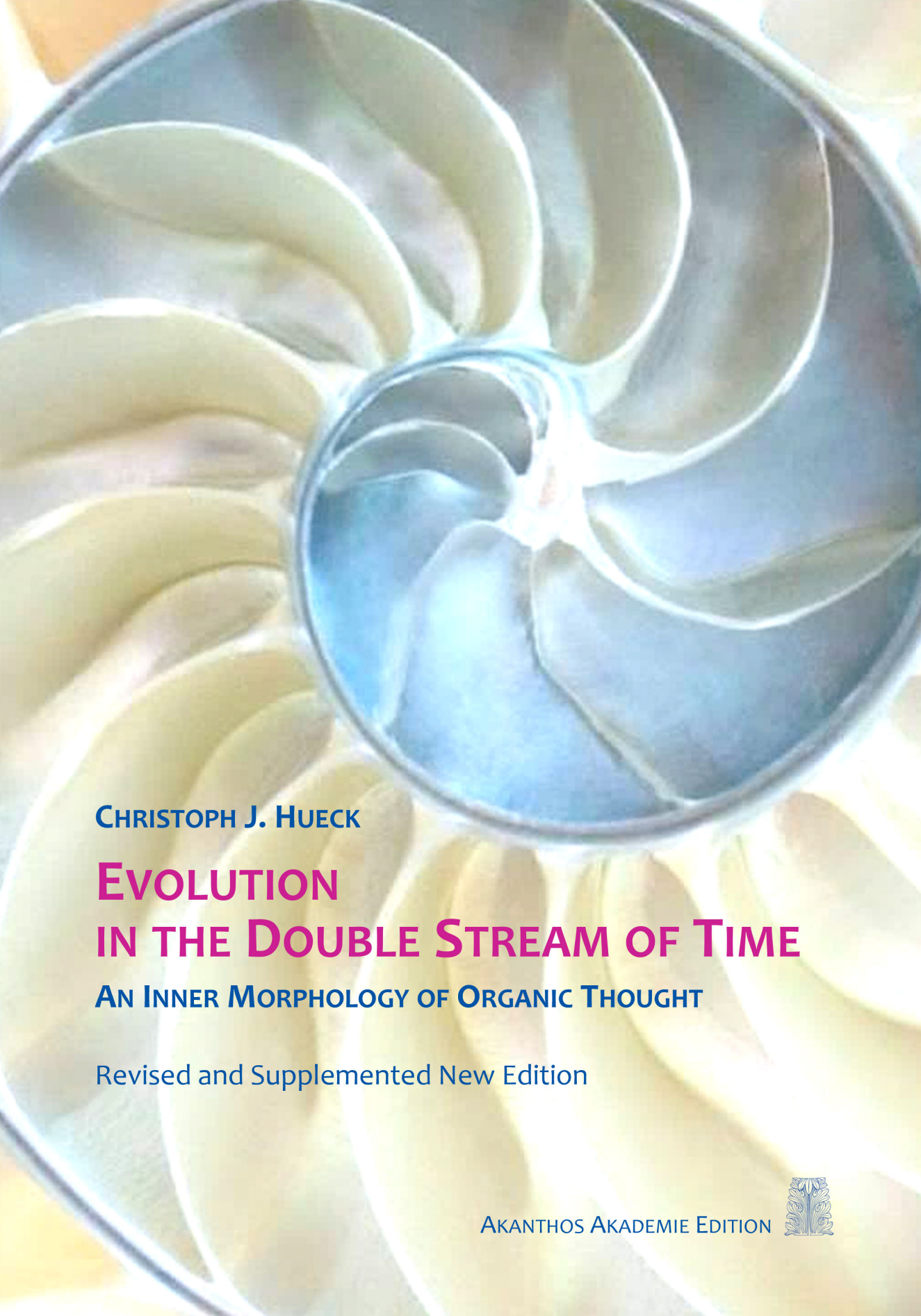

CHRISTOPH J. HUECK

EVOLUTION IN THE DOUBLE STREAM OF TIME

AN INNER MORPHOLOGY OF ORGANIC THOUGHT

Revised and Supplemented New Edition

AKANTHOS AKADEMIE EDITION

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Man knows himself only by knowing the world,
which he perceives only in himself
and himself only in it.

J.W. Goethe

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PREFACE

Why has evolution progressed to humans and not stopped with the fish or elsewhere? Do we owe our existence to a chain of coincidences stretching over millions of years? Can life have arisen from dead matter at all?

The answers that natural science gives to these fundamental questions cannot suffice for deeper thinking. For life and its evolution cannot be explained in a materialistic and causal-analytical way (which is explained in detail in this book), and 'evolution by chance' is not an explanation. Even a systems biology view, which understands the living as a complex of interdependencies[1], cannot explain why development in the course of evolution has proceeded in this way and not quite differently.

In this book it is shown that any materialistic, Darwinian or even systems biology explanation of evolution overlooks a crucial factor, namely cognitive consciousness. Here an attempt is made to answer the above questions by understanding cognition not as an uninvolved bystander but as an integral part of reality. From the perspective of cognition, it emerges that evolution was not a random event, but an organic process that can be seen as the becoming of man.

Again and again, there were researchers who understood evolution as the becoming of man. Among them were Karl Snell (1806-1886), Wilhelm Heinrich Preuß (1843-1909), Johannes Ranke (1836-1916), Louis Bolk (1866-1930), and Edgar Dacqué (1878-1945). Like Charles Darwin (1809-1882), they were convinced of the common descent of all organisms, but in contrast to Darwinian materialism, they saw human beings not as the product of chance, but as the principle and goal of evolution. Rudolf Steiner (1861-1925) also understood evolution in this sense, and he too referred to Darwin and in particular to Ernst Haeckel (1834-1919). Steiner, however, believed that one must still „*add the spirit*"[2] to the theory of descent to arrive at a

[1] See e.g. Capra & Luisi (2016); Noble (2008); Rosslenbroich (2020).

[2] Steiner, 1903-1906, GA 054, p. 18–19, 05.10.1905 Citations from Rudolf Steiner's lectures are presented by Collected Works (GA), page(s) and date of lecture (in German date format).

realistic understanding of the position of man in evolution. This did not mean another theory, but a view and understanding of the real spiritual forces at work in evolution.

Steiner referred to the metamorphosis teachings of Johann Wolfgang von Goethe (1749-1832) and to Goethe's method of 'contemplative power of judgement' ['anschauende Urteilskraft'], which can lead to the concrete observation of the spiritual forces and laws at work in the development and evolution of organisms. The addition of the spiritual Anschauung to the theory of evolution can bridge the gap between human consciousness and organic development that biology has always struggled with. How this 'addition of the spirit' to the study of life and evolution can be understood is presented here.

Building on Steiner's many suggestions and using Goethe's method, several researchers have further elaborated the understanding of evolution[3] and described such important findings as the morphological[4] and developmental[5] special position of humans, the fundamental importance of the upright posture for human development[6] or the increase in organismic autonomy during evolution[7], which then also entered 'mainstream' science at least in part.

But even among Goethean researchers the question of the purposefulness of evolution is controversial. Wolfgang Schad saw evolution as "*open to the future*", a "*learning on Earth with an open outcome*"[8]. During the final work on this second edition, Wolfgang Schad passed away. I owe him much.

Tübingen, autumn 2023
Christoph Hueck

[3] Bosse (2002); Husemann (2015); Kranich (1989); Suchantke (2002).
[4] Poppelbaum (1928); Schad (1965); Verhulst (1999).
[5] Kipp (1980).
[6] Schad (1985).
[7] Rosslenbroich (2007, 2014).
[8] Schad (2013), p. 64.

INTRODUCTION

In the year of the first publication of this work[9] a book by the American philosopher Thomas Nagel appeared with the provocative title *Mind and cosmos – why the materialist, neo-Darwinian conception of nature is almost certainly false*. Nagel makes it clear that materialism cannot explain the origin of life and consciousness, nor the fact of knowing and understanding (true/false), nor the reality of human value concepts (good/evil). These higher areas of the reality cannot be understood from the interactions of smallest material particles (nor, one might add, from quantum mechanics). One must work with adequate facts if one wants to understand the world, and life, consciousness, cognition, and values belong to the whole. Nagel, however, does not want to believe in an extra-worldly creator either, but wants to find principles *within* nature that point beyond a mere physical explanation. He is convinced "*that the mind is not merely an afterthought or accident or additional equipment, but a fundamental aspect of nature.*"[10]

At the end of his treatise, Nagel predicts the dawn of a new worldview that will centre on life and consciousness. Through a "great cognitive shift" one will learn to view consciousness as an objective and world-encompassing reality. And this worldview will include teleological aspects. Darwinism would have to be supplemented by the assumption of a purposeful force in nature: "*The teleological hypothesis states that life, consciousness, and values are determined not only by value-free chemistry and physics, but by a cosmic disposition that has led to their formation*"[11].

The aim here is to show a way in which Nagel's teleological hypothesis can be substantiated and confirmed. In doing so, I refer to Rudolf Steiner's theory of knowledge and his understanding of evolution. According to Steiner, the knowing consciousness is not simply a mere spectator of an external reality, but the stage ['Schauplatz'] on which reality is constituted in each individual act of cognition. The introspective observation of this act and the mental faculties involved in it can be carried

[9] Hueck (2012).
[10] Nagel (2012), p. 30.
[11] Ibid., p. 123.

out just as precisely as the investigation of the external nature. Applying the method of introspective observation to biological cognition opens an experiential approach to the riddles of life. A holistic view of evolution therefore does not require a turning away from the scientific method, but rather its expansion through the introspective self-observation of cognition. One works with facts found through empirical research and links them through thoughts that closely follow the phenomena, and in addition one observes *how* one grasps the facts and thinks their connections.

The consideration of cognition is also necessary because any theory of evolution needs a solid foundation. Nagel pointed out that "*the attempt to understand oneself in evolutionist ... terms must eventually find its ground in something that is understood to be valid in itself – something without which evolutionist understanding would not be possible.*"[12] Thus, one cannot call oneself and one's own knowledge an accidental product of evolution, for a statement, if it is to be true, must not negate the foundations that make its truth possible. It must therefore not be a coincidence (or, which amounts to the same thing, be based on foundations that have arisen by chance: brain, etc.), for otherwise something quite different could be true with equal justification.[13]

Every statement about the world presupposes the person making the statement and their realization of it. The knowing consciousness cannot be omitted from science. It is inescapable. The introspective self-view of cognition therefore provides the secure ground for understanding life and its development. Steiner once formulated this as follows: "*Nothing in the cosmos is considered at all without having the human being in it. Everything gets sense and at the same time ground of knowledge only by the fact that one considers it in relation to the human being. Nowhere is the human being excluded. Anthroposophically oriented spiritual science leads our view of the world back again to a view of the human being.*"[14] Introspective consideration of evolutionary cognition will therefore also lead to insight into man's place in evolution.

[12] Ibid., p. 118.
[13] For a short discussion of the so-called 'evolutionary theory of knowledge', which states that cognition developed because of selective adaptation, see Appendix, p. 178.
[14] Steiner, 1921, GA 338, p. 114, 15.02.1921.

This book builds on manifold works of biologists and physicians who, following Steiner, have done research according to Goethe's method. Especially Jochen Bockemühl, Dankmar Bosse, Armin Husemann, Friedrich Kipp, Eugen Kolisko, Ernst-Michael Kranich, Herrmann Poppelbaum, Bernd Rosslenbroich, Wolfgang Schad, Andreas Suchantke and Jos Verhulst are to be thanked for essential points of view.

In the first part, life and biological cognition are examined, a holistic concept of the organism is developed and deepened by a phenomenological view of time. In the second part, the knowledge gained is applied to biological development, molecular genetics, and the evolution of man. The presentation does not presuppose specialized knowledge of biology. The book is addressed to all who are interested in a scientific path beyond the one-sidedness of Darwinism. It wants to show that evolution can be understood under full consideration of natural scientific facts as a meaningful and purposeful, organic overall process, in a word as becoming of man.

Part I

The Enigma of Life, Knowing Consciousness and Time

1 The Question about Life

To investigate life, one must participate in life.[15]
(Viktor von Weizsäcker)

Have you ever watched a plant grow? Take an avocado, for example. First, you must soak the egg-sized brown pit in water for weeks until it begins to sprout roots, and then place it in a pot of soil. After some time, the mighty structure breaks apart and a thin, brown-purple shoot appears in the gaping crevice. Again, a little later, the first light green leaflets can be seen, which over the next few weeks, accompanied by the vigorous growth of the stem, unfold more and more. Soon there is a plant with large lanceolate leaves at the window.

What force propels this figure as if out of nowhere? Is it merely physical and chemical interactions? No machine, no matter how intelligently constructed, can accomplish something similar. Nevertheless, most biologists think that living things are machines that function according to physical and chemical laws. But why do these 'machines' form shapes? Why do living cells develop into plants, animals, and humans? And why do they develop into these particular shapes - because completely different ones would also be conceivable? Since Charles Darwin (1809-1882) the answer is simply: "by (useful) chance". During evolution, supposedly random changes in the forms and functions of organisms are said to have improved their chances of survival in the 'struggle for existence' and were therefore preserved.

An alternative to this ultimately gloomy picture is the religious view that looks for the intervention of an otherworldly Creator God in nature. Instead of Darwinian chance, one believes in a higher wisdom and will of creation. Thus, evolution supposedly takes on meaning, but one cannot really say how God created the organisms. Did he create the first living cell in a kind of heavenly laboratory and then put it in earthly conditions...? Materialism does not know *why*, creationism does not know *how* the organisms came into being.

[15] Weizsäcker (1942).

I do not go into more detail about creationism because, as Darwin remarked, it does not provide a real explanation for natural phenomena: "*According to the ordinary view of the independent creation of each species, it can only be said that it is so, and that it pleased the Creator to build all animals and plants ...; but this is no scientific explanation*."[16] But also the attempt to explain life materialistically falls short, because the genetic and biochemical processes taking place in the organism always presuppose life. Genes, proteins, and biological metabolism exist only in living beings, and they can be understood only in a living context. Every biochemist assumes at least a living cell when he speaks of 'metabolism', every geneticist implies an organism when he thinks of 'gene'. Molecular biology describes the necessary conditions under which life exists, but these conditions are far from sufficient to explain life itself. By isolating individual components from the living whole, one destroys the context from which they originate. But then life is no longer present, and the biologist must reassemble the whole in his imagination – the result of this operation is the living organism presupposed from the beginning. "*Whoever wants to recognize and describe something living / Seeks first to drive out the spirit / Then he has the parts in his hand / Missing, alas! only the spiritual bond*", Goethe says.

It is not the genes that explain the organism, but the organism that explains the genes. Unfortunately, this simple truth is rarely seen clearly. The suggestive power of reductionist 'explanations' is so strong that the primacy of the living organism is often simply forgotten. (However, so-called epigenetics has put a dent in the view of genetic causation.[17] It shows that not only the genes control the organism, but also the organism controls its genes. Here, as everywhere in life, we are not dealing with simple causality.)

Life is continuous development and transformation, a constant invisible flow that creates visible forms and also dissolves them again.[18] Doesn't its flow have to be understood differently from the parts that swim along in it? If you look only at these parts, you miss the essence. You have to understand the living whole to understand the essence and effect of the individual parts. One

[16] Darwin (1859), p. 518.
[17] Cf. e.g. Bauer (2008); Kegel (2009).
[18] Overview in Nicholson & Dupré (2018).

must "*not deal with nature separately and singly, but represent it acting and living, striving from the whole into the parts*"[19], as Goethe expressed it in his famous first conversation with Schiller about the primordial plant ['Urpflanze'].

Biologists and philosophers have repeatedly spoken of a 'life force' by which living bodies differ from dead ones. Aristotle called it 'entelechy' (from en-telos-echein: to have one's goal in oneself), Immanuel Kant a 'natural purpose', Henri Bergson the 'élan vital', Hans Driesch saw in it an immaterial factor present in the cells of an organism, Adolf Portmann paraphrased it as 'self-representation', Rupert Sheldrake called it the 'morphogenetic field', and so on.[20] However, as long as this force is considered as analogous to a physical force of nature, it must prove to be scientifically elusive. Thus Ernst Mayr (1904-2005), one of the most influential biologists of the 20th century, wrote: "*The logic of the vitalists was faultless, but all their efforts to find a scientific answer to the so-called vitalist phenomena were failures. Generations of vitalists laboured in vain to find a scientific explanation of the vital force*."[21]

Mayr is right insofar as life eludes observation if one looks for it like an object. Precisely because life flows continuously, it cannot be a single thing (or a force acting only presently). If one wants to grasp the flow of life like its parts, one reaches into the void. One must participate in the process of life, follow it and grasp it, if one wants to understand it. Then one finds out that there is an intimate connection between the organisms and oneself, a bridge which leads to the reality of the living.

This bridge is what we are talking about here. It will be seen that it is related to the experience of time, indeed that it is virtually 'made of time'. For we live in time. And the qualities of time can only be grasped inwardly; it is not an externally visible phenomenon (for the change in the position of the sun, the advance of the hands of the clock are only spatial changes). Through the inner observation of time one can recognize what life is. Time lived and experienced is the medium that connects life and cognition.

[19] Goethe (1817), p. 867.
[20] For an overview see Mayr (1998).
[21] Mayr (2002).

We are usually not fully aware of the flow of life. We see the small avocado plant today and the somewhat larger one tomorrow – but we do not see the living development that lies in between. However, it is possible to consciously 'dive' into this development process. One can actively imagine the changing organism and thus comprehend its development. Such observation of nature, not just observing and noting, but actively participating, opens an inner field of experience in which the living and transforming forces of the organic can be observed and explored. How this observation is possible, and to which results it can lead is described here in detail.

A procedure in which the research contents only appear through the activity of the observer seems to contradict the conventional view of natural science, which aims precisely at the elimination of all subjective influences. However, this objection cannot prevent one from carrying out the inner observations oneself. One can proceed as in an empirical science, even if one produces the facts to be observed oneself. Of course, one must be as conscientious in doing so as in any other science. One must strictly adhere to the phenomena, strive for the greatest possible freedom from contradiction in the explanations, the results must be intersubjectively reproducible and permit predictions which in turn can be confirmed by observation, and so on.

We do not want to presuppose theories about life and its forms, but simply turn to biological phenomena with an open mind and answer our own questions ourselves. We look at all biological phenomena: from living organisms to their organs, metabolism, and genes, to the fossils that tell of their evolution. In doing so, we challenge common explanations, however familiar they may be. We want to illuminate and explore the preconscious knowledge about living things that implicitly underlies all biological knowledge. We are interested in *how* life, organic development, and evolution are thought. We want to develop and ground a *morphology of evolutionary thought* through introspective empirical observation.

2 The Transition from Idealistic to Materialistic Biology in the 19th Century

It may be truly said that I am like a man who has become colour-blind.[22]
(Charles Darwin)

2.1 The Organism as an Interplay of Form and Function

Every living being appears as a Gestalt. A daisy, a butterfly, a sheepdog, or a chimpanzee can be recognized at first glance by their shapes. Many organic shapes appeal to the aesthetic sense through wonderfully harmonious proportions.[23] However, they are not only harmonious, but also surprisingly functional. There is hardly a feature in the vast realm of living things that is not useful for the life of the individual organism or its species.

Shape and purpose, form and function are closely linked in an organism. Different organic forms show a high degree of similarity and at the same time differ according to their function. Charles Darwin, amazed at this connection, wrote: "*What can be more curious than that the hand of a man, formed for grasping, that of a mole for digging, the leg of the horse, the paddle of the porpoise, and the wing of the bat, should all be constructed on the same pattern, and should include the same bones, in the same relative positions*?"[24] Thus the vertebrates are formed according to a general *type* which is modified by the external conditions of life of the particular species. "*It is generally acknowledged that all organic beings have been formed on two great laws: unity of type, and the conditions of existence.*" (pg. 183).

We will not discuss the primacy of one or the other law here but ask how these two are experienced in the introspection of cognition. How does one think the form, and how the function? Which thoughts and thought movements are tacitly assumed and carried out? We approach these questions by looking at two historical figures who each represented one of the two principles

[22] Darwin (1887), p. 46.
[23] Doczi (1981).
[24] Darwin (1861), p. 377.

in a typical way: the morphologist Richard Owen and the Anglican clergyman William Paley.

2.2 Relationship of Forms – Richard Owen and the Archetype

Richard Owen (1804-1892), founder and first director of the Natural History Museum in London, was an important advocate of the typological view. He carried out extensive studies on the structure of vertebrates. He was sent specimens of newly discovered species from all over the world, and Darwin himself entrusted him with the study of fossil mammal skeletons that he had brought back from his research trip to South America.

Owen was particularly interested in the limbs of vertebrates and wrote a famous comparative study of their structure. He found the same construction principle everywhere: one bone in the upper arm, two in the forearm, several small carpal bones, five bones in the metacarpal, five fingers. In animals with fewer than five fingers (or toes), in cows, horses, birds and others, he and other researchers were able to show that these are only deviations from the basic pattern in which some elements have been lost.

Richard Owen saw the explanation for this uniform blueprint in an underlying common *idea* or, as he called it, a common 'archetype'. He imagined this archetype as originating from the spirit of God, which preceded the individual animal forms and was realized in each of them in a particular way. At the end of his treatise *On the Nature of Limbs*, published in 1849, he wrote: "*The archetypal idea was manifested in the flesh, under divers such modifications, upon this planet, long prior to the existence of those animal species that actually exemplify it. To what natural laws or secondary causes the orderly succession and progression of such organic phenomena may have been committed we as yet are ignorant. But if, without derogation of the divine power, we may conceive the existence of such ministers, and personify them by the term 'nature', we learn from the past history of our globe that she has advanced with slow and stately steps, guided by the archetypal light, amidst the wreck of worlds, from the first embodiment of the vertebrate idea under its old ichthyic* [fish-like, note CH] *vestment, until it became arrayed in the glorious garb of the human form*."[25]

[25] Owen (1849), p. 86.

In these words still lives a sense of reverence for something that Owen saw as spiritual in nature and in the human form. Ten years later, this feeling and view would be swept away by Darwin's theory of evolution.

Owen is famous for his definition of the concept of biological homology as "*the same organ in different animals under every variety of form and function*"[26]. What happens in the knowing mind when we grasp the similarities between different forms? *What* you grasp could easily be captured as an abstract schema. But *how* does one grasp this schema (Fig.)? You form it while observing a single form and keep it when you move on to the next one; it can be changed by each new form and still retains what these forms have in common.

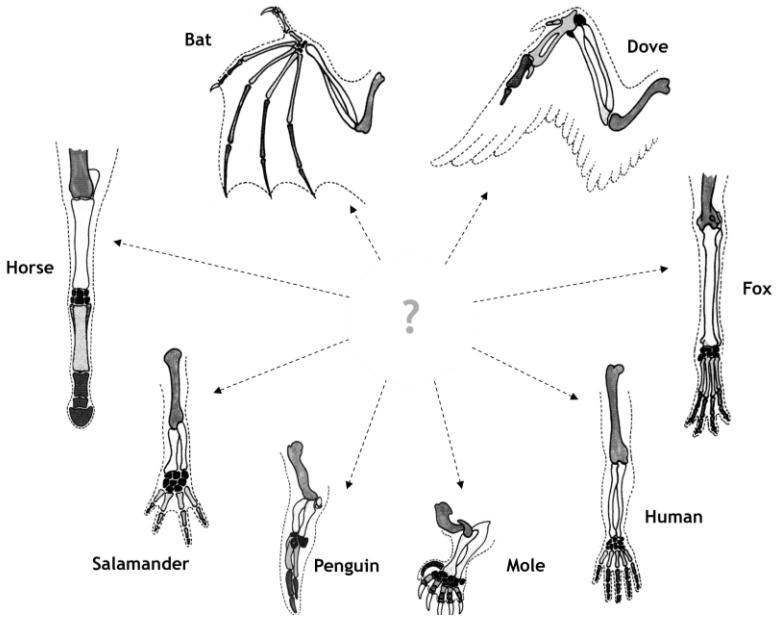

Fig. 1. How does one recognize relationship of form? Limbs of different vertebrates; homologous bones are drawn in the same grey (after Suchantke[27], modified).

