatment methods according to the four biological levels.

For ways to order the Companions see inside of front cover or check our website: **www.louisbolk.org/companions**

Wholeness in Science

A Methodology for Pattern Recognition and Clinical Intuition

How do you develop clinical intuition? How do physicians gain practical knowledge about disease?

The above questions are vital for medicine. Diseases do not merely concern a partial defect, they recreate the life of the patient. At the hand of Pfeiffer's disease, the author shows that experienced physicians conceive of diseases as integrated concepts, which they can apply to the individual situation of the patient. Their clinical intuition is a form of pattern recognition and pattern recognition supports the ability to recognize an integrated 'whole.'

This Companion presents practical exercises that allow readers to train and expand their ability of pattern recognition through Goethe's methodology. Questions and introspection aid them to become aware of what they did. This makes obvious that clinical intuition, as experiential knowledge, can become a skill that is actively developed.

Two comparative studies demonstrate that a 'science of wholes' broadens our knowledge and orders the abundance of scientifically discovered details in its context thereby gaining meaning and understanding.

the natural source of knowledge