The easiest way to approach this commonality is to let one form slowly merge into another in the imagination. To turn a

[26] Owen (1843), p. 674.
[27] Suchantke (2002).

mole's hand into a bat's wing, you need to lengthen the humerus, ulna, and radius, remove the extra digging claw, and greatly lengthen the bones of the hand and fingers. To obtain a horse's leg, the entire structure must be stretched, the bones must be made more stable, those of the forearm, metacarpal and phalanges must be fused, and the nail of the middle finger must be thickened as a hoof. During these metamorphoses, an inner, morphological-plastic activity takes place. Although this activity is subjective, it is not arbitrary, because it is guided by the phenomena.

Such an activity underlies all recognition of similarities, as is constantly practiced in biology. But it is hardly ever consciously reflected upon. Biologists ask about the biological cause of the similarities, but they do not ask *how* they recognize them. The recognizing mind is only treated as a spectator, as an unreal addition to world events. However, it is the inescapable scene of the world.

If you follow the changes in form slowly and actively, you can also experience how the limbs correspond with the movement in the respective environment: the bat's wing with the air, the mole's hand with the earth, etc. The inner movement that imitates natural phenomena also leads to a vivid experience (not just an abstract and pale idea) of the natural connections between the phenomena.

It is also possible to observe how, during the transformation of one form into another, one passes through a general state from which the specialized forms are derived. In biology, this general state is called 'type'.[28] Some biologists consider typological thinking to be an anti-evolutionary and potentially dangerous idealism.[29] But even they also always work with typological cognition, because biology always presents similarities.

For a living cognition, the type is not a rigid 'blueprint', but a dynamic active principle that is just as mobile in the knowing consciousness as it is in nature.

Richard Owen wrote that the archetypal idea must have existed long before the appearance of man in God's spirit: "*Now, however, the recognition of an ideal exemplar for the vertebrated animals proves that*

[28] Toepfer (2011), p. 537-565.
[29] Mayr (2002).

the knowledge of such a being as man must have existed before man appeared. For the divine mind which planned the archetype also foreknew all its modifications."[30] If one wants to penetrate to the reality of this idea itself, one must seek it out where it can be experienced, namely within the knowing consciousness. One must not externalize it, or one will quickly arrive at something unreal. Owen's formulation illustrates this dilemma of idealistic biology. On the one hand, he grasped something of the living efficacy of the type; on the other hand, his conception of a divine mind that planned the archetype seems shadowy and pale – a projection of his own mental activity into an imagined beyond. This idealistic conception of nature was too weak to resist or even prevail against the emerging materialistic naturalism.

Charles Darwin sought a natural explanation of the similarities of form and found the key to it in the idea of descent. For him, organisms did not merely coexist, so that the observer could only seek the connection between them in the mind of 'God'. "*On my theory*," he wrote, "*unity of type is explained by unity of descent*."[31] All four-legged vertebrates, he said, were similar because they descended from a common ancestor which was also already organized according to the same blueprint. In the fossil finds of primeval vertebrates this theory found a brilliant confirmation as a matter of course.

Owen and Darwin had basically the same empirical material: recent animals and fossil skeletons. Both recognized the unity in diversity. One interpreted it idealistically, the other materialistically. Darwin simply 'folded down' Owen's view into the material, so to speak. His interpretation corresponded to the spirit of the time.

But Darwin's conception also presupposes typological thinking because the similarities between ancestors and descendants can be recognized only in this way. By the conception of common descent, however, one has hardly any more reason to reflect on the formative thinking, which determines this similarity, by introspective self-observation of cognition.

[30] Owen (1849), p. 86.
[31] Darwin (1859), p. 237.

2.3 The Purposeful Function – William Paley and the 'Argument from Design'

Now what about function? The perfect correspondence of form and function, the purposeful design of living things, has always fascinated naturalists. The Anglican clergyman William Paley (1743-1805) placed functionality at the centre of his argument in his influential book *Natural theology: or evidences of the existence and attributes of the deity, collected from the appearances of nature* (1802). Paley is an exponent of the physical theology that had been widespread since the late 17th century, which sought to prove from the works of nature the existence of a divine Creator.[32] The perfection of organisms, Paley argues, suggests not only divine creation in general, but also God's character and goodness: "*The hinges in the wings of an earwig, and the joints of its antennas, are as highly wrought, as if the Creator had had nothing else to finish. We see no signs of diminution of care by multiplicity of objects, or of distraction of thought by variety. We have no reason to fear, therefore, our being forgotten, or overlooked, or neglected.*"[33]

At the heart of Paley's argument is the famous watchmaker analogy, with which he became one of the fathers of the concept of 'intelligent design': "*When we come to inspects the watch, we perceive … that its several parts are framed and put together for a purpose.* (pg. 7) … *Every indication of contrivance, every manifestation of design, which existed in the watch, exist also in the works of nature; with the difference, on the side of nature, of being greater and more, and that in a degree which exceeds all computation.*"[34] With devotion and detail, Paley describes the construction of the eye, the ear, the circulation of the blood, the internal organs, the muscular and bony systems, as well as that of insects, plants, and much else, and concludes: "*The marks of design are too strong to be got over. Design must have had a designer. That designer must have been a person. That person is God*."[35]

Was it not obvious, then, to think of purposefulness as having a purpose, of purpose as having a plan, and of plan as having a planning Creator? But man knows purposeful planning only from himself. And so William Paley also projected a

[32] Michel (2008).
[33] Paley (1802), p. 280.
[34] Ibid., p. 22.
[35] Ibid., p. 229.

characteristic of his own consciousness onto a supposedly otherworldly God. Charles Darwin looked for the causes of the purposeful organization in this world, in blind and mechanically working principles of nature.

Now we want to ask also here: How does one think a purposeful organization? An insect wing, for example, serves the flying, and the flying serves the survival of the species. In this sequence of thoughts one performs a different operation than in grasping an archetype of form. In morphological typologizing one proceeds in a pictorial-comparative way, plastically transferring the different forms into each other. The thinking of functions, on the other hand, does not proceed pictorially, but relationally. The idea of purpose is not directed at the form, but at its meaning: Something is good for …, it serves the survival of the species, because … etc.

It has often been pointed out that the real meaning of Darwin's theory lies in the idea of the change of all beings with time. In a certain way, however, temporal understanding already lived implicitly in the views of William Paley and Richard Owen. For the idea of purposeful functionality refers to the future. In thinking a purpose, the expected future result of a process is anticipated, brought back into the present, so to speak. Functions have a meaning for the future survival of the organism.

And as the thinking of purpose uses expectation, so thinking of shape-variation uses memory: one sees a shape and compares it with the previous one still present in memory. Expedient-functional thinking is anticipatory, it actualizes the future; archetypal-formal thinking is anamnestic, it actualizes the past. These two principles of cognition are fundamentally important in all biological comprehension.

The relation to the past and to the future is of course also valid for the organisms themselves. An organic form is always the result of a past process from which it emerged. A biological function, in turn, always has its importance or meaning for the future of the organism.

In a sense, then, Darwinism appears as the ingenious combination of the two Gestalt principles of form and function. In Darwin's system, the time references implied by Owen and Paley, that to the past and that to the future, are made explicit.

For Darwin interpreted the archetype as common descent and thus as actual past, and the functional meaning as actual future, namely the survival of the species.

2.4 Charles Darwin and British National Economics – Instead of God, the 'Invisible Hand' of Natural Selection

Interestingly, Paley's reasoning had a formative influence on Charles Darwin, who wrote of his theological studies (which his father had urged him to pursue), "*In order to pass the B.A. examination, it was also necessary to get up Paley's 'Evidences of Christianity', and his 'Moral Philosophy'. … The logic of this book and, as I may add, of his 'Natural Theology', gave me as much delight as did Euclid. The careful study of these works … was the only part of the academical course which, as I then felt and as I still believe, was of the least use to me in the education of my mind. I did not at that time trouble myself about Paley's premises; and taking these on trust, I was charmed and convinced by the long line of argumentation.*"[36]

Darwin frequently used the same examples as Paley; indeed, he structured his arguments in a similar way, only with the sign reversed. In place of a wise, free, and benevolent Creator, he substituted a blind, necessary, and inexorable mechanism of nature. The order of nature did not arise according to a divine plan, but by the organisms acting out their innate drive to reproduce, thereby varying at random, and then preferentially retaining the best-adapted forms: "*Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows.*"[37]

Darwin drew on a line of thought that had emerged as economic theory in England in the early 18th century. It is known that his reading of Thomas Robert Malthus' *An essay on the principle of population*, published in 1798, gave him the idea of natural selection. More comprehensively than Malthus's ideas, however, Darwinism reflects the views of the British national economist Adam Smith.[38]

The metaphor coined by Smith for the principle that should give rise to order in economic systems is the 'invisible hand' of

[36] Darwin (1887), p. 67.
[37] Darwin (1859), p. 578.
[38] Gould (2002).

the market. Each market participant, he argues, strives for the greatest possible profit out of self-interest; limited demand sustains those enterprises that best adapt to market conditions in the struggle with competition. Thus, a complex economic order would emerge, which would be all the more balanced the less it was planned by the state and the more it could develop according to the forces of the market. What for Smith was creative entrepreneurial action and the competition of the free market, for Darwin became the random emergence of evolutionary innovations, the survival instinct of organisms and the 'invisible hand' of natural selection. Smith wanted to replace the state intervening from the outside in the market process, Darwin the Paleyan Creator and his comprehensive world plan.

2.5 Understanding Through Inner Experiences – Anthropomorphism in the Knowledge of Nature

To explain natural phenomena, one must seek out the forces by which they are effected. For the phenomena face the observer finished and strange; one does not know how they came into being. It is different with the forces. Everyone has a concept of what 'survival instinct' and 'struggle for existence' mean, because one can comprehend them in inner experience. The phenomena can be looked at only from the outside, but the forces causing them can be experienced internally, namely by identifying oneself with them, by 'recreating' the phenomena internally, so to speak. In every explanation of nature, therefore, there are components that make the becoming of the phenomena as comprehensible as if one had created them oneself.

Concepts always contain a volitional part, originating from inner experience. A simple example: A rolling billiard ball meets a stationary one, the latter also comes into motion. I know that I myself can set a thing in motion by pushing it. The terms 'rest', 'motion' and 'push' come from experiences I have through my own body. By associating the perception of the balls with these terms, I understand the external process. The same is true for seemingly abstract concepts. For example, I can form the idea of the three-dimensional space because I experience the three dimensions as forces through my own corporeality: the vertical in the uprightness, the horizontal in the left-right, the depth

dimension in the front-back. Even in the abstracted concept of space an inner will part still remains alive, in that I can imagine myself in any point of the space, always holding the zero point in mind and referring to it from everywhere. These are all wilful gestures, which one carries out inwardly or at least carried out when one formed the concept for the first time. However, these inner gestures usually escape attention. (One can observe them when people explain concepts, since they usually show the volitional dynamics with their hands). Finally, concepts such as 'life', 'development', 'type', 'chance', 'meaning', 'consciousness', etc. are also deposited with inner experiences, but they are not so easily uncovered by simple spatial volitional movements. We will see later that such concepts are nevertheless based on inner experiences, but on experiences in thinking.

We comprehend nature as it corresponds to our inner experiences. Our understanding of nature is necessarily anthropomorphic. Without such experiences we would have no concepts, and without concepts we could only stare at nature, but never understand it. Steiner wrote: "*All physical explanations are hidden anthropomorphisms. One anthropomorphizes nature when one explains it, one puts into it the inner experiences of man. But these subjective experiences are the inner essence of things*."[39] Similarly, Hans Jonas (1903-1993) wrote in his book *The Principle of Life*: "*Without the body and its elementary self-experience, without this starting point of our most comprehensive and general extrapolation into the whole of reality, no conception of force and effect in the world and therefore of the effective connection of all things, hence no concept of nature at all, could be gained*."[40] And Robert Spaemann (1927-2018) and Reinhard Löw (1949-1994) wrote: "*The only sure criterion for life is our self-fulfilment of life, and we attribute analogies of this life thus experienced in its fullness to other beings. … First, we live, and then we can define and abstract. But with these operations we can by no means abolish the presupposition of our own conscious life*."[41]

These quotations make it clear once again that we must include the observing mind in any scientifically sound theory of nature. Any explanation of natural phenomena that does not take the

[39] Steiner, 1884-1897, GA 001, p. 335 [transl. CH].
[40] Jonas (1973), p. 46.
[41] Spaemann & Löw (1981), p. 255.

observer into account stands on shaky ground and will ultimately lead to unsatisfactory results.

In biological questions, we will therefore always look for the inner dynamics of will and the associated experiences that underlie the ideas. In this way, the split between the observer and the organisms can be overcome. The vital and creative forces of the organism can be experienced concretely in inner self-observation.

2.6 The 'Struggle for Existence' in Inner Observation

Every living being has an innate 'striving' to preserve itself and to reproduce. It wants to 'be here' and 'stay here'. In plants this striving is an unconscious tendency, in animals it is an inner drive. According to Charles Darwin, the driving force of evolution lies in the excess reproduction of organisms: "*A struggle for existence inevitably follows from the high rate at which all organic beings tend to increase* [reproduce, note CH]."[42]

The offspring of an organism vary. For example, some are slightly faster than others, some can utilize food slightly better, etc. Organisms that are better at accessing or utilizing vital resources survive longer and, in turn, can reproduce more frequently than their weaker relatives. Since resources are only available to a limited extent, the rampancy of life pushing to reproduce is limited by external scarcity. In this way, those organisms are preserved which are most suitable for life in a certain environment, while the unsuitable ones are 'selected out'.

How does one think the concepts of 'survival instinct', 'reproduction', 'limited resources' and 'natural selection'? Which movements of thought does one carry out? On which inner experiences are these concepts based?

The thought of the survival and multiplication instinct is experienced in the inner observation like a 'pressure' working from the inside to the outside, by which living things have the tendency to spread out further and further. This 'drive' is a general principle of the living. It works also in the multiplication by cell division, in the growth of an organ or in the proliferation of a tumour. If we express the thought of growth and

[42] Darwin (1859), S. 85.

multiplication by a movement, it would be a swelling, rhythmically expanding gesture in space. – In contrast, the thought of external conditions of life, e.g. a limited food supply, is experienced as a given that opposes the dynamics of multiplication and limits the expansion of the living.

Life 'strives' for its expansion, the external conditions set a limit to this urge. This corresponds to the experience of one's own striving and the circumstances opposing it. Is Darwin not also so well understandable because one knows this – mostly egoistic – striving? Would Darwinism have found resonance in a society that was entirely characterized by mutual aid, cooperation and altruism?

That self-preservation is the driving principle in Darwin's theory has perhaps been most consistently presented by the English evolutionary biologist Richard Dawkins. He wrote, for example: "*A mother is a machine programmed to do everything in her power to preserve copies of the genes she contains*."[43] It is probably for this reason that the growth and creative powers of organisms have repeatedly been seen as the expression of an 'inner self' which expresses itself in a manner similar to a human, active 'I'. Thus Adolf Portmann (1897-1982), one of the great morphologists of the 20th century, ascribed to organisms a general 'inwardness', which, however, could not be recognized directly, but only through its expression in form and behaviour as 'self-representation': "*Self-representation is the manifestation of a self whose essence always remains hidden to us*."[44] – We will see later how we can finally become aware of this self in inner experience.

Today, instead of 'self-manifestation', one prefers to speak of the 'self-organization' of biological systems. It is compared with the spontaneous emergence of patterns in cyclic chemical reactions (Belousov-Zhabotinskii reaction). Some think to have a model for living 'systems' and to be able to explain them by the physical interactions of their parts after all. But the chemical pattern formations are so far removed from the actions and reactions of living organisms that for the explanation of life one cannot do without concepts such as self-organization, self-creation (autopoiesis[45]), self-preservation, self-determination

[43] Dawkins (1976), p. 145.
[44] Portmann (1965), p. 213.
[45] Maturana & Varela (1984).

(autonomy[46]), etc., after all, which all imply – not only in the word, but also in the inner gesture of cognition – a 'self' of whatever kind.

2.7 The Question about the Organic Gestalt

Why do organisms appear in the way they do and not in a completely different way? We can imagine completely different forms that would have been able to survive according to Darwin's theory. Why, for example, do all terrestrial vertebrates have (at most) five fingers and not four or six? Darwin's explanation is that the five fingers developed by chance in the course of evolution, and they were obviously 'good for survival'. But what would the Darwinian explanation be if we and all four-footed vertebrates had only four fingers on each hand? – It would be the same! One could apply the theory to any imaginable living form. This little thought experiment demonstrates: *Darwinian theory does not explain form*. Form is chance. The Question of form dissolves in Darwinism.

With William Paley it is 'God' who is held responsible for the certain 'being like this' of organisms, with Darwin it is 'chance'. In the inner observation 'God' appears analogous to a human subject who is experienced as a free creator, and from whose ultimately 'unfathomable counsels' the organisms are supposed to have emerged. This is not far from Darwin's 'chance'. Both concepts could also be translated as 'I don't know'.

We believe that there are comprehensible reasons for the being like this of the form of the human being and that of the animals. But it will become clear only in the further course of our discussion in which direction a reason must be searched.

2.8 Consequences of Darwinism

Charles Darwin brilliantly captured the basic temporal structure of life, the simultaneous existence of the whence and whither. But with Darwinism all meaning disappeared from the world. Darwin presupposed life as a primordial living cell ("*I may here*

[46] Rosslenbroich (2007).

premise that I have nothing to do with the origin … of life itself"[47]), while the abundance of the different forms was to be explained by meaningless multiplication, random variations and blindly selecting conditions. According to Darwin, we – and all living nature with us – are but a random product of equally random circumstances.

Owen's and Paley's views took meaning from outside the world, from the will of an otherworldly creator God who, however, is unobservable. Darwinism completely directed the view to the material phenomena. The inner spiritual connection of the human mind with nature was lost and became only externally ascertainable. The fact that Darwinism got along without supernatural causes, however, made possible its triumphal procession in western thinking. And this gave the idea of evolution its far-reaching significance for nature, culture and human self-understanding, which it has acquired ever since.

»Darwin already experienced the negative effects of his teachings on himself. In his autobiography, the great naturalist remarked, "*in my Journal I wrote that whilst standing in the midst of the grandeur of a Brazilian forest, 'it is not possible to give an adequate idea of the higher feelings of wonder, admiration, and devotion, which fill and elevate the mind.' I well remember my conviction that there is more in man than the mere breath of his body. But now the grandest scenes would not cause any such convictions and feelings to rise in my mind. It may be truly said that I am like a man who has become colour-blind.*"[48]

Here it is clearly expressed how the materialistic conception desolates man's relation to nature and affects his self-understanding. If something divine or at least meaningful is sensed and felt in nature, this sense elevates man to the certainty of a higher principle which also rules in himself. If, on the other hand, nature is perceived only as dead, material, and mechanical, then also the flame of spiritual self-consciousness dies. Perhaps, then, something meaningful and spiritual can be found again in nature if man discovers something spiritual in himself, something that carries and explains itself and, as it were, shines out of itself.

[47] Darwin (1859), p. 287.
[48] Darwin (1887), p. 100.

3 The Enigma of Development of the Living Shape

For our opened eyes
the universe is not a state,
but a process.
(Teilhard de Chardin)

3.1 The Problem of 'Primordial Generation'

The most fundamental problem of biology is the origin of life. Everyone knows that life can only come from life. »*Omne vivum ex ovo*« (Francesco Redi, 1626-1697); »*omne vivum ex vivo*« (Louis Pasteur, 1822-1895); »*omnis cellula e cellula*« (Rudolf Virchow, 1821-1902); and even: »*every gene from a pre-existing gene*« (Hermann Joseph Muller[49], 1890-1967) – even in the biotechnological age, these fundamental theorems remain unchanged.

Where does life come from then? According to today's common opinion, first there was a material planet, on which life arose only long after solidification of the first rocks. In spite of the present impossibility of primal generation it is assumed that the first organisms composed themselves spontaneously from dead components. And because this is difficult to imagine even with completely different physical-chemical conditions, one gives to the act unimaginably long periods of time, in whose darkness it is supposed to have happened then nevertheless somehow … The chemist Hans Kricheldorf writes after detailed analysis of usual hypotheses to the emergence of life: "*The numerous knowledge gaps, negative results and counterarguments … make it difficult with the present state of knowledge to accept from distant, scientific view the former existence of a chemical evolution leading to life. In spite of numerous advances … the results available so far are far from sufficient to substantiate a chemical evolution to living organisms*."[50]

Primordial generation is a Frankenstein problem: even if all the components had been assembled in the correct mutual

[49] Nobel Prize in 1946 for the discovery that radioactive radiation can trigger mutations.
[50] Kricheldorf (2019).

proportions, the whole would still have had to be set in living motion as if by an electric shock, so that all the constituent parts would turn into perpetual metamorphosis and re-generation. The structure would have had to acquire the ability to maintain and to reproduce itself, although its components are subject to permanent change.

The individual components of a living entity are also mutually dependent on each other. Metabolism, for example, can only take place within a cell. The cell wall, however, is formed from products of metabolism. Metabolism and cell wall are mutually dependent, one cannot exist without the other. The same is true for genes and proteins. The genetic code, i.e. the sequence of individual building blocks (bases) on the DNA, cannot be formed without the help of proteins, which synthesize this DNA in the first place. The proteins, in turn, are encoded by the sequence of bases on the DNA. Of course, this interdependence also applies at the level of the whole organism, whose organs are mutually dependent on each other.

Immanuel Kant (1724-1804) precisely described this interdependence of the parts of organisms in his *Critique of Judgment*: "*An organized product of nature is that in which everything is an end and reciprocally also a means. Nothing in it is in vain, purposeless, or attributable to blind natural mechanism. … An organized being, then, is not merely a machine, for this has only motive power; but it possesses in itself formative power that it communicates to matter (it organizes), which matter itself does not have. Thus a reproductive formative power, which cannot be explained by motive power alone (mechanism). … In such a product of nature, each part, as it exists only through all the others, is also thought of as existing for the sake of the others and of the whole, i.e., as a tool (organ): which, however, is not enough; … but as an organ producing the other parts (hence each mutually producing the other): … and only then, and therefore, will such a product, as an organized and self-organizing being, be able to be called a natural purpose*."[51]

Let us try to consider the thought of primordial generation in the light of inner experience. Let us think the transition from a conglomerate of dead parts to the living wholeness of an organism, and observe what we experience in the process. First there shall be immobile parts, then a living transforming whole.

[51] Kant (1790), p. 283.

First the interaction of the parts should be external, then the parts together should form a wholeness working, as it were, from within. The necessary Frankensteinian shock is a jolt that one has to give to one's own thinking in order to jump from one qualitative level to the other. The vividness and coherence of thought are lost for a moment in the process – one becomes untrue.[52]

Conversely, the step from the living to the dead is very well conceivable and – in contrast to primordial generation – is always carried out before our eyes when a living being dies and its material parts fall out of the stream of life. One cannot imagine how the living originates from the dead, but the dead can originate from the living at any time. Only this connection an unprejudiced science may state.

Thinking comes up against a real cognitive threshold if it wants to derive the living from its components. One may certainly get something like 'mental bumps and scrapes' from it. The perspective of a solution opens up only when reality is no longer sought only outside of the knowing consciousness, i.e. from the spectator's point of view.

3.2 Causation from the Future?

Another problem is the development of organisms in time. From the egg a caterpillar crawls, which changes after moults into a pupa, from which finally a butterfly hatches. The complicated processes of gestalt formation that take place in the embryo and pupa depend on the preceding developmental steps, but also follow the goal of becoming a butterfly. Each single step is lawfully embedded in the *whole* process. Always both the past has an effect after and the future before. An organism is not only a spatially, but also a temporally integrated whole.

The question of the purposeful development of organisms has occupied thinkers since time immemorial. Aristotle described it with the term entelechy (having its goal in itself).[53] By how is

[52] In a recent publication, the philosopher Christine Zunke has once again analysed the leap from causal to teleological observation that takes place during the transition from the dead to the living and which makes primordial generation unthinkable. Zunke (2023).
[53] Aristoteles (2017).

entelechy brought about? How does the chicken 'know' that it must lay eggs in order to reproduce? Can purposefulness be derived from the material constituents of the living being? Kant devoted a lengthy discussion to this question with the result that it would be possible only for a divine, what he called an archetypal intellect, to see through living, planned wholeness, but that man, to whom alone a discursive understanding, progressing from the parts to the whole, was proper, must be content with the mere description of organic goal-directedness, without being able to comprehend it as a natural property of organisms: "*We place, it is said, final causes in things and do not, as it were, lift them out of their perception*."[54]

In clear terms, Nobel Prize winner Jacques Monod[55] (1910-1976) wrote about purposeful organic development. In his book *Chance and Necessity* he provided an excellent analysis of the problem of life. He wrote about the "*fundamental property which characterizes all living things without exception: Being objects endowed with a plan which they simultaneously represent in their structure and carry out by their performances. … We say that these are distinguished from all other structures of all systems existing in the universe by the property which we call teleonomy*."[56] Similarly, evolutionary biologist Ernst Mayr stated, "*Living organisms are ... programmed for teleonomic (goal-directed) activities from embryonic development to the physiological activities and behaviour of adult organisms*."[57]

With the concept of 'teleonomy', biology attempts to solve the problem of the goal-directedness of biological processes by suggesting that they are controlled by a 'program' built into the organism. This program is considered to reside in the genes. But this notion only postpones the problem: Instead of living in the mind of the biologist, it now lives on in the imagination of what genes are supposed to accomplish. For how can genes 'know' what is to happen in the future? And how – we must ask in the light of self-observation of biological cognition – does the biologist know that genes are supposed to contain a program for future development? We will discuss the role of genes at length. Here it should only be pointed out that also for the determination

[54] Kant (1790), p. 514.
[55] Nobel Prize 1965 for the discovery of gene regulation.
[56] Monod (1971), p. 27.
[57] Mayr (1998), p. 46. See also Mayr (1979).

of genes as a program code the implicit knowledge of the living wholeness and developmental capacity of the organism must be presupposed. Without organism there could be no genes, and without the concept of organism one cannot think the concept of gene.[58]

Every single process that takes place in the development of an organism can be explained from its initial components and conditions. But *why* does it happen just at this point? – Because it prepares the next, and this again the next and so on. The position of an individual structure or process in the development of the whole can only be understood from the following steps.

Another example: In the metabolism of glucose, the sugar is first converted to a sugar phosphate. Why? Because this is what makes the following transformations possible in the first place. If the first step is considered in isolation or reproduced in a test tube, it can be explained causally from the initial components and conditions according to chemical laws. However, the *purpose* of the reaction in the whole metabolic process and in the life of the organism can be understood only from the following reactions. Each single step takes place in the organism only because and insofar as it serves the living whole.

Geneticists and biochemists therefore always imply the whole of the organism without consciously reflecting on it. If one would consider the living whole right from the start – and would not want to explain it par tout only from its parts – then a much more holistic perspective would arise. The biological context, i.e. the interaction of the organs as well as the past and future of every single developmental step, must always be taken into account, because it is the whole that determines the parts and their behaviour and only makes them understandable.

The *causes* of biological phenomena lie in the past, their *meanings* (for the development, maintenance, and survival of the organism) in the future (see Fig.). The role played by a present

[58] Robert Spaemann and Reinhard Löw also saw this clearly: "*On the basis of which properties does one know whether a system belongs to the class of living systems or not? … If the empirical-pragmatic answer is: 'living systems have a genetic programme', then it is evident that this definition was derived from an earlier study of the class of living objects, which obviously did not include this definition! It may indeed be a necessary condition for the phenomenon of life, but: Necessary conditions for a phenomenon must not be confused with the phenomenon itself!*" Spaemann & Löw (1981), p. 256 [transl. CH].

process within a living whole is derived not only from past conditions, but equally from the future goal of development. In the organism, both the past and the future are equally effective; living beings integrate them in present events.[59]

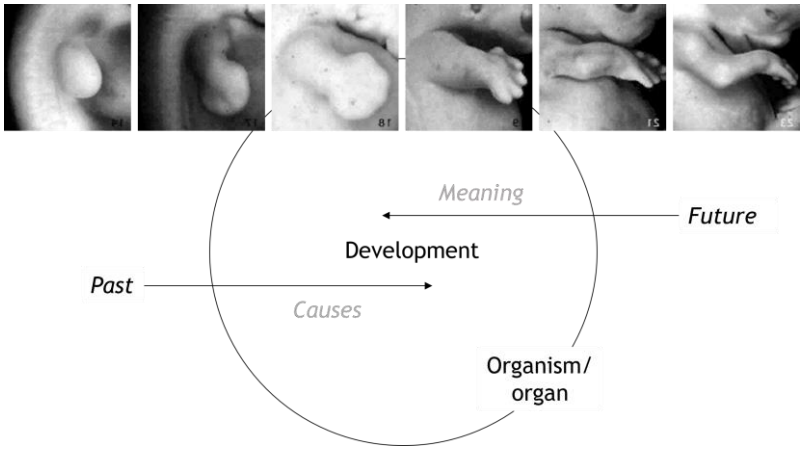

Fig. 2. The integration of causation (causality) and meaning (finality) in the organism, illustrated by the example of embryonic development of the human arm and hand. In the palm (3rd from left), both the processes that took place in the limb bud have an after-effect and the goal of development, the differentiated limb, has an advance effect.

But is it possible not only to describe this fact, but also to understand it? How can an effect happen 'from the future'? Goal-directed processes can be observed everywhere in the world of organisms, but conscious planning is known only from humans, who can anticipate the future. The involvement of a planning consciousness cannot be observed for organic development and thus cannot be established as a scientific fact. – Thus again a seemingly insurmountable threshold is erected in front of cognition.

3.3 The Living Being as an Autonomous Whole

Another fundamental property of organisms is their subjective autonomy, that is, the fact that they form themselves and keep themselves alive. Jacques Monod wrote that all man-made

[59] On biological time integration cf. Schad (1997).

objects (but also the beaver dam or the honeycomb) result "*results from the application to the materials constituting it of forces exterior to the object itself*," whereas "*the structure of a living thing emerges from an entirely different process; it owes almost nothing to the action of external forces, but everything – from its general shape to the smallest detail – to its internal, 'morphogenetic' interactions. Its structure proves a clear and unrestricted self-determination, which includes a quasi-total 'freedom' from external conditions and forces. External conditions may well impede* [or modify, note CH] *the unfolding of the living object, but not direct it; they cannot impose its organization upon it.*"[60]

The autonomous wholeness of the organism is shown, among other things, by the healing of injuries. Why does a broken bone not simply remain broken? There is a force at work which leads to the restoration of the whole, and this force is obviously superior to the fact that has arisen by physical impact. This 'superior force' is as mysterious as the living impulses of development 'from the future'.

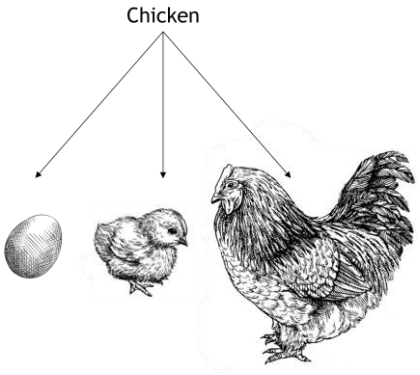

Fig. 3. Changing manifestations of the organism and its constant nature in time.

The autonomous power of formation is closely related to the *species* an organism belongs to. The organismic autonomy expresses itself in the ability to produce a species-specific form as well as species-like individuals by reproduction. Within certain boundaries *the species forms a supra-temporal constant*. The individual organism is subject to permanent change: fertilization, development, maturation, aging and death, but due to the

[60] Monod (1971), p. 28 [transl. CH].

constancy of the species we can speak not only of the egg, the chick and the hen, but of the 'chicken' (Fig. 3). Organisms live out before our eyes what we otherwise accomplish only in our minds: To grasp the individual manifestations of a thing under their common concept (a connection between life and mind, which shall concern us later in more detail).

3.4 Organism and Environment

Despite the autonomy that organisms possess through their morphogenesis and species constancy, each living thing can only exist within a particular environment. It needs the earth, water, air, and light, as well as the biological environment of other organisms. It is 'organized' into an ecological niche. Thus, the environment is also a (co-)determining factor in the life and design of organisms (but not their primary cause).

In an inimitable way Goethe described the closely interwoven relationship of organism and environment: "*Man, by relating all things to himself, is thereby compelled to give all things an inner determination outwardly; and it becomes all the more convenient for him to do this, since everything that is to live cannot be conceived at all without a perfect organization. Now, since this perfect organization is inwardly highly purely determined and conditioned, it must also find outwardly equally pure relations, since it can also exist from without only under certain conditions and in certain relations. Thus we see on the earth, in the water, in the air the most manifold forms of animals moving, and according to the most common conception the organs are provided for these creatures, so that they can produce the different movements and maintain the different existences. But does not the elementary power of nature, the wisdom of a thinking being, which we are accustomed to place under it, become more respectable to us when we ourselves accept its power as conditioned and learn to see that it forms just as well from the outside as to the outside, from the inside as to the inside? The fish is there for the water, seems to me to say much less than: the fish is there in the water and through the water; for this last expresses much more clearly what lies only darkly hidden in the former, namely, that the existence of a creature which we call fish is only possible under the condition of an element which we call water, not only to be in it, but also to become in it. Exactly this applies to all other creatures. This would be the first and most general consideration from the inside to the outside and from the outside to the inside. The definite form is, as it were, the inner core, which is formed*

differently by the determination of the outer element. It is by this that an animal gets its purposefulness from the outside, because it has been formed from the outside as well as from the inside; and what is even more, but natural, is that the outer element can form the outer shape rather than the inner one. We can see this best in the species of seals, whose exterior assumes so much of the fish form, when their skeleton still represents to us the perfect quadrupedal animal."[61]

The autonomy of organisms (their formation 'from within') and their determination by external circumstances (their 'adaptation') form a separate dimension of the organic. Graphically, this dimension can be represented perpendicular to the axis of past, present and future. For the biological species acts at every moment of life, in the embryo as well as in the adult organism, and the organism is and remains always dependent on its environment

3.5 The Fourfold Unity of Life

Thus we can describe a living being by four aspects, which exist and can be conceived of only in mutual connection and interaction (Fig. 4):

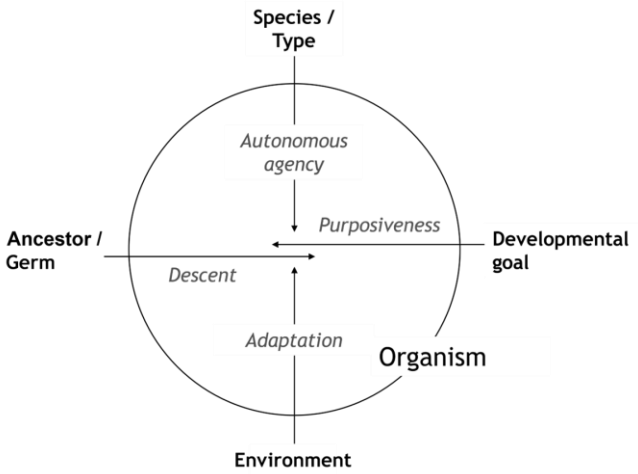

Fig. 4. Four factors or effects that interact to determine the life and development of organisms.

[61] Goethe (1790), p. 228-229 [transl. CH].

1. Descent from another living being (or, in the case of an organ, from its anlage; in the case of a cell, from its progenitor). No living thing, no organ, no cell emerges from dead material; every organism always has a living past.
2. Purposiveness of all living processes. Every living process always develops into a next one, and the future one is already prepared in the present one. The development continuously strives towards a goal, which, however, is not strictly determined (being rather a 'target area' instead of a 'target point').
3. Autonomous agency of the organism, which is expressed, among other things, in the time-spanning constancy of the species (the evolutionary changeability of the species is not yet considered, which we will deal with later).
4. Perfect adaptation of living beings, their organs and vital functions to the external conditions of life.

This tetradic structure provides a key to the understanding of the living organism. I would like to call it the TIME CROSS OF LIFE. This is to express that it is the temporal extension of an interaction of 'form' and 'substance', which is classically thought merely in terms of 'above' and 'below'. The consideration of time makes it possible to think the classical dualism as *development*. The aspects facing each other form dynamic equilibria, the horizontal plane signifying temporal development, the vertical the relation of organism and environment, its relative emancipation from the influences of the environment. The weighting of each aspect is different for each species and level of organization: Bacteria develop very rapidly and show a high degree of environmental dependence; mammals develop slowly and show a high degree of autonomy. The weightings are also different at different times in development: a child develops rapidly but is not very emancipated, in the adult the ratios are reversed, etc.

The interrelationship of descent, purposiveness, adaptation, and autonomous agency itself forms an organic whole. A comprehensive theory of the living must take all four aspects into account and illuminate them in their interrelationships. Thus it becomes clear once again that organisms cannot be understood in physical and chemical terms alone. The integration of time

goes beyond the dead, and there is no physical or chemical phenomenon which represents a connection of all four aspects mentioned.

3.6 Outlook to an Extension of Cognition

But how does one comprehend organismic autonomy and the effect from the future? They cannot be explained in materialistic terms. One must broaden and deepen cognition. So we have to ask again *how* to think the four aspects of the living. We must observe developmental thinking more closely in order to *seek the sources from which cognition of the living springs*.

It seems obvious that one can understand life because one is alive. But how does one experience one's own aliveness? From which inner experiences do the concepts arise with which one grasps the organic phenomena? We have to find the realm in which we experience life inwardly and consciously.

This is also justified from a scientific point of view, because in any comprehensive concept of a science, the observer must be included. It is precisely through this that the expansion of scientific knowledge becomes possible, that one not only observes nature, but also oneself in the process of observing nature. One then also pays attention to the gestures of cognition that one performs internally, according to the respective external object of observation. Both belong together, because without the inner movement one could not grasp the outer object at all. – This marks out the further course of our investigation.

3.7 The Enigma of Evolution

The previous remarks refer to individual organisms or to species, but not yet to their evolutionary history. The evolution of species goes beyond the aspects mentioned so far. It is the *quinta essentia* of life, its real enigma. How and why does something new arise in evolution? Was there a direction? Why are animals and humans not designed quite differently? Are we an accident? – Before these questions can be discussed, evolutionary thinking must first be closely observed.

4 GOETHE, RUDOLF STEINER AND THE KNOWLEDGE OF LIVING THINGS

Where object and subject
touch each other, there is life.[62]
(Goethe)

4.1 Conception and Activity in the Thinking of Metamorphoses

Richard Owen, William Paley and Charles Darwin gave very different answers to the question about the enigma of life. What they have in common, however, is that they sought the causes in an objective reality outside the subject – Paley and Owen in a creator God, Darwin in natural processes. Towards this external 'reality' they behaved like *spectators*.

Johann Wolfgang von Goethe approached the living in a different way. Instead of merely observing the growth of plants and the forms of animals and thinking about what he observed, he 'slipped' into the organisms and their transformations in an inner, imaginative activity. Goethe thus initiated a method of life research which, even though he developed it only in its beginnings, can rightly be called revolutionary.

In 1790 Goethe wrote in his *Attempt to explain the metamorphosis of plants*: "*Anyone who only observes the growth of plants to some extent will easily notice that certain external parts of them sometimes change and pass over into the form of the nearest parts either completely or more or less*." This metamorphosis "*is what can always be effectively noticed by stages from the first seed leaves to the last formation of the fruit. The transformation of one form into another ascends, as it were, on a spiritual ladder to that summit of nature, reproduction by two sexes.*"[63]

Later he also summed up his insight in poetic terms:

All figures are similar, and none resembles the other;
And so the chorus points to a secret law,

[62] Quoted by Gustav F. K. Parthey after a conversation with Goethe on August 28, 1827. Goethe (1827), p. 183.
[63] Goethe (1790, 1817, 1831), p. 22-23 [transl. CH].

To a sacred enigma. Oh, could I to thee, dear friend,
The solving word at once happy deliver!
Becoming consider it now, how little by little the plant,
Gradually guided, forms to blossoms and fruit.[64]

The law according to which the transformation takes place consists in a threefold alternation of expansion and contraction: "*The same organ which has expanded on the stem as a leaf and assumed a most manifold form, now contracts in the calyx, expands again in the petal, contracts in the sexual organs, in order to expand for the last time as fruit*"[65], and you could add: finally contracts in the seeds, closing the circle of growth and opening a new one. The first round of expansion and contraction takes place from the cotyledons to the foliage to the sepals. Then, in the flower, the expanded petals stand next to the contracted stamens and pistils, and finally the circle closes in the interlocking of the expanded fruit and the contracted seeds, *one after the other*, *side by side*, *inside each other*.[66] The spatiotemporal logic of these successive stages allows for no further change, and the cycle begins anew.

Finally, the *same organ* always appeared to Goethe in the various forms of transformation of the developing plant: "*Just as we have now sought to explain the various seeming organs of the sprouting and flowering plant all from one, namely the leaf, which usually develops at each node: so we have also dared to derive those fruits, which tend to close their seeds tightly within themselves, from the leaf form. – It is self-evident here that we should have a general word by which we could designate this organ, which has metamorphosed into so many different forms, and compare all the phenomena of its form with it: at present we must be content with getting used to holding the phenomena forwards and backwards against each other. For we can just as well say: a stamen is a contracted petal, as we can say of the petal: it is a stamen in a state of extension: a sepal is a contracted stem-leaf approaching a certain degree of refinement, as we can say of a stem-leaf that it is an ... extended sepal.*"[67] Pointedly, Goethe wrote from Italy, "*Forwards and backwards, the plant is always only leaf.*"[68]

[64] Goethe (1790, 1817, 1831), p. 90-93 [transl. CH].
[65] Goethe (1790, 1817, 1831), p. 56 [transl. CH].
[66] First formulated in this way by the botanist appointed by Goethe to Jena Friedrich Siegmund Voigt (1817), p. 440-441.
[67] Goethe (1790, 1817, 1831), p. 57 [transl. CH].
[68] Goethe (1816-1817), p. 561 [transl. CH].

Goethe's method thus captures four aspects of the developing plant:

1. the individual, concrete *forms* of the leaves, flowers, fruits, etc.,
2. the transformative *movement* (metamorphosis) of the forms out of and into each other,
3. the *law* according to which this metamorphosis occurs (expansion and contraction), and finally
4. the *essence* of the thing which remains the same in its different manifestations, namely the 'leaf'.

We now want to ask here as well: How does Goethe think the metamorphosis of the plant? From the contemplation of the details he swung up to the inner comprehension of their transformations and thereby 'liquefied' his own imagination: "*The formed is immediately transformed again, and we have to keep ourselves, if we want to reach the living contemplation of nature to some extent, so mobile and pictorial, according to the example with which it presents itself to us*."[69]

Fig. 5. Developmental stages of a leaf of ragweed (*Lapsana communis*, from Bockemühl[70], not to scale).

To observe developmental thinking, let us consider the growth of a plant leaf from the first bud to the fully grown shape (Fig. 5). The first form shows itself as an almost point-like contracted structure, which then increases in size by stretching and

[69] Goethe (1807, 1817), p. 14 [transl. CH].
[70] Bockemühl (1966).

expanding its surface. The edge of the leaf appears slightly articulated from the beginning. The third form (from the left) already differentiates into the leaf blade, which continues to expand, and the petiole, which remains contracted. With the subsequent elongation of the petiole and the growth of the blade, this difference becomes more pronounced, with a rhythmically structured zone of differentiation forming at the transition between the rounding blade and the linearly contracted petiole.

Through sensory perception, we observe individual stages different from each other. However, we know that they represent a continuous line of development, in which various interpenetrating tendencies of formation are operative: Stretching, spreading of the blade, division of the leaf margin, and elongation of the petiole. These 'formative gestures' are real, and yet one cannot see them with one's eyes; one experiences them inwardly by tracing them. Also the connection of the individual forms results only by actively connecting them forwards and backwards. The individual forms can be viewed as solidified moments in a process of lawfully intermingled movements.[71]

Goethe is often said to have disliked the introspection of cognition. The following notation, however, gives a precise description of his cognitive activity in thinking metamorphoses: "*When I see an originated thing before me, ask about its origin, and measure back the course as far as I can trace it, I become aware of a series of stages which, although I cannot see them side by side, I must imagine in my recollection to a certain ideal whole. At first I am inclined to think of certain stages; but because nature does not make a leap, I am at last compelled to look at the succession of uninterrupted activity as a whole, cancelling out the particular without destroying the impression.*"[72]

There is a distinct difference between looking at the forms and experiencing the movement that connects them. The individual forms lie before me, I can observe them, the relationship between them and me is a representational one. In the connecting movement this representationality is lost, the separation between me and the objects is suspended for

[71] Jochen Bockemühl (1928-2020) described these form movements in the leaf area of higher plants in detail and vividly in a classic essay. Bockemühl (1966).

[72] Goethe (ohne Datum), p. 193 [transl. CH].

moments. I am then no longer a passive observer, but an active co-creator who lives, as it were, in and between the forms.

The ordinary consciousness always needs a counterpart to which it can hold on. It is 'object consciousness'. The possibility for exact observation of the creative movement between similar objects is therefore limited at first. For object consciousness the inner movement is hardly perceptible, actually a nothing. One must try to bring light into this darkness if one wants to come closer to the enigma of life. The more often one consciously practices such formative movements in the living imagination, the clearer the experience becomes.[73]

✯

With this we have arrived at a decisive point in the cognition of organic life. For as long as one seeks the living only through the object-oriented, representational consciousness, one will necessarily miss it. The object-oriented consciousness can only grasp the details that have fallen out of the flow and coherence of the living. All the above-mentioned riddles of life – the interdependence of the parts of an organism, the lawful development through the integration of past, present and future, the inner autonomous creative power and the temporal permanence of the species – will remain unsolvable for the object-oriented consciousness. One cannot deduce organic life from its constituent parts. Any attempt at a materialistic explanation of the phenomena of life must inevitably fail.

But also an 'idealistic' biology will poke in the fog, as long as it looks for the 'spiritual bond' of the life phenomena outside of consciousness and does not take into account the concrete cognitive activity, by which the single phenomena are connected. The 'spiritual bond' becomes observable through the inner activity of the observer. *In the inner observation of one's own activity of transformation lies the possibility of an empirical access to the essence and forces of the living.*[74]

[73] Cf. in the appendix *Rudolf Steiner: Extension of Natural Science by Observation of the Will in Thought*, p. 179, as well as *Rudolf Steiner: Goethe's Metamorphosis Thought Leads to the Spiritual View of the Reality of Living Things*, p. 180.
[74] Cf. in the appendix *Rudolf Steiner: Perception of the Vital Force by Strengthening the Power of Thinking*, p. 180. *The Knowing Will as the Real and Idealistic Basis of Evolutionary Knowledge*, p. 181.

Most scientifically thinking people shy away from seeking an inner access to the living, because the observation of one's own inner life is under the almost insurmountable prejudice of subjectivity. In the inner pursuit of organic metamorphoses, however, no subjective process takes place at all. For on the scene of consciousness nothing else happens than what also happens 'outside' in nature. We do internally the same thing that nature does, and we experience the same forces that are at work in nature. This will be described in more detail below.

4.2 Form, Life, Consciousness, Being – Four Stages of Cognition

Observing single organic forms and connecting them by inner activity are two clearly distinguishable stages or levels of the cognition of the living. At the first level, which can be called 'objective' or 'representational consciousness', one faces the objects as an observer. They appear as prefabricated, distinct parts. At the next stage, one must develop an inner, productive activity through which one participates in the transformations of form. At this stage of metamorphosis activity, the boundary between subject and object can no longer be drawn as sharply as in representational cognition; the two oscillate, as it were, within each other. The following figure is meant to illustrate these relations (Fig. 6).

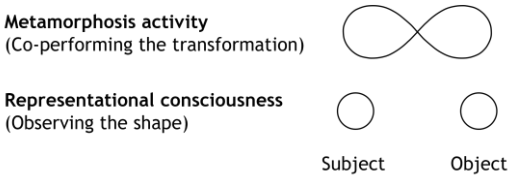

Fig. 6. The relationship between subject and object at the first two levels of cognition of the living.

The 'metamorphosis activity' oscillates between the inner, volitional generation and the inner observation of the generated results (Fig. 7, left). One can call these imagined results 'external' to the subject (it places them, even if within its consciousness, in front of itself). Fig. 7, right shows how individual organic shapes are interwoven by the activity of the subject into a coherent series of development.

In the thinking of metamorphosis, the subject is active in two ways: It generates the inner representations, and it looks at what is generated. The source from which the conceptions are produced by inner activity is *within* the subject. We must therefore look deeper into this activity of the subject. We can ask, for example, how one knows in which direction and with which aim one has to carry out a transformative movement? Obviously, one must *know the law* according to which the transformation takes place. If one does not know what is to become of the leaf bud (Fig. 5, left), one could not do anything further with it. The formative movement is therefore guided by a *superordinate knowledge* that spans the entire developmental series.

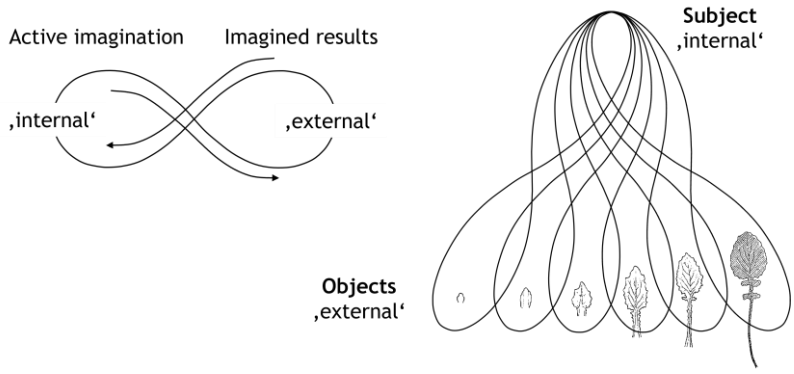

Fig. 7. Left: The metamorphosis activity between bringing forth and looking at what is brought forth. Right: How the metamorphosis activity connects the perceptions of individual stages of development to a continuum.

Goethe meant this knowledge of the law of metamorphosis of flowering plants when he wrote from Naples in 1787: "*With this model and the key to it, one can then still invent plants into infinity, which must be consistent, that is: which, even if they do not exist, could exist.*"[75]

And finally the three levels are combined into a unity by a fourth, namely, by *the thing itself*. For it is, after all, always a 'leaf' that is transformed here. Goethe also grasped this stage of cognition in intuitive insight: "*Everything is leaf, and through this simplicity the greatest diversity becomes possible*."[76] It is the *essence* of the

[75] Goethe (1816-1817), p. 503 [transl. CH].
[76] Goethe (ohne Datum), p. 189.

thing itself that lives in the contemplation of the forms, the pictorial movement connecting them, and in the superordinate knowledge.

Now what is the relation between subject and object at the third and fourth level? With the superordinate knowledge, I can no longer speak of this knowledge being external to me, nor do I present it as an image. I can express the lawfulness in words, but only because it lives in me, because I have recognized it, because I *know* what is meant by it. But the law is also not yet the essential being itself, which is at stake here, but a knowledge *of* the transforming being. At the fourth level, the (active!) subject and the (living!) essence of the thing now coincide into one.

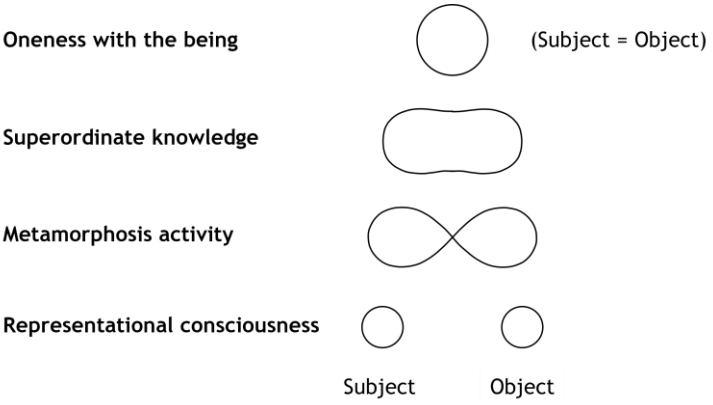

Fig. 8. The relations between subject and object at the four levels of cognition.

We thus obtain a symbolic representation of the relations of subject and object on the four levels of cognition of living developmental processes (Fig. 8). Only at the lowest, representational level does one face things; only at this level can a real distinction be made between the inner and the outer world. In the activity of metamorphosis, oneself (the active producer) and the objects (the imagined representations) alternately merge into each other. Each time one actively carries out the movement to the next object to be held, one merges with the imagined object for a short time; then one separates again and looks at the object imaginatively, etc. At the third level of superordinate knowledge, the content no longer lives outside the subject. It is

found *in* him and yet it is not a merely subjective matter, for it comes from a world of objective laws. Nevertheless, the knowing subject can still be distinguished from what it knows. Only at the fourth level do the I and the object coincide into one, for the (spiritual) object appears through the spiritual activity of the I. This creative actualization is an entirely active and yet entirely selfless devotion of the I to the essence or being.[77]

The four levels or aspects of cognition can also be characterized by distinguishing the abilities of the soul which are preferably involved at the different levels. Indeed, we can distinguish (1) the sensuous *perception* and inner *representation* of fixed external objects, (2) the active and pictorial *thinking* or imagining of their metamorphoses, (3) the knowing and understanding, which on closer inspection has a character akin to *feeling* ("*if you do not feel it, you will not capture it*" [Goethe]), and (4) the *willing*, i.e., the active production of contents and actions. On the level of objective representation, perception is the mainly involved ability. Metamorphosis activity requires thinking representation. The superordinate knowledge is characterized by a felt understanding, and at the highest level, the spiritual world content is brought forth and experienced through one's own volition.

We have thus characterized four important concepts, four levels or aspects of the knowledge of living development:

1. sensual perception and representation of the objective forms,
2. actively transforming, thinking imagination that connects the individual forms,
3. experienced or felt knowledge of the superordinate, content-related context and
4. intuitive actualization of the essence itself, living in the wilful activity of the subject, transforming itself and yet remaining the same in the transformation.[78]

[77] This level of realisation is referred to as 'intuition': "*Intuition is the life of things in the soul. It is to be taken quite literally when one says of intuition: one creeps through it into all things.*" Steiner, 1905-08, GA 012, p. 22. For a detailed examination of the anthroposophical concept of intuition, see Hueck (2016).

[78] For the inner observation of these four stages of cognition in the self-experiment, cf. Appendix *On the Inner Self-Observation of the Four Stages of Cognition*, p. 182.

4.3 Physiognomic Cognition of Shape

The third stage of cognition of organic forms, the knowledge of the superordinate context, has still another peculiarity. Organic forms ('gestalts') have an overall expression, a 'physiognomic character'. The metamorphosis thinking of the second stage does not yet give any information about the nature of the forms. Questions like: 'Why does the oak bear acorns and not chestnuts?', 'Why do only (some) hoofed animals have horns?', 'Why does the human being have five fingers and not four or six?' cannot be answered by the metamorphosis knowledge alone. For this it is necessary to grasp the holistic gestalt motifs which are superordinate to the details.[79] Let us, for example, compare the Norway Maple (*Acer platanoides*) and the Sessile Oak (*Quercus petraea*) (Fig. 9).

Fig. 9. Different gestalt expression of maple (left) and oak (right).

The maple bears a crown of branches that extend far outward and curve slightly upward. In spring, it blooms a conspicuous bright yellowish-green before the leaves emerge. It has long-stalked, symmetrically pointed leaves that turn brilliant yellow in the fall. Its propeller fruits hang in loose clusters below the leaves, and at ripening time in late spring, they whirl into the surrounding area with a rotating motion. Its wood is light-coloured, not too heavy, hard yet resilient. It grows quickly and easily in almost any location and holds tenaciously in the soil even as a sapling. In all these characteristics, as varied as they are, there is a consistent formative gesture. It could be described as

[79] Cf. Kranich (1996).

powerful, generous, yet light and free, radiating into its surroundings. The oak, on the other hand, is gnarled, bears short-stemmed, irregularly lobed leaves that turn dull brown in the fall. The flowering is inconspicuous. The late-ripening fruits sit tightly clustered on the branches; thudding to the ground. Oak wood is brownish and hard, but not very elastic; it has a high density compared to other woods. Oak bark contains astringent (!) tannins with anti-inflammatory effect. The formative gesture of the oak, from the whole figure to individual substances, appears defiant, idiosyncratically contracted, as if clenched in on itself or backed up. – These gestalt motifs can be described just as clearly as the scientific fact that both trees belong to the seed plants. But they only open up to a holistic view, to an artistic sense. They are not to be understood also from Darwin's theory, and school biology has neither view nor explanation for them.

One could call the gestalt motifs the character, expression of the essence of a species. They appear as an overall impression, akin to the experience of art, which is not easily put into words. However they are as lawful as the laws of metamorphosis (e.g. expansion and contraction), and like these laws, they are experienced through 'knowing feeling'.

While one grasps the changes in form of the organisms through increased inner activity, one can experience the motifs of form by standing back and listening, as it were, to the language of nature. How does an oak express itself, how does a maple? How does a budding plant speak, how a flowering and how a wilting one? What impressions do we get from a tadpole in a pond, from a snail by the wayside, from a frog in the reeds? How does a deer at dusk speak to our inner understanding, a lark high above a summer field, a mouse scurrying by …? Every look into nature creates subtle inner experiences through which nature speaks to us.

4.4 Space, Time, Wholeness, Effectiveness – Four Levels of the Organic

We can now describe the whole of a living being – at least on a macroscopic level:

1. individual *forms* in their respective state of development,
2. their *transformations*, growth and metamorphosis,

3. superordinate *laws and motifs* permeating the details of the living beings, according to which the species are formed,
4. an autonomously acting, species-maintaining *formative force*, which produces the forms, transforms them and keeps them alive.

The forms are *spatial* phenomena. Growth and metamorphosis are *temporal* events in which past, present and future are integrated and which can only be grasped by remembering past forms and anticipating future ones. The overarching motifs of gestalt, while found through the study of forms and developmental processes, are themselves neither spatial nor temporal; they can only be consciously grasped through an *inner* holistic gestalt view. Finally, the autonomous formative power is *pure efficacy*.

We identify ourselves with the autonomous formative power by experiencing it in our will and through it. We know nothing of it, because we cannot observe the will at its origin (at first), but always only at what is brought forth by it. Rudolf Steiner, on whose ideas the fourfoldness developed here goes back, called this objectively creative will 'spirit' (Tab. 1).

Organism	**Cognitive activity**	**Realm**
Spatial forms	Observation through sensual perception and conscious representation	Physical
Temporal metamorphosis	Imaginative transformation	Living
Laws of development, holistic shape motifs	Experiencing and understanding through feeling	Psychic / Mental
Autonomous agency	Actualization through wilful activity	Spiritual

Tab. 1. Four levels of the organic, their perception by four cognitive activities and their correspondences with four realms of being.[80]

[80] The living organism also includes its interactions with the environment in which it lives [ecology], the variations of its family [microevolution] and its position in the series of organisms [macroevolution], i.e. not four, but seven aspects in total. Cf. appendix *Seven Aspects of the Organic*, p. 188.

The gestalt motifs are a species-specific, holistic expression of the spiritual life force shaping the organism from within. They are not experienced wilfully-creatively, but rather artistically-perceptively and express a content related to feeling. Plants, animals, landscapes, all sensual perceptions in general can also be felt and understood as soulful expression of a spiritual essence. In feeling them we live with the living beings as it were in a common inner world. This is not a matter of vague sentimentalism, but of distinct experiences differentiated in manifold ways.

Gestalt transformation is the actual realm of the *living*, its growth and metamorphoses. This level is experienced in the image-forming activity of consciousness ('imagination'). Finally, on the lowest level, the gestalt is sensually looked at and consciously represented as a *physical* appearance.

The four levels can thus be described for both the reality (ontology) and the cognition (epistemology) of living development. None of these stages can be neglected, for only through their totality is an organism what it is.

The four stages are not experienced with the same alertness in ordinary consciousness. Only in the confrontation to the objective world fully awake consciousness prevails. The level of the actualizing will, on the other hand, is wrapped in deep sleep within ordinary consciousness. The level of felt understanding is experienced, if at all, only as if dreaming, while the imaginative activity, which represents a transition from 'inside' to 'outside', could be called 'awakening'. Rudolf Steiner described these important relations in great detail.[81]

The different degrees of consciousness lead to the fact that natural science only accepts as real that which can be perceived by the senses. The higher levels appear to it either as non-existent or as relevant only in the subjective human mind. Thus natural science overlooks the essence of organic development, because growth and development cannot be sensually perceived, but can only be grasped in the interplay of inside and outside. The living expresses itself in sensually perceptible phenomena, but *life itself is not a material process*. If one follows – like Goethe – the

[81] See e.g. Steiner, 1905-08, GA 012, p. 16-18; Steiner, 1919, GA 293, p. 91-104, 27.08.1919.

transformation processes of the organisms inwardly, then one becomes aware of the fact that they cannot be grasped spatially-materially, but only temporally, and that still higher levels of the organic express themselves in them. If one would be aware also of the feeling-knowing and the producing-actualizing mental activities, then one would not even come to the idea to regard organisms as *only* material.

4.5 Darwinism, Goetheanism and Anthroposophy

Darwin sought a natural explanation of evolution. He did not attribute to the living any design principles of its own; according to his view, all higher development is brought about by external conditions of life. The living appears in Darwin's view merely like a kind of self-reproducing jelly, an unformed but formable substance, which 'wiggles out' randomly in any direction and is then held in purposefully adapted forms by external circumstances. This view is entirely consistent with the stage of sensual observation and representational cognition. Darwin's theory of evolution resulted from a pure spectator standpoint.

Goethe looked deeper, and paradoxically by stopping at the phenomena. He did not conceive a 'theory' of living evolution: "*Just do not look for anything behind the phenomena, they themselves are the teaching*!" The 'theoretical' part of his cognition consisted in his inner identification with the phenomena, he 'slipped' into them[82], as it were, and penetrated the forms with an attentive, inner process of will, especially by actively recreating the transitions between them. In this way he experienced the power of living transformation and could therefore rightly speak of a "*law of inner nature, by which plants are constituted*", which interacts with a "*law of outer circumstances, by which they are modified*"[83]. Goethe practiced a participatory view of nature, his observation meandered around the borderline between objectivity and activity: "*The form is a moving, a becoming, a passing away. Theory of gestalt is theory of*

[82] "*I therefore had to remain with my old way, which compels me to observe all natural phenomena in a certain sequence of development and to attentively accompany the transitions forwards and backwards. For in this way I arrived all by myself at a living overview, from which a concept is formed that will then meet the idea in an ascending line*." Goethe (1825), p. 649 [transl. CH].
[83] Goethe (1795), p. 111.

transformation.“[84] Goethe’s view corresponds to the metamorphosis stage of cognition.

Rudolf Steiner, as a young editor, dealt intensively with Goethe’s view of nature for almost 16 years and wrote several expositions on it.[85] About Goethe’s doctrine of metamorphosis he wrote: “*The greatness of this thought … becomes apparent to one only when one tries to bring it to life in one’s mind, when one undertakes to reproduce it. One then becomes aware that it is the nature of the plant itself translated into the idea, which is just as alive in our spirit as it is in the object; one also notices that one imagines an organism animated down to its smallest parts, not as a dead, closed object, but as developing, becoming, as the constant restlessness within itself.*”[86] Through one’s own activity – which has nothing arbitrary about it, because it is guided by the phenomena – a new, spiritual field of experience is opened up.

In 1916 Steiner described this active devotion to the phenomena in the way “*that one contemplates life in nature in a more intimate way. One seeks, for example, to look at a plant in such a way that one not only takes up its form in thought, but in a sense feels with it the inner life that stretches upward in the stem, unfolds in width in the leaves, opens the inside to the outside in the blossom, and so on. In such thinking the will quietly resonates; and it is there a will developed in devotion which directs the soul; which does not take its origin from it, but directs its effect upon it. One will naturally believe at first that it has its origin in the soul. In the experience of the process itself, however, one recognizes that through this reversal of the will an extra-mental spiritual is seized by the soul.*”[87]

This is Steiner’s method of cognition: to identify oneself with things in a Goethean way, to let them live in oneself, and then to observe what one experiences in the process. He deepened Darwin’s and Goethe’s way of science through the inner self-observation of cognition (“*I observe myself what I accomplish myself.*”[88]). Steiner wrote about Goethe’s worldview: “*Seeing with the eyes of the body conveys the knowledge of the sensuous and the material; seeing with the eyes of the spirit leads to the view of the processes in the human consciousness, to the observation of the world of thought, feeling, and will; the living union between the spiritual and the bodily eye enables the knowledge*

[84] Goethe (ohne Datum), p. 415 [transl. CH].
[85] Steiner, 1884-1897, GA 001; Steiner, 1897, GA 006.
[86] Steiner, 1884-1897, GA 001, p. 12-13 [transl. CH].
[87] Steiner, 1916, GA 020, p. 162-164 [transl. CH].
[88] Steiner, 1894, GA 004, p. 50.

of the organic, which lies in the middle as a sensuous-supersensuous element between the purely sensuous and the purely spiritual."[89] Steiner thus made fully conscious all the stages involved in metamorphosis cognition. He experienced the laws guiding the metamorphic movement through volitional union with the spiritual living being (Fig. 10).

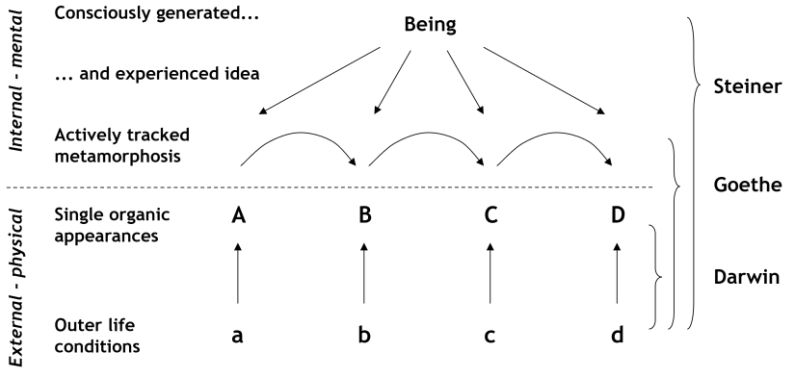

Fig. 10. The epistemological connection between Darwinism, Goetheanism and Anthroposophy.

As long as one understands evolution like Darwin only as relationship of representational forms, it remains something external. One must regard oneself as the result of this process, but thus cannot gain a meaningful relationship to it. Was evolution accidental? Why did it proceed as it did? – But if one follows the processes of transformation with Goethe, then one 'liquefies' the representationality of the forms and dives into the stream of living becoming. In this way one can already connect oneself more closely with the evolutionary development. One experiences it as a lawful metamorphosis. If one finally awakens through Rudolf Steiner's stimulation to the fully conscious experience of what one does in this living-in, then one experiences the spiritual being that works in the organisms and their evolutionary development. Evolution then appears as a meaningful organic process, which can and must be read and understood from its end, the self-conscious human mind.

Anthroposophy sees itself as an extension of natural science, not as an alternative or counter position. Rudolf Steiner

[89] Steiner, 1897, GA 006, p. 155-156 [transl. CH].

repeatedly emphasized that the results (not the theories) of natural science could be seamlessly united with the results of spiritual research, but that the former could only be truly understood in the light of spiritual science. He used for this the image of a printed book page: While natural science was occupied with the investigation of the letter forms, Anthroposophy would correspond to the reading of the printed, thus grasping the meaningful connections standing behind the sensually perceptible appearances.

4.6 Consciousness as the Stage of the World

Richard Owen, William Paley and Charles Darwin sought reality outside of cognition. They presumed that reality exists quite independently of the observer. If they would not be there, the world would exist exactly as it appears to them. If the evolution had not produced humans, the other organisms would exist nevertheless.

But the perceptions, from which they started, occurred only on the scene of their consciousnesses. And so it is with all perceptions. These convey, purely by themselves, no full reality. Only through thinking the part missing to them, namely their connections, are added. To recognize means to reconcile the two elements of world reality, the perceptions and the ideas, which appear separately on the scene of consciousness. The ideas, like the perceptions, are world-contents. "*We give only the opportunity that the content of thought may unfold according to its own nature. … Our mind accomplishes the composition of the masses of thoughts only according to their content.*"[90] The form of perceptions and concepts depends on my consciousness and activity, but their content is 'objective', it does not belong to me but to the world. "*Perception is … nothing finished, completed, but one side of total reality. The other side is the concept. The act of cognition is the synthesis of perception and concept. Perception and concept of a thing, however, first make up the whole thing.*"[91]

According to this view, then, reality is neither what I perceive, to the exclusion of my subject, 'out there' in the world (naive realism), nor a mere subjective construction that I spin out of myself (constructivism). Rather, reality emerges again and again

[90] Steiner, 1886, GA 002, p. 48 [transl. CH].
[91] Steiner, 1894, GA 004, p. 92 [transl. CH].

as a living encounter between the (objectively given) contents of perception and thought on the scene of the individual consciousness (Fig. 11).

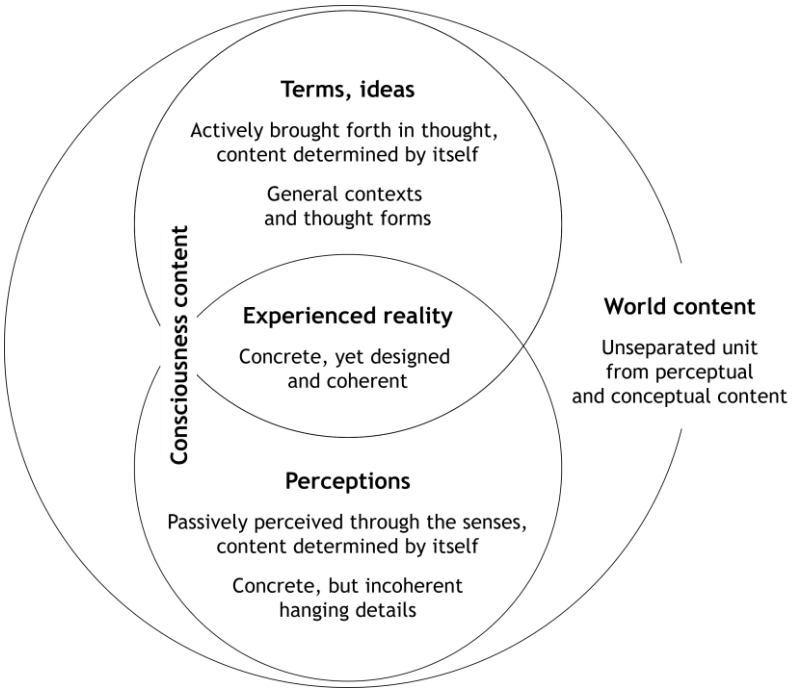

Fig. 11. Experienced reality arises on the scene of consciousness by the union of perceptions and concepts.

The knowing consciousness of man is the stage of world events. Our conscious inner life does not face the world as an alien, uninvolved spectator, but belongs to it! In my consciousness world events live; I live in my consciousness *within* world events, not outside. This conception also fulfils Thomas Nagel's quest mentioned in the introduction. The 'great cognitive shift' he predicted, by which cognizant consciousness will be given a central role in understanding the world, is realized in Rudolf Steiner's epistemology and spiritual science.

This thought has also a fundamental implication for the understanding of the living. If I observe the growth of a plant, then I see at different times individual forms, which appear successively as perceptions without connection. They are

unfinished and represent therefore no full reality. They become real only if they are connected by the concept of 'development' to a continuous and lawful connection. The plant grows, of course, even if I do not recognize it. But which *force* is it that makes it grow? Can I find this force in the perceived, that is, the material side of the world? Or is there another way to recognize it? – It must become ever clearer: *The actual force of growth and development of organisms is of the same kind as the force which in my consciousness connects the perceptions of the individual stages into a lawful developmental connection*. In Rudolf Steiner's sense, the *spiritual* side of the world's reality lives in an experienced thought as its sensual side lives in perception. The forces of development of the living are not of sensual-material, but of spiritual nature. They are *really experienced* in the inner identification with and comprehension of organic development.[92]

[92] Cf. Appendix *Rudolf Steiner: Perception of the Vital Force by Strengthening the Power of Thinking*, p. 180.

5 Organism, Cognition and Time

My inheritance how glorious, far and wide!
Time is my possession, my field is time![93]
(Goethe)

5.1 Organic Development and Cognition

In the search for the solution of the enigma of living organisms we have followed a path which has led us to an intimate observation of the cognition of living development and form. We have seen that organic development cannot be perceived externally, but can be comprehended only in inner activity. Therefore, no material parts can be found to explain life, for material parts are known only through sensory perception. The limits of cognition towards the living, explained in the second chapter, result from the fact that the developmental and organismic connections between the organic phenomena, which can be grasped only inwardly, are transferred unnoticed into the material world of perception and cannot be found there again because they do not originate from this realm.

The living forces of growth and development must be experienced and contemplated in inner comprehension. Thus we have also met Thomas Nagel's quest, mentioned in the introduction, that knowledge of nature can only be sustainable if knowledge itself is taken into account.

We have described that every organism has emerged from past stages of development through shaping and reshaping and carries its future, its development goal like a kind of 'plan' within itself. From a simple initial form (seed, egg, etc.) it differentiates into a complex shape and expresses its species-typical design motifs more and more clearly. The physically perceptible form represents only a current excerpt from development and appears embedded in specific environmental conditions. Finally, the organism is permeated by an autonomously acting formative force. These four aspects of living organisms are perceived by the discerning observer in different ways (Fig. 12).

[93] Goethe (1819), p. 71.

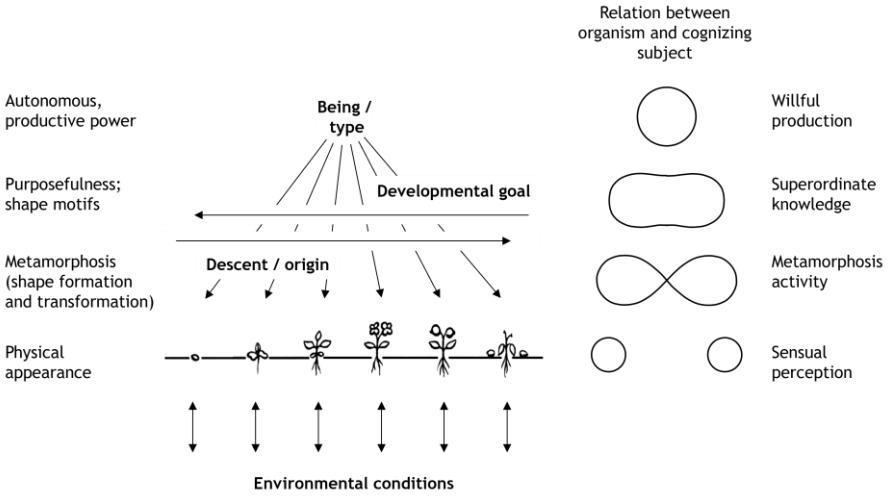

Fig. 12. Four aspects of living organism and their relation to different stages of cognition.

With this now a solution of the ancient question about the entelechy of the living beings appears. How can the organism know about its own future if it has no consciousness itself? How can its own future development exist as a 'plan' if plans exist only in the human mind? And what is the inner autonomous force that makes organisms grow and keep them alive against external adversities? It is the supersensible essential layers of the organic that the viewer can experience in his imaginative metamorphosis activity, his superordinate knowledge, his intuition that willingly actualizes the essence of the being. What the human being recognizes and experiences on the physical, living, mental and spiritual level is effective in the organism in a physical, living, mental or soul (physiognomic) and spiritual (autonomous) way. The higher one rises above the level of physical appearances, the more intimately one is connected with the supersensible aspects of the organisms, and in intuition one grasps their productive life force as if in one. *To recognize means to experience life from within*.

Some thinkers likewise come to the conclusion that the living can be comprehended only if one ascribes to it an inwardness, a form of consciousness, an autonomous subjecthood.[94] But only in the 'exceptional state' (Rudolf Steiner) of first-person self-

[94] Cf. e.g. Kummer (1987), p. 65; Weber (2007), p. 85.

perception of cognition, in which one's hitherto unnoticed own cognitive (and the emotional and volitional) activity at work in it is awakened to fully conscious experience, does a basis arise on which such thoughts can be elevated to an *empirical* science. The soul and the spirit, which work in the world, must not be thought as object-like in the same sense as we otherwise conceive the objective world. They are to be observed only on the scene of human consciousness; but there they actually appear. And this observation can be achieved by everyone who is willing to advance from the passive, abstract and merely combining intellect to the living and contemplative activity of cognition.

This opens the possibility to look behind the limits of life and evolution. The field on which answers can be searched is our knowing consciousness itself. Much can become lightful and understandable, if one only becomes clearer and clearer about *how* one understands the phenomena of the world. The forces, which are active in living nature are *of the same kind* as the forces which are active in cognition. Only an active cognition is meant by this.[95] He who undertakes to lift the veil of nature sees – wonder of all wonders – himself.

5.2 Viktor von Weizsäcker – Form, Time and Cognition

Organic development happens in time. But what is time? A mere medium? Would there be time if there were no change, no development? Can we better understand gestalt formation if we understand time?

Organisms have a different time structure than dead objects. They integrate their past and future in present events. A thinker who clearly recognized this was Viktor von Weizsäcker (1886-1957). In his little book *Gestalt und Zeit*[96] he provided an ingenious analysis of the importance of the conception of time for the cognition of organic Gestalt formation. Von Weizsäcker wrote: "*Life is always 'time-transcending present', actuality binding past to future*" (p. 23) and contrasted this 'biological' time with 'mechanical' time: "*Mechanical time is successive, biological time is proleptic [anticipatory] with respect to the resulting movement*" (p. 18), – and it is

[95] Cf. Appendix *Rudolf Steiner: Perception of the Vital Force by Strengthening the Power of Thinking*, p. 180.
[96] Weizsäcker (1942) [transl. CH].

also, as we have shown, anamnestic, i.e., 'remembering'. Von Weizsäcker concluded "*that life is not in time, but time is in life, or more precisely becomes through its self-setting*" (p. 19).

Von Weizsäcker examined the connection between biological time and gestalt. First he analysed the conditions of *gestalt perception*, because "*a shaped real being wants to be sensually perceived. So the senses show us shapes, and should they, the senses, be uninvolved in how the shape appears to us? … Thus, one cannot think out the gestalt problem without self-contemplation*" (p. 4). Ingeniously, he started from moving figures. He described, for example, an experiment in which a circular shape is seen consisting of light points lighting up successively at different positions on a screen. At any given moment, only one point of light lights up at a particular position. The spectator, however, 'sees' a shape, a movement that forms a circle. To do this, the preceding positions must be remembered and related to the current one: "*The figure of a movement is simultaneous representation of successive pasts - is actually an act of memory*" (p. 32). "*The performance which perception accomplishes in the path of movement-seeing … implies the faculty of anamnesis*" (p. 33). But expectation is also involved. Namely, from the previously perceived movement, its further course is anticipated as a complement to a meaningful overall form. "*Experimental experience has now shown that also … the direction of the movement is an essential feature of all figure-perception. E.g., in many cases the eye makes comprehensible additions to the figure only from this 'there-to', which are not founded at all in the stimulus (the object presented). We call this the prolepsis of perception and thus come to the statement of the anamnestic-proleptic character of the perceptual figures. … It is the structure of a biological time which alone proves capable of uniting the transitoriness of gestalt and the directionality of gestalt with its solidity in a present*" (p. 50).

Time integration in gestalt *perception* is therefore just the same as in gestalt *development*! Once more it is shown that the cognition of organic gestalt formation is not possible without the consideration of the knowing consciousness.

The same applies to the perception of resting shapes. Here not the sensory stimulus moves, but the perceiving eye. In gazing, one 'scans' the figure to be perceived, jumps from one point to the next, so that at the current moment only a section is really clearly seen, but the figure is mentally completed in an anamnestic-proleptic way – remembering past impressions,

expecting future ones. It is the concept of the whole under whose point of view the completion is made. This can be followed very nicely in the self-experiment on the basis of Fig. 13.

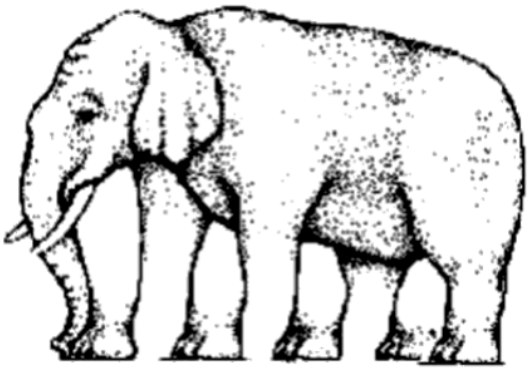

Fig. 13. How many legs does the elephant have? For (self-)observation of the anamnestic-proleptic character of gestalt perception based on present sense data and a superordinate concept guiding time integration and gestalt perception.

At first sight, one recognizes an 'elephant', the holistic integrating concept. But then the view wanders e.g. to the trunk and the foremost 'foot', from there to the front 'leg' – and immediately an inner contradiction arises, which is strengthened by further 'wandering off' of the leg and foot area. What one sees in each case is not what one expects to see, nor does it correspond to what one has seen before. In each moment, the memory of the previously perceived as well as the expectation of the future to be perceived are effective, which in this case just cannot be combined to a consistent overall shape.

Von Weizsäcker compared these principles of biological gestalt perception with those of physical thinking: "*One must further realize that the analytical form of natural science … virtually dissolves and destroys the concept of gestalt. For the perception of the figure of the analytically conceived motion of a moving particle of matter presupposes 'memory'; consequently this perception cannot be based only on matter, cannot be anything material, cannot correspond to anything material. For matter (of analytic mechanics) possesses no memory [and no expectation]; rather it*

belongs to its definition that it as res extensa is not res cogitans. … The real [of the perceived gestalt] is thus an unreal in analytic mechanics" (p. 49).

But because gestalt is given to us only as perceptual gestalt, the physical, causal-analytical method cannot explain gestalt from the movement and interaction of matter particles! The causal-analytical research finds "*its limit at the forms or shapes*" (p. 39). "*Objective time, a basic concept of analytical natural science (mechanics, theory of motion) destroys the reality of gestalt; but biological time, as anamnestic-proleptic visualization of life events, overrules objective time. For gestalts demand synchronicity of objectively no longer existing with objectively not yet existing in a present – they thus escape the law of objective time and become nullified in objective time. One may say: the mechanical reality kills the biologically-formed with the time. … The biological annuls the objective order of time by presupposing retention and anticipation according to its concept*" (p. 54). And finally he remarks: "*It is not objective time in which we live, but we get the times by living. … Biological time is, it now follows, also subjective time*" (p. 54).

Viktor von Weizsäcker has shown not only that it is impossible to explain life and form-development of the organisms from the interaction of dead particles, but also why. It becomes clear to what extent the biochemical, genetic, molecular biological, etc. analysis of living organisms must always miss the living whole: One has the parts in hand, missing, alas, only the temporal band.

Similarly, one could also show that the biological 'self', which we have characterized as an autonomous wholeness and species-preserving force, cannot be explained from the interaction of material parts. For a 'self' constitutes by itself its boundaries and thus at the same time sets itself apart from its environment. Material parts cannot delimit themselves from their environment. The limitation of a purely physical system can only be caused by external forces.

At the end of his treatise, von Weizsäcker then arrives at a characterization of gestalt perception as a rhythmic *interplay* between (perception-guided) cognition and (concept-guided) perception, through which gestalt is constituted between the knowing subject and external, material being in the first place. "*'Gestalt', however, is the mode of appearance which … assumes that which appears. Namely, in that the rhythm of systole of cognition and diastole of action separates in time and reunites from this passing time to appear in a present – in that this rhythm appears as one – gestalt appears. With this,*

the togetherness of gestalt and time is shown as a necessary one from the essence of gestalt. In the same way, however, it is now shown that the way over the problem of perception was not an arbitrary application, but that this way was an equally necessary one, demanded from the concept of gestalt" (p. 58).

The gestalt does not stand outside of cognition, the observer does not merely look at it, but it arises only through and within the encounter of perceiving and thinking. The gestalts are neither material nor ideal, but (as perceptual gestalts) time-integrated and (as organic gestalts) time-integrating intermediate beings. They stand – or better said: they live – in a double in-between: between past and future as well as between man and world.

5.3 Time as a Double Stream

According to common understanding, time is a continuous sequence of moments, which one likes to imagine as a (spatial!) arrow, running from somewhere to somewhere through the point of the present. Each point on this arrow, whether past, present or future, is considered to be perfectly equivalent. This is an abstract notion that is not valid in the living. In order to better grasp the living time, the rooting of the concept of time in inner experience shall now be considered. I refer here to a lecture Rudolf Steiner gave in 1910, in which he presented human consciousness from the perspective of time.[97]

Consciousness is always a present phenomenon, but it is connected with the past as well as with the future. It recalls the past through memories, through representations formed on past experiences. The once imagined is forgotten again and lives on unconsciously connected with the subject. From this stream, which continuously flows from the past into the present, individual contents can be presented again, i.e. remembered. Then Steiner referred to feelings such as longing, impatience, hope, anxiety, fear, etc., which relate to the future and "rumble" strongly in the soul as an expectation or, as he said, "desire" of what is to come. One can understand such feelings if one presupposes that phenomenological time not only flows from the past into the future, but "*that which we desire does not flow at all*

[97] Steiner, 1909-1911, GA 115, p. 179-213, 04.11.1910 [transl. CH].

in the same direction as the flowing stream of representations, but that it comes towards this stream. … You will be able to throw a tremendous flash of light on your whole soul-life, if you only presuppose this one thing: that everything which desires … are, represent a current in the soul-life, which does not flow at all from the past into the future, but which comes towards us from the future, which flows from the future into the past. – All at once the whole sum of soul experiences becomes clear! … Then what is our soul life at the moment? It is nothing else than the meeting of a stream from the past into the future, and a stream flowing from the future into the past. … You will easily understand that these two currents come together in the soul itself, as it were, they collide. This clashing is the consciousness. … Thus our soul participates in everything that flows on from the past into the future, and in everything that comes towards us from the future. If you look into your soul life at any moment, you can say: There is something like an interpenetration of what flows from the past into the future with what flows from the future into the past and opposes the former as desires, as interestedness, as wishes and so on. Two things interpenetrate."[98]

Let these unusual yet illuminating statements be clarified by a thought experiment. How would consciousness be configured if it had either no memory of things past or no expectation of things to come?

Let us assume that I looked out of the window and that there was snow outside. Usually, this sensory impression is associated with a variety of associations that arise from my memory: That it must be cold outside, that the snow feels cold, that it is winter, that there is a summer, etc. All this knowledge implicitly emerging with the sensory impression would fall away if I had no memory. I would simply see 'white stuff' on the landscape. But I could not even speak of 'white', of 'stuff' or 'landscape', because I would not know what these terms mean. – Without memory one would have only the pure, present sense impressions, with which one could connect no sense and meaning (or only current thoughts). I could also no longer experience myself as a conscious subject in relation to the world, because the perceptions of my body and my inner experiences would be completely equivalent to the perceptions of the 'outer' world, impressions under impressions – all order of being would dissolve in a great, structureless flowing whole.

[98] Ibid., p. 190–191, 04.11.1910 [transl. CH].

If, on the other hand, I had no expectation of what was to come, the world would seem frozen to me. I would always have the impression of standing in front of an impenetrable wall. I could no longer move purposefully, e.g. reach for a cup, because this movement presupposes the expectation that I will grasp the cup in a moment. I could no longer speak a sentence because I would not know where it would end. Just as cutting off the past would make my *imagination* chaotic, closing off the future would make my *will* 'crazy'. Without memory and expectation, normal consciousness would not be possible; both are always present and interpenetrate each other.

What do memory and expectation mean for our relationship to the world? I must be able to expect that I will grasp the cup, that this sentence will end, that there is still a world around the next corner. Usually one interprets this fact in such a way that there is a spatial-material reality 'out there' independent of me, which I watch in its course and in which I move (Fig. 14a). One interprets the phenomenal experience of time by the assumed constancy of matter in space. (It is really only an assumption, because one can perceive matter neither in the past nor in the future!) But if one really sticks to experience, then one must start from what one experiences from the world and not from what one thinks about it. One must observe not the world, but the world within the consciousness of the world and its course. In this way, consciousness shifts from the outside position of the uninvolved observer into the stream of world events, as it were; it goes from being a spectator to being the stage or scene (Fig. 14b).

The habitual external perspective of consciousness may be called the 'representational spectator consciousness', the phenomenological internal perspective the 'participatory scene consciousness'. For the scene consciousness there is a stream from the past, in which its memories flow, that is met by a stream of what is expected from the future.

Of course it is not meant that the expectations of future events will come true. It is merely pointed to the hardly conscious threads which the soul constantly stretches out in the direction of the future and which it needs for its present experience, especially for its acts of will.

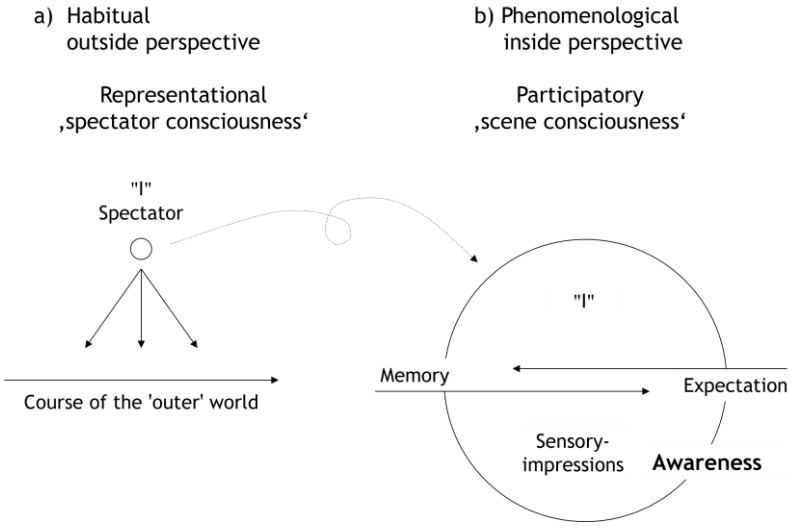

Fig. 14. The external and the phenomenological internal perspective of the experience of time.

5.4 The General Structure of Consciousness is the General Structure of the Organism

Rudolf Steiner further elaborated the image of the double stream of time experience enclosed by the circle of consciousness. For in consciousness is also found the 'I', that is, the fact that there is a self-conscious and autonomously acting element which, on the one hand, can actively deal with the stream from the past (through conscious memories), and, on the other hand, actively places itself in relation to what is expected or desired in the future (through 'judging'). According to Steiner, the influence of the 'I' can be "*graphically represented – and the graphic representation in this case corresponds completely to the facts – by letting the stream of the I fall perpendicularly on the stream of time. … You will come to terms with the phenomena of the soul if, in addition to the two currents – the one from the past into the future and the one from the future into the past - you assume another such current in the human soul, which stands perpendicular to the other two. This is that which corresponds to the impact of the 'I' itself.*"[99]

Finally, concerning the impressions of the senses, which also occur in consciousness, Steiner said, "*If I now draw the fourth*

[99] Ibid., p. 198–199, 04.11.1910 [transl. CH].

direction, from below to above, I would have to call the direction running opposite to the I the direction of the physical world. … The impressions of the physical world thus go, graphically represented, from bottom to top and reveal themselves in the soul as sense impressions."[100] We thus arrive at the following overall representation (Fig. 15), which represents the soul's experience as an experienced order of time.

The 'I' places itself above the continuous flow of time and stops this, as it were, for moments: presence. Things therefore do not appear blurred in transition, but as delimited particulars. What thus confronts the 'I' becomes its counter-object. In recognition, it takes a sum of perceptual impressions from the flow of time and fixes them temporarily as a form. Thus conscious presence arises in the confrontation of the 'I' with the world which it has helped to shape. In the twilight state of dreaming, in trance or ecstasy, the separation of 'I' and world blurs and changes the experience of world and time.

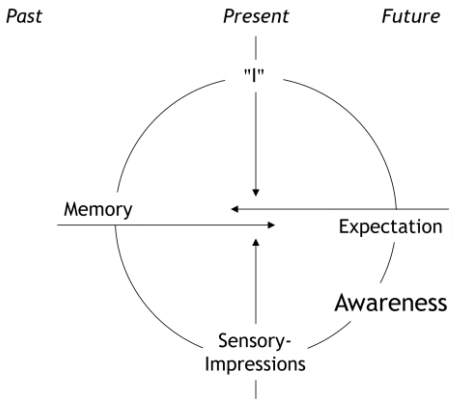

Fig. 15. The TIME CROSS of consciousness according to Rudolf Steiner. (Steiner called the stream from the past the 'stream of representations', the one from the future the 'stream of desire'. Further explanation in the text.)

Summing up, Steiner said, "*Now I can give you the assurance that innumerable riddles of the soul will be solved for you if you take this scheme as a basis. … In this cross, which is traversed by a circle, [is given] a very good scheme of the life of the soul, as it adjoins the spiritual above, the physical below, the [past] to the left and the [future] to the right. Only, in doing so,*

[100] Ibid., p. 205, 04.11.1910 [transl. CH].

you must rise to the idea that the stream of time is not merely something flowing calmly along, but that something is coming toward it, but that the life of the 'I' and the life of the senses can be comprehended only when they are understood as meeting the stream of time at right angles."[101]

The structure of biological development presented above thus corresponds to the structure of consciousness. For comparison, let us once again place the two side by side (Fig. 16).

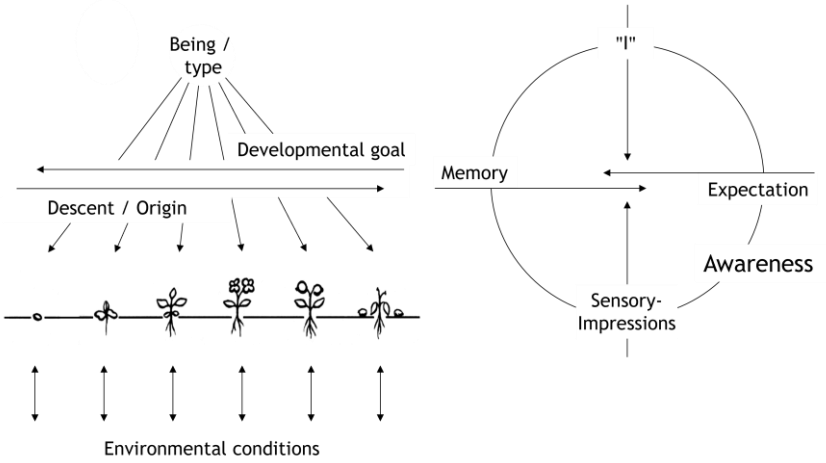

Fig. 16. Comparison of the structure of biological development with the structure of consciousness.

As in consciousness, so in the organism four aspects interact:

1. the spiritual being (the species),
2. the descent or origin, i.e. the past course of development up to the present,
3. the future developmental paths and goals, as well as
4. the respective physical appearance, embedded in a likewise physical environment, to which the organism is adapted and against whose influences it asserts itself.

If one pushes the individual stages of development together in Fig. 16, one obtains the general structure of the organism (Fig. 17). It may be called the idea or the type of the living organism, the *Bio-Logos*.

[101] Ibid., p. 206-207, 04.11.1910 [transl. CH].

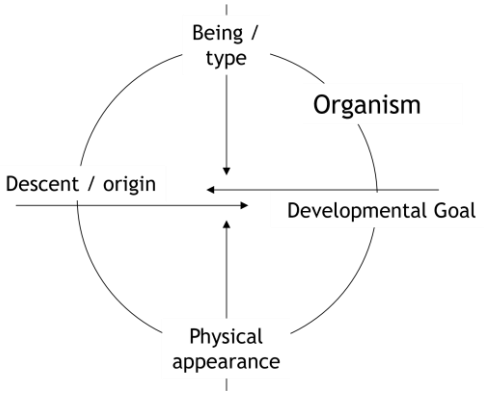

Fig. 17. The general structure (type) of the organism, the *Bio-Logos*.

We have thus gained the possibility of examining the quality and essence of the four aspects of the organism on the basis of the four aspects of consciousness; an inner, differentiated experiential access to the living opens up. In true organicism, the ontology of life and the epistemology of cognition coincide into one.

Immanuel Kant wrote in the *Critique of Judgment* that "*it is left as unanswered whether in the inner ground of nature itself, unknown to us, the physical-mechanical* [i.e., the causal, note. CH] *and the* [final] *connection of purpose in the same things may hang together in one principle: only that our reason is not able to unite them in such a one*."[102] One now sees how these two causalities nevertheless hang together in one principle, and that the *inner ground of nature* unknown to us can be found in our consciousness itself. Thomas Nagel's quest, mentioned in the introduction, for an understanding of nature which contains a teleological component immanent in nature, is fulfilled for the living organism by the link between cognition and organicity. That this view can also apply to the evolution of organisms will be shown in the second part of this book. On the basis of what has been said above about the relation of subject and object in developmental thought, the comparison of the aspects of the organic with those of consciousness is also fully justified. For the past development of an organism is opened up by memory of it, its future by expectation. Only the respective present physical appearance in its environment is accessible to sense observation.

[102] Kant (1790), p. 338 [transl. CH].

Finally, the living being, which permeates and connects all individual appearances is experienced in the volitional intuition of the 'I'.

5.5 The Problem of the Wholeness of the Organism

The inclusion of self-observing consciousness in biological cognition also sheds light on the problem of the wholeness of organisms. Kristian Köchy, who investigated this problem in the history of biological ideas[103], wrote: "*The question of the actual relation between the whole and the parts may belong … to the deepest and so far least solved problem fields of the philosophy of the organic*."[104] The wholeness of an organism, which integrates the individual parts spatially and temporally, cannot be grasped in sensory perception. Perception can always see only details or individual states of development. But these details are not the real organism. There is more to the rose than the blooming shoot. The wholeness represents the spatial and temporal total form of the organism. It is its idea, which connects the details to a unity, namely on the scene of the recognizing consciousness. This idea is not an unreal, subjective addition of the human mind to the external phenomena, but the actually effective, unity-creating instance, an objective world power, which appears on the scene of the knowing consciousness. The question of wholeness can only be solved by the realization of the effect of the supersensible in the sensually perceptible.

Goethe had grasped this wholeness when he said to Schiller "*that one can also represent nature acting and living, striving out of the whole into the parts*"[105].

5.6 The TIME CROSS, the Four Aristotelian 'Causes' and the Critique of Teleology

The structure of the TIME CROSS is already spanned by the famous four 'causes' that Aristotle considered necessary for the explanation of natural things. In the 2nd book of Physics he asked for the reason of things: "*To know each we believe not sooner*

[103] Köchy (1995, 2000) [transl. CH].
[104] Ibid., p. 263.
[105] Goethe (1817), p. 867.

than until we have apprehended the why with respect to each, i.e., its first cause." Then he distinguished, "*In one way cause is called that of which … something consists of, e.g., the ore of the statue and the silver of the bowl; but in another way the form … – that is the concept of what it should be, e.g. of the octave the division ratio of the string two to one; furthermore, that from where the first beginning of the movement or the persistence comes – e.g. the father is the cause of the child and everything changing of the changed; furthermore, one speaks of cause in the sense of the goal, this is the therefore – e.g. of going for a walk the health. Why does one go for a walk? We say: to stay healthy. And by speaking thus, we mean to state the cause*."[106]

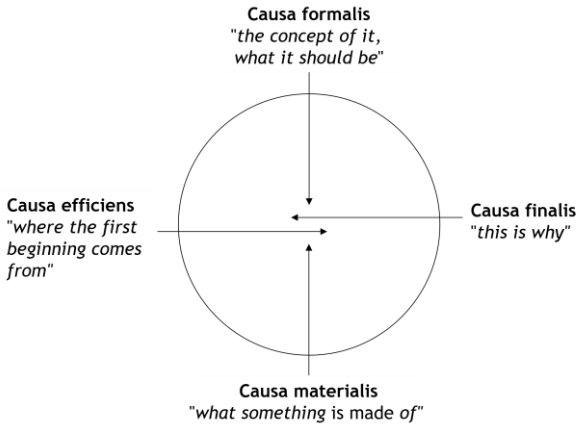

Fig. 18. Aristotle's four 'causes' in the cross of time.[107]

In later philosophy, the four causes have been called form cause (*causa formalis*), substance cause (*causa materialis*), effect cause (*causa efficiens*), and goal cause (*causa finalis*). The cause of form is the 'what' of a thing, the archetype or the idea (Greek *eidos*, 'the thing to be seen'), which causes its essential peculiarity. The cause of substance means the 'what material', that is, the sensually perceptible material. The effect cause means the 'whence' or the effecting (it corresponds to today's conception of a mechanical or efficient cause), and the goal cause means the 'wherefore', the purpose or the goal (Fig. 18).

[106] Aristoteles (2021) Physik II 3, 194b 23-35 [transl. CH].
[107] Volker Harlan has described the four causes in detail with a view to the living organism and comes to the same conclusion as we do. Harlan (2002). Cf. also Lauenstein (1976).

For Aristotle goal-causes were operative not only in the human mind but also in nature: "*Therefore some are perplexed whether with the mind or something else the spiders do their work, and the ants and such animals. If we go a little further, it becomes clear that in plants, too, something conducive to the goal comes into being, e.g. the leaves for the protection of the fruit. If then by nature and for the sake of a goal the swallow builds its nest, the spider its spider's web, both the plant has its leaves for the sake of fruit and the roots not upward but downward for the sake of food, it is evident that there is such a cause* [namely, a goal cause] *in beings that by nature become and exist.*"[108]

The goal cause has often been criticized, and modern natural science has radically abandoned all teleological explanation. Paradigmatically, Francis Bacon (1561-1626), founder of the methodology of empirical natural science, formulated this criticism in his *Novum Organum* (1620): "… *not bad is the statement of four causes: Matter, form, the agent, and the purpose. Of these, the cause of purpose is not only useless, but downright harmful to science; it applies only to human action. One despairs of the discovery of form; … In nature … nothing truly exists except the individual bodies with their particular, pure, lawfully produced efficacy; in the sciences this very law, its investigation, discovery, and explanation, is the basis of knowledge as well as of action*."[109]

Bacon takes a radically empiricist standpoint and concentrates entirely on representational knowledge. He has no awareness of the inner aspects of knowledge; they are perceived only as an obstacle to a knowledge of nature that aims at mechanistic understanding and technical usability. "*Knowledge is power* [over nature]," this thought attributed to Bacon summarizes what has become the basis of scientific-technical culture since the 17th century.[110]

[108] Aristoteles (2021) Physics II 8, 199b 21-30. Spaemann and Löw explain: „*A* [living] *natural thing is characterised by the fact that the what and what for fall into one in itself. The purpose is the form of the thing itself, hence the word entelecheia: I carry the goal within me. If one seeks to understand the processes that take place in a living body, one must orientate oneself towards their possible or functional meanings for the preservation or production of the living being. The starting point for such an understanding is the natural human being, which knows by itself what its parts and organs are 'good' for, i.e. what they can be used for. 'Man is the best-known animal, because his parts do not elude perception'.* [Aristoteles (2013) Hist. An. I 6, 491a 23]". Spaemann & Löw (1981), p. 62.
[109] Bacon (1620), p. 73.
[110] Cf. Appendix *Francis Bacon's Four Fallacies*, p. 184.

Aristotle saw the tetradic structure in nature in terms of ontologically effective causes. One can assume that he still experienced something of the living formative forces that connect subject and object. Baco could no longer do this and looked only at an objectified, externalized, and in this sense dead nature to which cognition is alien. Rudolf Steiner made conscious man's own share in the emergence of world reality through the self-observation of cognition and thus showed that true cognition of nature is at the same time cognition of spirit. If this spiritual knowledge cultivates the scientific thoroughness and conscientiousness of a Francis Bacon also in its field, it becomes spiritual science.

5.7 Man and Nature – Together a Whole

Rudolf Steiner designated the four directions of the TIME CROSS with four terms, which in Anthroposophy describe four so-called 'essential members' of the human being. He called the past current (psychically the current of memory, organically the current of living becoming) the 'etheric body'. This term stands for the organization of the life forces of man as well as of other living beings (one can also speak simplistically of 'life'). The stream of expectation and organic development potential, which comes from the future, he called 'astral body' ('soul'). The stream, which represents the sense perception, he called 'physical body' (material body), and the vertical impact from above 'I' ('spirit') (Fig. 19).

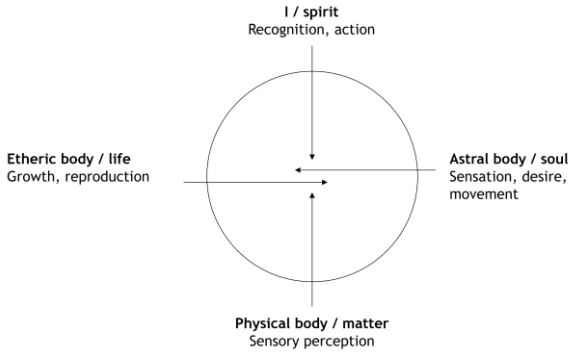

Fig. 19. The TIME CROSS as interaction of the essential members of the human being (according to Rudolf Steiner).

The four members of human consciousness and organic development also correspond to the four realms of nature: stone, plant, animal and human. A stone has a physical body, but no etheric body, no astral body and no I (active spirit). A plant has a physical body (it's current appearance for the senses), and also an etheric body (its life). It has no sensation and desire, thus no astral body in the sense in which it is effective animals. And nevertheless: Future, formative developmental goals also work in a plant, and it has likewise also a spiritual being. The 'psychological' and the 'spiritual' do not appear in it as such, but 'hover around' it as it were from the outside. The plant 'knows' nothing of its future, it does not strive for it, but the future is effective in it. The plant has also a spiritual aspect to it, which does not awaken to self-consciousness as in man, but still works in it as the species-specific, autonomous forming power. In the animal then the psychological *appears* (as sensibility, desire and behaviour), and in man the spiritual in the thought-life and free action of the I.

How do we recognize the future of the organisms, their purposiveness? – We experience it in our consciousness! As knowing subjects we always complete those aspects of the TIME CROSS which are missing with the natural beings. A stone also has its history and future – but the forces that formed it are in its environment and not in itself. As knowing subjects, we add them to what appears to us of it as a sense impression (Fig. 20). In the plant, we see the becoming power realized in the being, we see what has grown. It is immediately clear that it has formed by its own power. We could call plants *embodied memories*. Their future potential of becoming, on the other hand, does not appear in the present appearance. Here it is again we as observers who expect their further development. (In sprouting seedlings, leaves and flower buds one can observe how their sight is surrounded by an aura of expectation of their further development). In the animal appears then also the ability to expect the future. The animal feels and behaves, strives for satisfaction of its needs. In this sense, animals are living, *embodied intentions or desires*. However, their spiritual essence does not appear in the physical being, but is completed in our cognition. Finally, in man a spiritual essence is also individually 'embodied' as a self-determining, autonomously

effective 'I'. Here the outer way of life of the being and the inner structure of the cognition completely coincide.

In this way the world becomes comprehensible, e.g. the fact that a plant potentially continues to grow, while the animal closes itself in a finished form.[111] In the plant the future expectation does not yet embody itself in a formative way, it lies in the observer, while in the animal the intentionality pushes itself into the living formation processes and helps to form them. In man, finally, the intentionality, in general the psychic, is drawn into the realm of the 'I' and thus remains freely movable, while in the animal it appears embodied and species-specifically determined.

With all this one must keep in mind that the TIME CROSS represents the living synopsis of four different world layers and modes of experience. It should always be referred to the experiences underlying it by taking the spatial figure in its temporal sense.

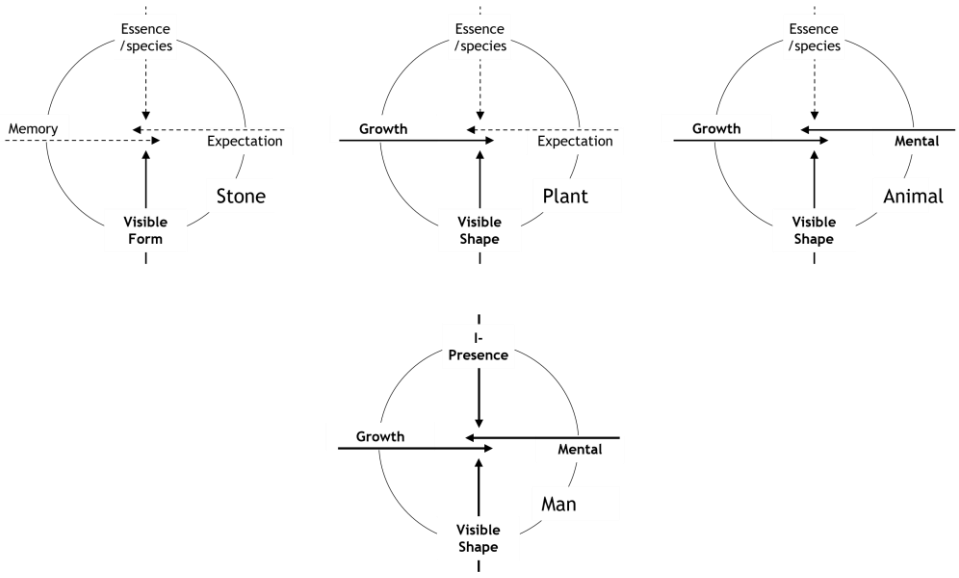

Fig. 20. The connection of human cognition with the natural kingdoms. The solid lines signify the actually appearing, 'embodied' aspects, the dashed lines those aspects which man adds to the appearances in the act of cognition.[112]

[111] Kunze (1981).
[112] Cf. Witzenmann (1986), p. 83; Witzenmann (1983).

At the end of this chapter, an interesting phenomenon of consciousness should be pointed out. The Munich brain researcher Ernst Pöppel showed that adult humans determine a present moment as two to three seconds long. Poems, indeed languages in general, are structured in this measure of time. If you hold someone while shaking hands for longer than 2 to 3 seconds, it seems strange, etc. "*What we experience as 'present' in each case is not an extensionless point on the time-axis of classical physics, but are events with meaning integrated into shapes. … This temporal frame is the basis of our consciousness activity; for a short period of time, consciousness 'concentrates' on one fact and automatically, after a few seconds, the brain 'forces' the concentration to the next content*."[113] The length of this period of time seems to be determined primarily by the *duration of one breath*. When breathing in, one grasps the respective content of consciousness in a contoured manner; when breathing out, one lets it go again. It is like a fine waking up and falling asleep, which lets us glide from one present moment into the next. The experience of time is not continuous, but rhythmically structured.

[113] Pöppel (1984), p. 135 [transl. CH].

PART II

THE TIME CROSS AS STRUCTURE OF LIVING DEVELOPMENT AND EVOLUTION

6 The Animal Form as Expression of the Psyche

That form, how pregnant with a godlike trace!
A look, how did it whirl me t'ward that ocean
Whose rolling billows mightier shapes embrace![114]
(Goethe)

In the first part of this book it was shown that an understanding of the living opens up when one takes into account, besides the biological phenomena, the knowing consciousness. One can understand consciousness not as a spectator but as the scene of world events. In the second part, the question of the human form and its evolution will be pursued. Can we find reasons for the design of animals and especially for that of man that go beyond Darwin? Has our shape developed by chance? And what roles do heredity or genetics play? – In order to understand the human being, the formation principles of the animal shape are to be looked at first more exactly.

6.1 Metamerism and Shape

An important formation principle of organic forms is the repetition of the same or similar elements (metamerism). From cell division to reproduction, this principle is elementary for all living things. Adolf Portmann described the metameric structure as a basic pattern of animal formation: "*The repetition of similar parts in rows is characteristic for large circles of related animals. The body sections of an earthworm or a caterpillar, the order of the trunk muscles in a fish, a salamander are familiar examples.*"[115] (Fig. 21).

"*Particularly striking*," Portmann continues, "*is the series of equivalent limbs in early stages of development of vertebrates or arthropods, even in species in which the adult body outwardly shows nothing more of them. The row-wise arrangement of the organ systems appears therefore at first as a building principle, as a possibility to provide the building material in a simple way for the formation of more complicated body forms. … At these early stages of development the embryos of fishes, birds, and man resemble*

[114] Goethe (1826), S. 366.
[115] Portmann (1965), p. 36 [transl. CH].

each other in many general features of the building plan; those of spiders, insects, and crustaceans are also remarkably similar."[116] (Fig. 22).

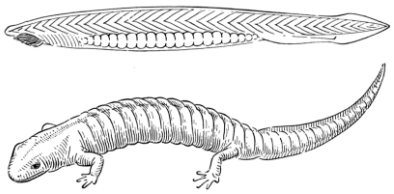

Fig. 21. Metameric body articulation in the lancelet and an earth salamander (from Portmann, 1965).

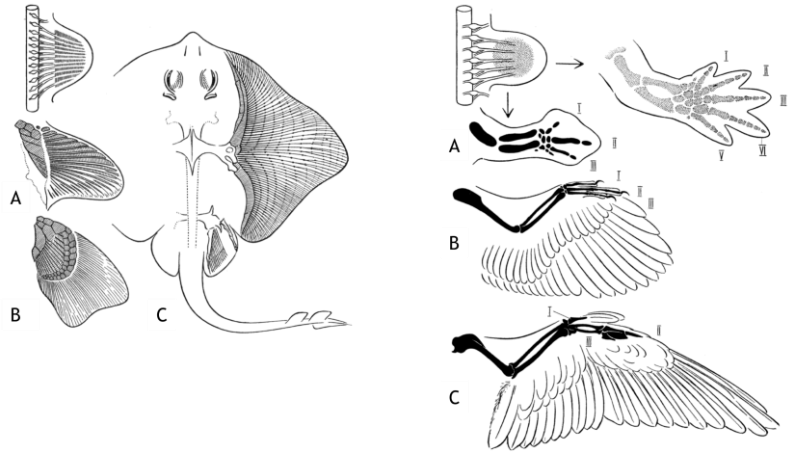

Fig. 22. Metamerism and developmental height. Left: In the fins of primitive fishes, the embryonic metameric arrangement (upper left) of the structural elements (nerves, muscle, skeleton) is largely preserved. A: pectoral fin of Devonian cartilaginous fish; B: pectoral fin of shark; C: ray. Right: The limb bud of terrestrial vertebrates resembles that of a fish fin. It usually develops into a five-rayed limb (top right). The embryonic structure (A) of a bird-wing still shows clear resemblance to the five-rayed prototype. Oldest birds of the Jurassic period show three clawed fingers (B). Skeleton of an extant bird (C) by secondary remodelling (from Portmann, 1965).

Ernst Haeckel's famous embryo chart also shows the early metameric body structure (Fig. 23). In more highly developed organisms, it is over-formed in the course of individual development by the design principle of the organism as a whole.

[116] Ibid., p. 36 [transl. CH].

Like ontogeny, also phylogeny leads from the simpler, rhythmic-metamorphic forms (fish) to differentiated forms (birds and mammals).

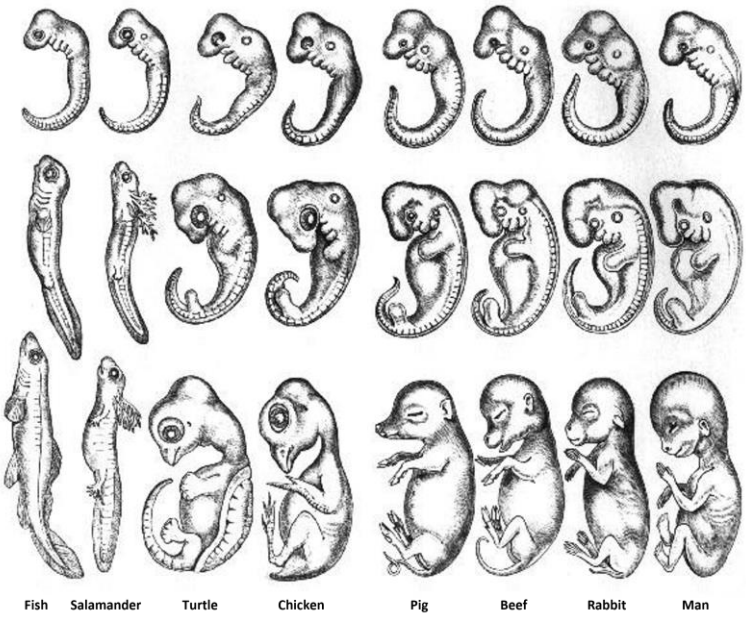

Fig. 23. Metamerism and gestalt formation. Embryonic development of vertebrates according to Ernst Haeckel.[117]

The reshaping of metameric structures underlies many biological formation processes (Fig. 24), such as the formation of the five-rayed hand from cartilaginous elements of prehistoric fish or the formation of the mammalian dentition from the homodontic tooth-rows of prehistoric reptiles. In each case, similar elements are first differentiated, specialized, reduced in

[117] Around this representation there has been some dispute. Especially from creationist side Haeckel was accused of simplification and falsification. In fact the different early stages of the vertebrates are more dissimilar than drawn by Haeckel. But this is not decisive here, because the metameric division of the body is given in all vertebrates. This is also shown by molecular genetics, which, as it were, newly discovered the metameric organization of all vertebrates on the basis of the segmental activity of different genes. For a detailed discussion of Haeckel's account, see: Richardson & Keuck (2002). Cf. also chapter *Ontogeny und Phylogeny*, p. 137.

number, and integrated as parts under the whole of a superordinate gestalt.[118]

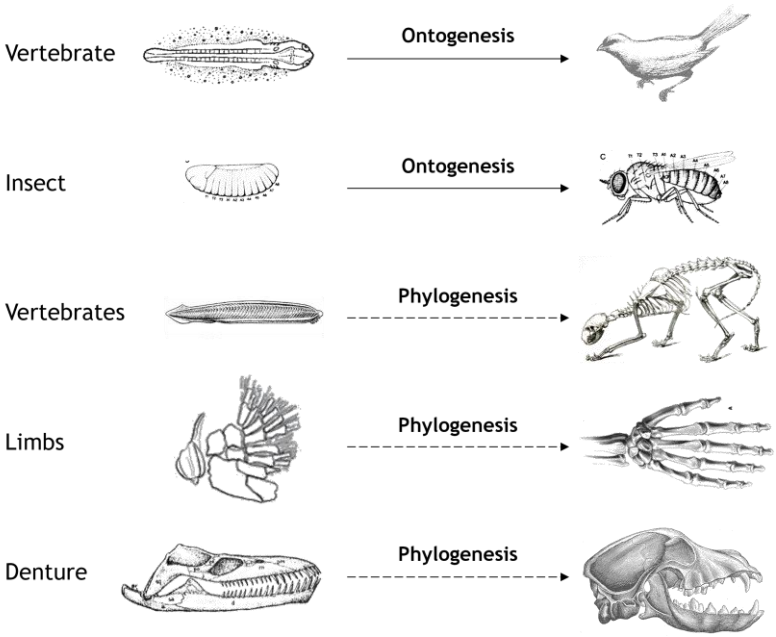

Fig. 24. Examples of gestalt differentiation by integration of metameric structures. For vertebrate and insect, embryonic stages are shown on the left, and adult organisms are shown on the right. The three lower figures show differentiations from phylogenetically older forms to later, integrated forms. Vertebrates: from the lancelet (left) to the mammalian skeleton; limbs: from the fin of a prehistoric fish (*Sauripterus*) to the human hand; dentition: from the homodont dentition of prehistoric reptiles to the mammalian dentition.

The earliest complex organisms of the so-called Ediacara and Burgess Shale fauna, which evolved long before present-day animal phyla, also show astonishing metamerism, with the phylogenetically younger organisms from the Burgess Shale characteristically already remodelled into more differentiated forms (Fig. 25).

[118] Palaeontologist Samuel Williston wrote in 1918, "*It is a law of evolution that the number of parts of an organism frequently diminishes, these rarer parts then being functionally specialized.*" Cited from Carroll (2008), p. 39.

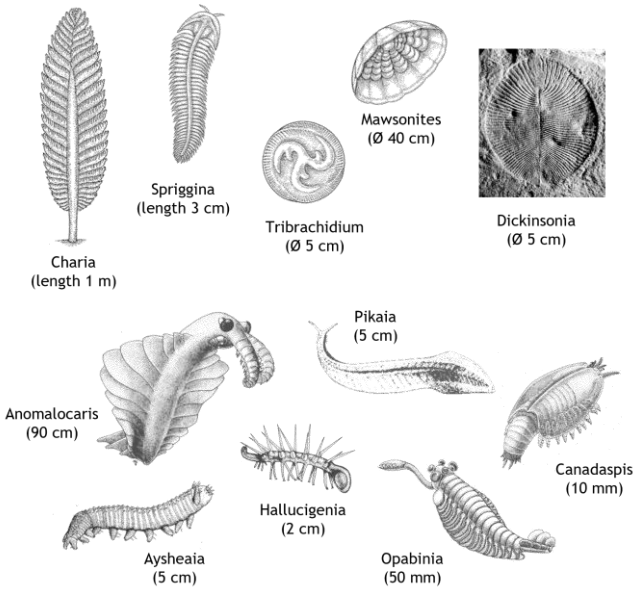

Fig. 25. Organisms of the 580-540 million year[119] old Ediacara fauna show plant-like, metameric designs. These are soft-bodied organisms whose imprints (upper right) were found in the sedimentary rocks of the Ediacara mounds of southern Australia. Bottom: Animals from the geologically younger Canadian Burgess Shale (505 million yrs.), some of which already formed hardened outer skins.

This is an important principle of organic shape formation: the simpler an animal is organized, the more similar it remains to its metamerically structured embryonic form, the more highly developed it is, the more it departs from it. Goethe, too, had already clearly recognized this principle: "*The more imperfect the creature is, the more these parts are alike or similar to each other, and the more they resemble the whole. The more perfect the creature becomes, the more dissimilar the parts become to each other. In the latter case, the whole is more or less similar to the parts, in the latter case, the whole is dissimilar to the parts. The more similar the parts are to each other, the less they are subordinated to each other. The subordination of the parts points to a more perfect creature.*"[120]

[119] According to today's usual time indication from geological dating. One can be of different opinion about the absolute meaning of these numbers [cf. Bockemühl (1999); Bosse (2002)]. Here they are consistently meant as relative markers of geological distances.
[120] Goethe (1807, 1817), p. 15 [transl. CH].

6.2 The Animal Form as Expression of the Psyche

Metamerism means repetition of the similar. In inner experience, metameric repetitions are felt as relatively dull because of their uniformity. One is pointed to the life processes from which the individual elements emerge in a rhythmical way. In the case of the integrated figures, on the other hand, the (much more alert) attention lies both on the details and on the whole figure, which is immediately experienced as a self-contained wholeness. And this expresses something inward, psychological. While the metameric divisions resemble growth patterns of plants, the integrated figures clearly express the element of animal experience and behaviour. How responsive and 'awake' a fly appears while its larva is still incubating in dull life processes! A mammal shows a differentiated psychological expression in comparison to a reptile, and what sublimation expresses the hand of man in relation to the fin of a primeval fish! Consider also the increasing differentiation of the soul, the increasing 'richness of world-reference' (Adolf Portmann), which is shown in the series from fish to amphibians, reptiles, birds and mammals and finally in man (cf. Fig. 26).

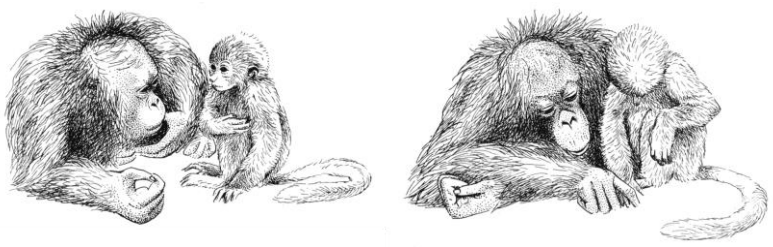

Fig. 26. The shape of animals as an expression of their inner psychic life (according to Portmann). The higher an animal is organized, the richer and more directly the shape expresses the psychic life.

In the self-observation the kinship of the animal-psyche with one's own inner experience becomes apparent. The boundary between subject and object does not exist here as it does in representational consciousness. We live with the animals in a common psychological space.

When watching the forms and especially the behaviour of animals we experience certain psychological impressions. When we look at animals in this way, we also see that they belong to their respective habitats: fish belong to water, butterflies to

flowers, air and light, horses to the steppe, deer to the mountain forest, bats to dusk, and so on. In the light of inner experience the physical appearances of the animals and their life worlds become transparent for a soul world expressing itself in it. The brilliant mathematician and natural philosopher Karl Snell (1806-1886), whose thoughts on evolution we will discuss later, formulated very succinctly: "*Every living natural being seems to be determined in its peculiarity by a psychic principle which stands in the most exact connection with the external world of the animal, indeed which is the same that is also capable of exciting this particular external world of the animal in the soul of man; a creature appears as an imprint of the spirit which inhabits that sphere of nature in which it has its external world assigned to it.*"[121]

The psychological or soul life appears in animals largely 'embodied'[122], i.e., fused with their physical appearance and interwoven with their environment, whereas in man it is environmentally independent and free. Man can inwardly detach himself, as it were, from his corporeality and his external conditions of life; he can think, feel and will this today, that tomorrow. In the course of evolution, a being has evolved in which the psychological is held back from embodiment and thus can be inwardly freely moving.

6.3 The Interaction of Life and Soul as a Design Principle in the Development and Evolution of Animals

The repetition of similar parts is a principle of the *living*, in gestalt integration *soulfulness* expresses itself. Living repetition of the similar and soulful moulding to holistically integrated shapes are the two basic principles of animal development. Repetition enables an uninterrupted stream of life and renewal, which also includes reproduction, while soulful (psychological) shaping is associated with individual aging and death. In the course of evolution, the forms are more and more differentiated and shaped by the psychological, although they mostly develop from simple, metameric stages. The psychological pushes back, so to speak, the effects of the living. The living builds up the organism, the psychic degrades it. The Tübingen zoologist Karl Friedrich

[121] Snell (1847), p. 149 [transl. CH].
[122] Cf. Suchantke (1964), as well as the epistemological presentation in Heusser (2011), p. 199-206.

Kielmeyer (1765-1844) already described a correspondingly reversed relationship between reproductive power and sentience in the animal series: "*The more … reproduction, the more the sentience is excluded. … The more one of these powers has been developed on the one side, the more it has been neglected on the other.*"[123]

Anthroposophy calls the living reproductive power the 'etheric' and, in so far as this power is individually organized, the 'etheric body'. The faculty of feeling is called the 'astral' or, correspondingly, the 'astral body'.[124] The etheric body supplies the living material through repetition. Steiner says: "*The most elementary principle of the etheric body is that of repetition. … We see this in the plant in the most pronounced degree. We see how leaf after leaf develops on the plant. This is due to the fact that the physical body of the plant is permeated by an etheric body, which has the principle of repetition. It forms one leaf, then a second, a third, and thus adds leaf to leaf in constant repetition.*"[125] "*That in a living being members repeat themselves over and over again is the fault of the etheric body, for it always wants to produce the same thing. That is why there is something in life which we call reproduction, the bringing forth of one's own kind. It is essentially based on an activity of the etheric body. Everything that is based on repetition in man and also in animals is due to the etheric principle. That in the backbone ring-bone is repeated ring-bone is due to this activity of the etheric body.*"

The life principle of the etheric body alone, however, *does not* cause the formation of the animals, but merely supplies the living material, which is then formed by the soul or psychological principle of the astral body. Steiner wrote: "*In the astral body the animal form arises outwardly as a whole form and inwardly as the form of the organs. … Life is not brought* [in the animal] *within the etheric up to the formed life. It is maintained in flow; and the shaping pushes itself through the astral organization into the flowing life.*"[126] Elsewhere he said that

[123] Kielmeyer, 1793.

[124] Steiner, 1908-1909, GA 107, p. 83–84, 02.11.1908. With such new terms, we should first and foremost ask what they mean instead of rejecting them or even making fun of them. They are not that completely new. Aristotle and Thomas Aquinas already spoke of the soul as a 'form of the body'. Rudolf Steiner presented these concepts in an extremely differentiated way and continued to deepen and develop them in the course of his spiritual scientific research.

[125] Ibid., p. 28–29, 21.10.1908 [transl. CH].

[126] Steiner & Wegman, 1925, GA 027, p. 35-36 [transl. CH].

"*the astral body counts, but it counts differentiatingly, counts the etheric body. It shapes it counting.*"[127]

We have shown above that the astral 'works' backward in time. Thus, animal formation can be understood from the interaction of two time currents from the past and from the future (Fig. 27). In one stream the perpetual repetition of the similar takes place, which leads to the production and propagation of organic material. One can imagine the living forces in this stream as acting from the inside out. In the other stream, the living material is shaped into differentiated and integrated gestalts in a discontinuous manner. These gestalts express the inner psychic life of the animals. The shaping and differentiating forces can be conceived as if acting from the outside. The first stream is and remains continuously alive, the other always leads to death. *The counteracting effectiveness of life (etheric body) and soul (astral body) in the double stream of time provides a key to the understanding of biological gestalt development.*

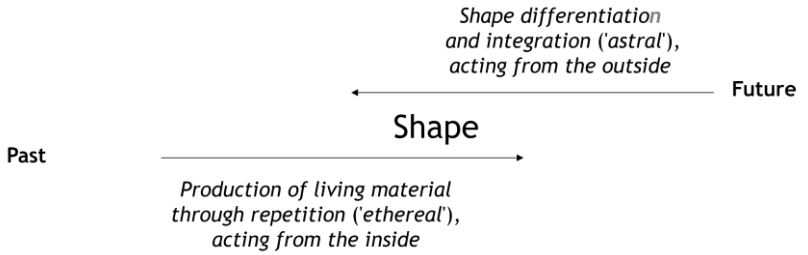

Fig. 27. Shaping of the living gestalt by interplay of (etheric) repetition and (astral) shaping in the double current of time.

It should be noted that this concept is similar to Darwin's notion of descent with variation and natural selection by environmental conditions. Thus, reading Darwin in the light of inner experience can lead to similar results as described here.

[127] Steiner, 1921, GA 204, p. 139-140, 23.04.1921 [transl. CH].

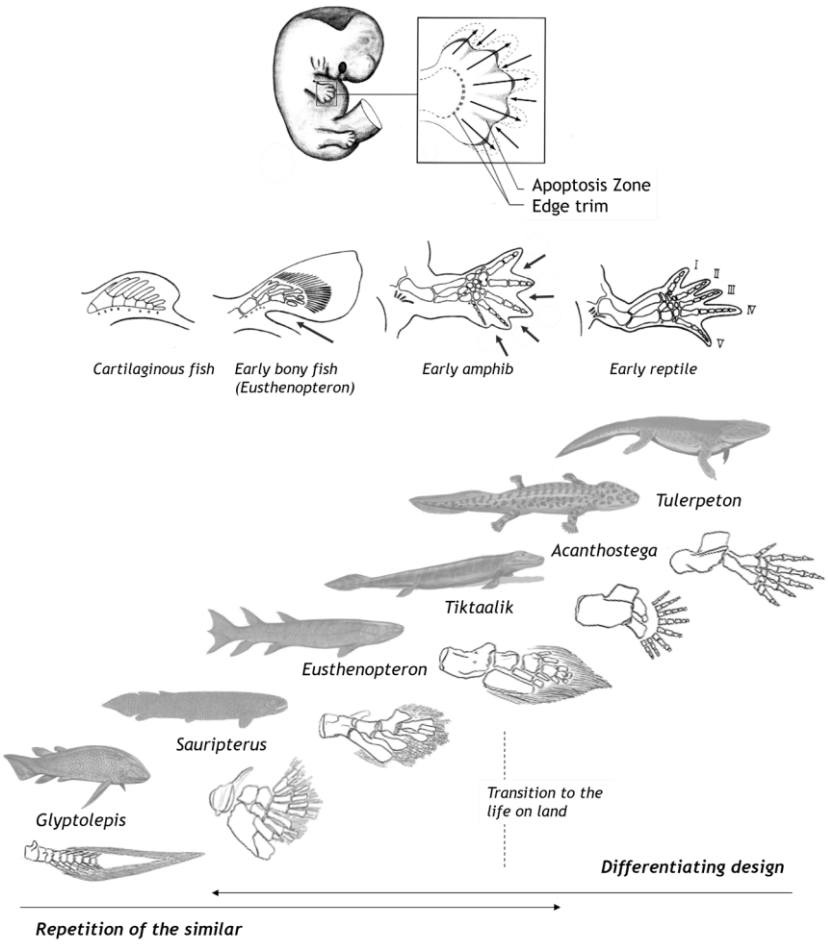

Fig. 28. Top: Growth and programmed cell death (apoptosis) in the embryonic hand bud. Middle: Evolution of the hand. Bottom: Evolution from fish fin to terrestrial vertebrate limb. Transition to terrestrial life in the Devonian 375 million yrs. ago. (from Rohen, Bolk, Shubin,[128] modified).

The described principle of formation applies to both the individual and the phylogenetic development of animals. It is in both cases a dynamic 'shift' on this double axis. Embryonic and early forms of evolution are to be located far 'to the left', while in the course of ontogenesis and phylogenesis, which are

[128] Bolk et al. (1938), p. 64; Rohen & Lütjen-Drecoll (2002), p. 51; Shubin et al. (2006).

associated with ever-increasing penetration of the psychic, their place shifts further to the 'right'.[129]

In evolution, moreover, the above-mentioned Williston's law is manifested: many similar elements are transformed into a formally differentiated and functionally integrated whole consisting of fewer, distinctly different elements. It is the interplay of the building-up life processes, the repetition of the similar, with the degrading and differentiating soul effectiveness.

The ontogeny and phylogeny of the hand provide nice examples of the effect of the formation principles described. Embryonically, the hand forms from a limb bud (Fig. 28, top). Differentiation into individual fingers occurs by programmed cell death (apoptosis) of the cell tissue initially still present between the fingers – an interplay of living, space-filling cell growth (ethereal) with bifurcating, differentiating death (astral). The same principle operates in the transition from the fins of fish to the extremities of terrestrial vertebrates.

6.4 Evolution of the Tripartite Organization

Although we have now described a principle of formation of the organic gestalt, the question is still open as to the reasons for the specific formation. The fact that it arises through the influence of the soul (astral) on the living material of the physical-etheric organization, says nothing about why the forms of the animals and the human being are formed just in such a way and not

[129] Among anthroposophically oriented, Goethean biologists, Hermann Poppelbaum has described this connection. In his *Tier-Wesenskunde* he wrote: "*The more developed limb-animals are to be understood by concentration, compression and subordination of the* [metameric] *successive pieces into higher units. In these processes of concentration the efficacy of the astral body proves itself, as in the stringing together of uniform successive pieces that of the etheric. … The subordination of the segments into higher units points to an increase of the state of consciousness.*" Poppelbaum (1937). Also Iwer Thor Lorenzen has pointed out the interaction of etheric and astral body in animal formation, e.g. in the metamorphosis of insects or the generation change of hollow animals between polyp and medusa: Lorenzen (1969). See Appendix *The Life Cycle of Jellyfish as an Example of the Work of Etheric and Astral Formative Forces*, p. 190. In contrast to this, Wolfgang Schad was of the opinion that the TIME CROSS and especially the interaction of etheric and astral body only applied to the psyche, but not to the organic development. Schad (2013), p. 194. In Schad's opinion, the living (etheric) stands between the physical, in which causality rules, and the soul (astral), which is determined by finality, and forms itself from itself. Schad (1966, 2013).

completely differently. To get further, I fall back on a central discovery of Rudolf Steiner: *The threefold structure of the human organisation.*

Three soul faculties can be distinguished: representational imagining (thinking in a broader sense), experiencing feeling and active willing. Imagining is experienced in a waking consciousness. Feeling, on the other hand, surges up and down on the border between the conscious and the unconscious; compared to waking representation, it has a dream-like character. Willing, finally, plunges completely into the unconscious depths of the human organization, there to become effective in the movements of the body and its limbs.

Rudolf Steiner's seminal discovery[130] is that these three soul faculties have their physiological bases not only in the brain, but in three bodily functional systems. He did not see the soul faculties only in connection with the brain, but differentially embodied in the entire physical organization:

- representative imagining/thinking in the nervous- and sense system,
- feeling in the respiratory and the circulatory systems (the so-called rhythmic system), and
- willing in the metabolic and limb systems.[131]

The three systems are clearly distinguishable from each other and yet they interpenetrate each other. The nerve-sense system has its centre in the head, respiration and circulation in the chest, the metabolic-limb system in the lower trunk and limbs. Imagination is bound to the nervous-sensory system. Willing, on the other hand, lives out in the movements of the limbs, which are 'fuelled' by metabolism. Feeling is related to heartbeat and breathing; it is not only experienced there, but also directly affects rhythmicity.

The will is localized where it is also experienced, namely in the movements of the limbs or the entire voluntary musculature. Not the imagination of what I wish or want is will, but the actual doing. Thinking belongs to the nerve-systems (head), which only

[130] Steiner, 1917, GA 021, p. 150-163.

[131] The tripartite organization has often been described in great detail and is only sketched here in the very roughest outlines. Cf. e.g. Kolisko (1921); Vogel (1992); Rohen (2000).

serves the awareness of the will impulses. The same is true for feeling: Feelings become conscious in the head, but they are experienced in connection with heartbeat and breathing. The whole body is organ and expression of the soul (Fig. 29).

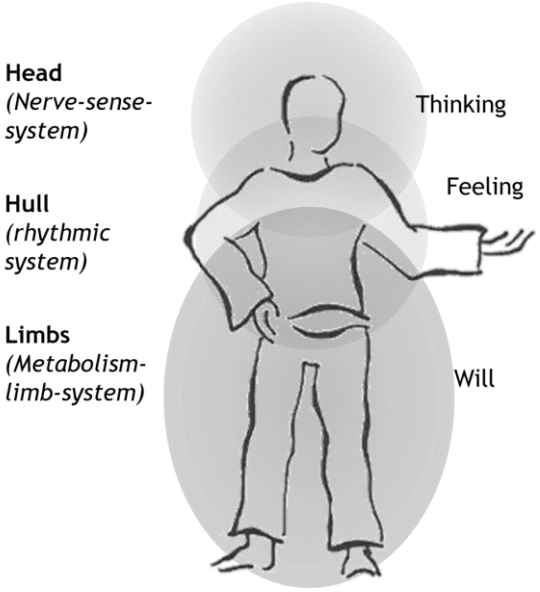

Fig. 29. The tripartite organization of man.

The three bodily functional systems have gradually differentiated from each other in the course of evolution (Fig. 30).[132] In a primitive chordate animal, as in fishes generally, the head merges into the trunk without incision; it is the mere front end and cannot be moved independently of the trunk. The brain capsule, if already present, is open to the abdominal cavity. The lateral line organ, which is important for the orientation of the fish and from which the sense of hearing and the sense of balance of the inner ear will develop in evolution, is spread over the whole body. The middle, rhythmic system also does not yet close in a 'chest', indeed in primitive fishes there are no ribs (fishbones) yet. Limbs with an inner skeleton are missing, the whole trunk serves as an organ for locomotion.

[132] Vgl. Kipp (1948).

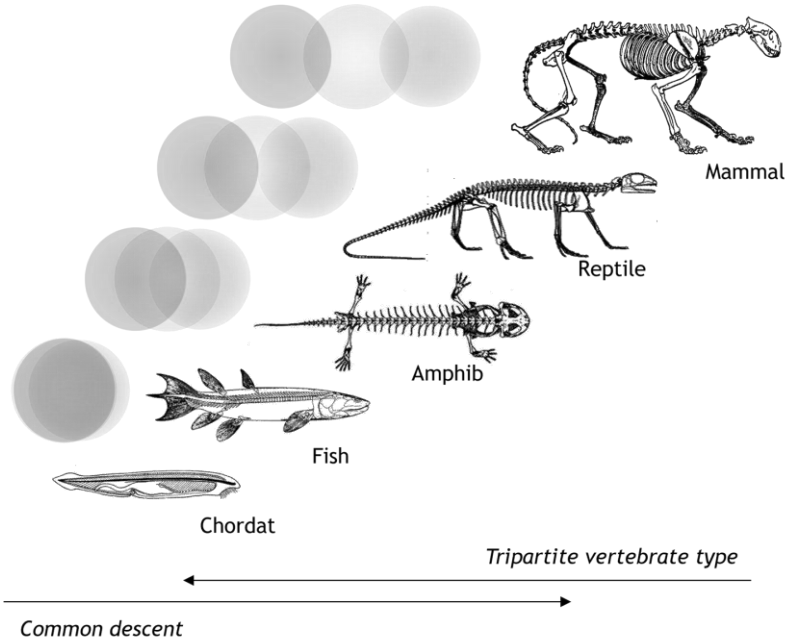

Fig. 30. The evolution of the tripartite organization of vertebrates in the double stream of time.

Amphibians already have an independent head and limb formation. Locomotion, however, still shows the flailing of fishes; the limbs are not yet brought under the trunk as in reptiles, their leverage is still little efficient. The head merges into the trunk without an externally visible neck. Respiration is also not yet concentrated in the thoracic region, but is spread over the body surface in addition to the lungs. Reptiles show increasing independence of the head and limbs, each differentiated from the trunk. However, the entire trunk is still dominated by the rhythmic element of ribs and vertebrae. Only in mammals, through the diaphragm, do the systems of the abdominal cavity differentiate into the thoracic cavity with the central organs of the rhythmic system and the abdominal cavity with the organs of metabolism. Only mammals form the tripartite structure completely. In the course of vertebrate evolution, therefore, the three systems gradually 'unmix', and thus the tripartite type comes to appear more and more clearly.[133]

[133] Thus, as Ernst-Michael Kranich wrote, "*the fish-type can be ideally derived from the much more perfect mammalian type*". Kranich (1989). p. 62.

Nevertheless, in mammals, the three areas or the gestalt are still functionally intertwined and only become completely independent of each other in humans through the upright posture. In animals the head still serves as an organ of grasping and the front limbs for locomotion, the rear limbs are often used like hands (for climbing, scratching etc.). The human spirit, however, can live only in a formally *and* functionally tripartite organization. In the bodily organization of a fish no independence of imagining, feeling and willing would be possible. Only by the separation of the three organ systems the soul abilities can differentiate. And only by the differentiation of the soul abilities the human being can be what he is. Only in this way can he imagine something without at the same time triggering a behaviour; only in this way can he accompany, evaluate and change his actions imaginatively; and only in this way can he distinguish himself in feeling from the outer world. The separation of imagining, feeling and acting are therefore the prerequisite for the unfolding of human *self-consciousness*, of feeling oscillating freely between *self- and world-experience*, and of free and self-responsible *self-efficacy*.

We can call this threefoldness the archetypal lawfulness or the 'type' of human organization. This type was realized in the course of evolutionary development, in that the tripartite organization as a soul-body differentiation has shaped itself more and more in the forms arising from the common descent.[134] In this sense the reason for the evolutionary development up to the human being lies in the shaping of the tripartite (human) organization.

[134] The three main groups of mammals – rodents, carnivores and ungulates – are also to be understood from the tripartite structure. In rodents, the nervous and sensory systems predominate, in ungulates, the metabolic and limb systems predominate, while carnivores represent a balanced middle. Schad (2012).

7 Molecular Genetics in the Double Stream of Time

For only that which can still do its work,
in truth deserves its name.[135]
(Aristoteles)

7.1 Genes and Gestalt Formation

If you open a modern textbook of biology, the first thing you usually find is a presentation about cells and molecules: The cell as the so-called basic building block of life with the hereditary substance DNA in the nucleus, which is supposed to contain the program by which organisms construct themselves. The cause of the otherwise inexplicable properties of life, it is suggested or formulated, is the genetic 'blueprint'.

Since the discovery of the DNA structure (the famous double helix) by Francis Crick, James Watson, Rosalind Franklin and Maurice Wilkins (1953) and the subsequent elucidation of its function, an immeasurable wealth of information about molecular biology has been amassed. But as much as one has learned in this way, the attempts to explain the living form and wholeness from its supposed genetic 'causes' and to create it in the laboratory have remained unsuccessful.

Of course, genes have an enormous influence on life phenomena, they are part of the living. Goethe was already interested in this side of organisms. A few weeks before his death he wrote to the chemist Heinrich Wilhelm Ferdinand Wackenroder: "*I am highly interested in how far it is possible to come to terms with the organic-chemical operation of life, by which the metamorphosis of plants is effected according to one and the same law in the most manifold way.*"[136] Goethe wanted to follow the metamorphosis principle down to the material details of plant chemistry.

Genes have a linear arrangement of their building blocks. Their order constitutes the genetic code, which is translated into the structure of proteins. Proteins build cells and organs and they act as enablers (catalysts) of material conversions in the organism. They catalyse the breakdown of food and the building-up of

[135] Aristoteles (1955), p. 390a.
[136] Goethe (1832), p. 209.

endogenous substances, but they also act as pores through which substances are transported into and out of cells, as sensors that detect hormonal and other signals, as regulators that control the activity of individual genes, and so on. All of these different activities each require specific proteins, and each of these different types of proteins is encoded by a different gene.

Each individual body cell capable of division contains the totality of all the genes of the organism, the so-called genome. However, different genes are activated or inhibited in different cells; other genes are activated in a liver cell than in a retinal cell. The control of genetic activity is effected by regulatory proteins, which themselves react to influences from the whole of the organism and its environment (e.g. certain food-degrading proteins are produced by the organism only if the corresponding nutrients are present in the digestive system). The same principle applies in a complicated way to all the genes that are active in embryonic development and where mutations can lead to serious malformations.

Genes are thus necessary for the development and shaping of an organism, but they are far from sufficient. The question therefore arises whether and how the above-described shaping principles can be reconciled with genetics.

7.2 The TIME CROSS of Genetics and the Threefold Structure of the Cell

DNA is a macromolecule of individual building blocks, called bases, arranged in a row. The sequence of the bases is passed on from cell to cell and inherited from the ancestors to the descendants. This process involves the respective sequence-identical duplication of DNA (replication). Individual sequence segments of this macromolecule represent functional units, the genes. The genetic 'information' rests in the DNA. When needed, it is activated (a process called gene expression). Then those gene sequences are 'translated' into protein sequences that are needed by the organism here and now. During gene expression, the DNA sequence of a gene in the cell nucleus is first 'transcribed' as a mirror image into the sequence of a messenger molecule, the so-called mRNA (transcription). The mRNA migrates from the nucleus into the cytoplasm, where transmitter molecules, the tRNAs, 'read' the sequence of the

mRNA and mediate its 'translation' into the sequence of amino acids of the proteins (translation) (Fig. 31).

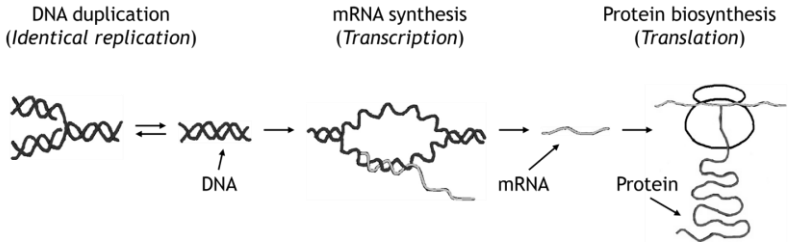

Fig. 31. A (highly simplified) schematic of the components involved in gene expression.

Interestingly, DNA is a completely passive molecule: It is duplicated, read, activated, inhibited, passed from cell to cell, etc. All these activities are brought about by proteins, which are the active components of the molecular events in the first place.

How do DNA and proteins relate to time?[137] – As a molecule of heredity, DNA clearly acts from the past into the present. Its sequence was formed in the past, and it preserves it for the present and the future. DNA keeps the past of an organism present; it is the conservative molecular memory of the cell.

In contrast, the catalytically active proteins have a specific relationship to the future. They are the progressive enablers of all biochemical and molecular biological events. After all, catalysis means enabling reactions that would proceed so slowly under natural conditions that they could no longer have any significance for life. Proteins thus literally bring future possibilities into the present. In this way, they simultaneously enable the further development of organisms. The DNA mediates the presence of the biological past, the proteins that of the biological future in the present molecular-biological events.

The third class of molecules mediates between DNA and proteins. They are different varieties of RNA. They act between the DNA structure and protein function by realizing parts of the DNA 'information' as needed via conversion into functional proteins. This need is communicated to the genes via signals (with the help of regulating proteins). Through such signals, the cell, surrounding tissues, organs, and indeed the whole organism

[137] Detailed in Hueck (2009).

and its environment, act to activate and inhibit individual genes (epigenetic control).[138]

One can represent the preceding as a TIME CROSS of genetics (Fig. 32). In the double stream of time, the functions of genes (inheritance) and proteins (metabolism) meet and interpenetrate in protein biosynthesis. Their interaction is mediated by RNAs and controlled by signals that regulate the process according to the needs of the whole organism.

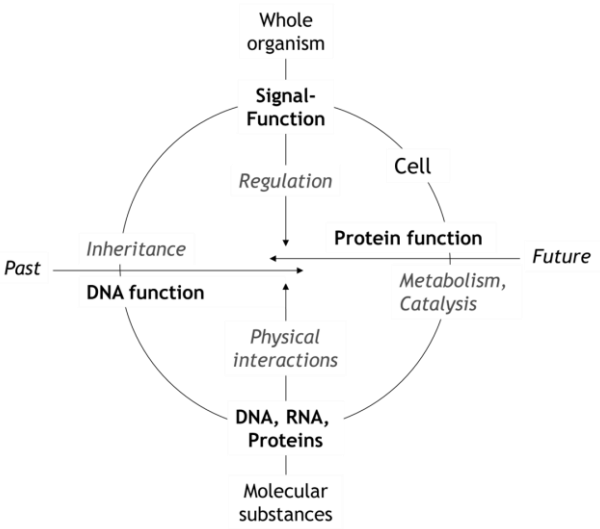

Fig. 32. The TIME CROSS of genetics. Further explanation in the text.

Inheritance, metabolism/catalysis, and regulation are functions that go beyond the material interactions between molecules. The heredity function of DNA is only possible if a living ancestor existed to inherit, and metabolism likewise presupposes an organism in which substances change. Thus, the functions of DNA and proteins are more than physics and chemistry, although they occur as physico-chemical interactions between molecular substances. The material appearance of molecules and their physico-chemical properties thus correspond to the 'material' aspect of the sense perception of the physical world in the TIME CROSS, i.e. the direction from below.

[138] Bauer (2008). Mayr (1998), S. 229.

The DNA is the past-preserving molecular memory of the cell, from which individual 'information' in gene expression is recalled, as it were, on the current occasion. The genetic stream of heredity corresponds to the stream of memories in the time cross of the consciousness. Remembering and inheriting are related processes. Just as at any given moment only a portion of the genetic 'information' for the synthesis of proteins is realized, so at any given moment we are aware of only a portion from the sum of the images we carry within us.

Unlike linear DNA, in which one 'unit of information' follows another, proteins are spatial entities, and their functionality is based on their three-dimensionality. It is through structured surfaces and interiors, depressions and pockets that proteins become biochemically active. Proteins are dynamic molecules. They act like active tools, like hands that can grab a substance, reshape it, and let it go.

One understands proteins by comparing their mode of action with one's own voluntary action. Action is active; one moves one's limbs in three-dimensional space, grasping, changing, and releasing the objects of action. Finally, the connection between action and proteins also lies in the fact that the exercise of will requires an active metabolism catalysed by proteins. Proteins represent the will pole of the cell that makes the future possible.

The correspondences between DNA function and imagining, protein function and willing show up even in the microstructures of the molecules. Both, DNA and proteins, consist of a molecular backbone on which their respective building blocks are arranged like beads on a chain. In the case of DNA, this backbone consists of sugar phosphates; in the case of proteins, it is the nitrogen-containing peptide bonds of the amino acids. While the functional parts (the bases) of DNA are oriented inward (head principle), the side chains of proteins are oriented outward (limb principle). Without the inward orientation of the bases, the mirror principle of DNA replication and transcription would not be possible, while the outwardly extended side chains of the amino acids determine the spatial structures and functionality of the proteins (Fig. 33).

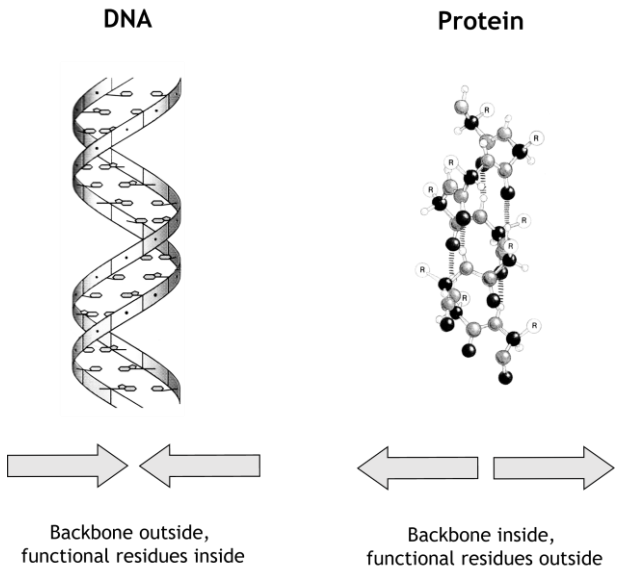

Fig. 33. Polar structure of DNA and protein. R = functional residues of protein building blocks (amino acids).

RNA occupies a middle position functionally and structurally. It carries sequence information, but as ribosomal RNA it can also form a protein-like, three-dimensional structure. It usually unfolds into two-dimensional, sheet-like structures and can even be catalytically active in certain forms.

We thus have an image that describes the interrelationship of DNA, RNA and proteins in an organism. It is much more than an analogy between consciousness and molecular biology. In it, the essence of molecular processes is expressed, because molecules are understood through their corresponding psychological activities. To understand proteins, one has to understand their dynamics in inner will movements. One slips into the protein with inner activity and lets it perform in the imagination those movements which explain its catalytic activity. In the case of DNA, on the other hand, passive pictorial ideas are sufficient for a basic understanding. Becoming aware of these psychological processes, which take place in each act of cognition, opens the way to a 'reading in the book of nature' and unites inner consciousness with outer nature in a higher unity of experience and cognition.

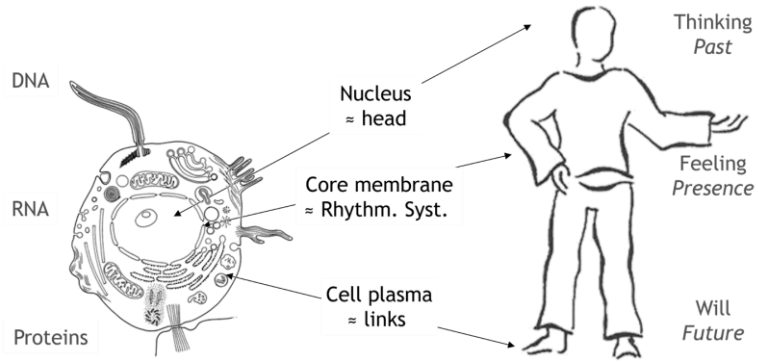

Fig. 34. The tripartite structure of the cell and the classes of molecules that are significantly involved in gene expression.

The whole cell is also tripartite in design. The DNA is located in the (spherical) nucleus, the 'head' of the cell. The cytoplasm, where proteins catalyse cellular metabolic and motility processes, represents the metabolic limb pole, while the nuclear membrane and the RNAs mediating the exchange between the two represent the rhythmic system of the cell (Fig. 34). – The human head reflects stalled images of the past; through metabolism and limbs, we give birth to future becoming. These polar processes are rhythmically integrated in the chest as present experiences. Thus, the functions of genes and proteins are embedded in a time structure that corresponds to the time structure of life and consciousness.

The tripartite structure is also evident in the physiology of the nervous, respiratory and blood systems. The basis of thought is the nervous system, that of will the blood system. The blood is the energetic carrier of the impulses of will which permeate the whole body.[139] Nerve cells and red blood corpuscles show a particularly interesting polarity just from the point of view of the double stream of time, because for both the embedding in this double stream is interrupted in a characteristic way. Nerves are completed, finished formations. Nerve tissue, once formed, still has a minor, peripheral capacity for growth, but hardly for reproduction and regeneration. Nerves are thus determined from the past, but their connection to the biological future is, as it were, cut off.

[139] Steiner, 1919, GA 293, p. 30-44, 22.08.1919.

In contrast to nerve cells, red blood cells do not have a nucleus. They, too, have lost their regenerative capacity, but for a reason opposite to that of nerve tissue: For red blood cells, the connection to the biological past has been cut, they are no longer anchored in the living stream of development. Blood is constantly being formed, it is in a constant state of becoming. It is the same with blood as it is with proteins: It is formed, fulfils its function for some time (especially in metabolism) and is then broken down again. Nerve and blood are thus integrated between imagination and DNA or will and proteins.

Past	**Present**	**Future**
Memory	Actuality	Potential
Imagining	Feeling	Willing
Head	Chest	Limbs
Nerve	Respiration / Circulation	Blood
Cell Nucleus	Exchange through Membranes	Cell plasma
DNA (Inheritance)	RNA (Regulation)	Proteins (Catalysis)

Tab. 2. Threefold structure on different levels of the organism.

Above we had said that the threefoldness is the type of the human being, of the evolution of mammals and also of the three main groups of mammals. The same basic principle applies also to physiology and down to cell structures and molecules.

7.3 What is Organic Matter?

The level of cells and molecules is governed by the same laws as the whole living organism. However, we have to analyse more thoroughly how the molecular level relates to the life of the organism in order to understand the relationship of the organic formative forces, which we had called 'supersensible' above, to the material substances.

Material substances always appear only in the present; they can be observed and handled only presently. As soon as the current moment has passed, one can no longer perceive the material

appearance, and there is also no sensual perception of the future. One rarely makes this simple fact completely clear to oneself. But it has significant consequences, which Rudolf Steiner outlined in an early essay. He wrote that "*the concept of matter* [owes] *its origin to a quite mistaken conception of time. One believes that the world would evaporate into an insubstantial semblance if one did not think that the variable sum of events was subordinated to something that persists in time, to something that is unchangeable.* … [But] *only he who cannot complete* [the] *ascend from appearance to essence … needs … an existence that outlasts the changes. As such he grasps the indestructible matter. With it he has created a thing which time shall not harm. … But actually he has only shown his inability to penetrate from the temporal appearance of facts to their essence, which has nothing to do with time*."[140]

'Matter' is a content of perception, not a permanent substance. What is permanent are the regularities and the essence of sensuously perceived phenomena. "*The sensuous world-view is the sum of metamorphosing perceptual contents without an underlying matter.* … [With this]*, of course, only that concept of matter is met which physics bases its considerations on and which it identifies with the old, likewise incorrect concept of substance of metaphysics. Matter is something else … as phenomenon and as appearance. … For if I call that which fills space 'matter', then this is merely a word for a phenomenon to which no higher reality than other phenomena is ascribed. I must thereby only keep this character of matter always in mind*."[141]

This insight has no consequences for our perception of the world and its phenomena, but significant consequences for our understanding of the world. If one looks at the perceived phenomena with the thought: these are all appearances "*without an underlying matter*", then one is immediately much closer to the spiritual. The sensuous things appear as presently perceptible,

[140] Steiner, 1884-1897, GA 001, p. 272-273 [transl. CH]. Cf. Appendix *Consciousness and Matter*, p. 185.

[141] Ibid., p. 274 Steiner wrote elsewhere: "*The idea of 'matter' is only a provisional one, which has its justification as long as its spiritual character has not been seen through. But one must nevertheless speak of this 'justification'. For the assumption of matter is justified as long as one faces the world perceptively with the senses. Whoever in this situation makes the attempt to assume some spiritual entity behind the sensory perceptions instead of matter, fantasises about a spiritual world. Whoever first penetrates to the spirit in inner experience, does not transform himself dreamily, but exactly vividly, what first 'haunts' as matter behind the sensory impressions, into a form of the spiritual world, to which he himself belongs with the eternity of his being.*" Steiner, 1921-1925, GA 036, p. 266, 22.04.1923 [transl. CH].

floating in time: "*The sensuous world* [is] *only a part of that which surrounds man. From the general environment of man this part stands out with a certain independence, because it can be perceived by the senses, which leave out of account the psychic and spiritual, which likewise belong to this world.*"[142] In the phenomenological attitude of consciousness, which we characterized above as the participatory scene consciousness, this statement is perfectly intelligible. These considerations apply to the material appearance of organisms, which, as present forms, have no duration, but are mere extracts from the continuous stream of life

The substances of which an organism 'consists' are subject to metabolism and continuous change. Only when they fall out of the stream of life (e.g. in tooth enamel or fingernails), or when the organism is broken down into its component parts, do they appear as dead, permanent substances. As long as they flow in a living context, they always have a specifically biological past and future. The concept of a biological molecule, therefore, quite analogous to the concept of an organism, encompasses both substantiality and processuality. When the biochemist speaks of proteins in the organism, he means not only a material structure, but at the same time a biochemical function. The geneticist implies with DNA in addition to the material structure always the hereditary function. The substances isolated from the life process are products of a living, i.e. changing, interrelated and structured whole. As isolated substances they are, as it were, frozen, arrested processes.[143] The material of a living being is already dead. The becoming, life itself remains invisible. But because the consciousness can at first fully awake only at the objective, the illusion arises that living beings are material, and that life can be explained from the interactions of material particles.

7.4 Part and Whole in Biology – from Meaning to Molecule

Biologists always include in all their findings the implicit knowledge they have of the living organism. Without this knowledge, one could not develop any understanding of biological phenomena at all. When one speaks of 'genes', one knows that genes have certain functions in cells; that cells are parts of an organ; that organs belong to an organism; that the

[142] Steiner, 1904, GA 009, p. 146.
[143] Rozumek (2003).

organism is a specimen of its species living in a certain environment; that this species has developed in evolution from certain precursor forms, and so on. From the smallest to the largest, you think of everything when you say 'gene'. And one implies the temporal integration of having become and becoming potential. Only in this way one can think the term 'gene' at all. It leads through itself beyond itself.[144]

'One sees only what one knows' is an important principle, especially for biology. But one does not always know how one sees. Nobody would have come up with the idea of looking for a substance in living beings that mediates the inheritance of individual characteristics if one had not first thought of the whole organism, broken it down into individual characteristics, and recognized these characteristics as inheritable. Only this knowledge has shown the way to the finding of the genes. The conception of the whole necessarily precedes the determination of its parts. This fact describes again a point where an objective property of organisms coincides with a subjective property of cognition: we must think the whole first if we want to determine its parts, but this whole must also be there first if its parts are to be there. To emphasize it once more: From the whole organism one can always gain (by destruction) its parts, but one can never rebuild the whole from the parts.

The light of the concept of life must illuminate the organic details, otherwise they would not be seen. But because one lives in this light oneself as a recognizing I, one does not notice it, but only looks at the appearances illuminated by it. One sees the physical light only through the objects it illuminates. The light that illuminates the living world is the living light of the knowing mind. And it is, as we have seen above, of the same kind as the growth forces of the living organism.

We have characterized above the relation between the imaginative activity and individual ideas. The same relation as between the wilfully imagining 'I' and what it imagines also apply to the organism (Fig. 35). Its vital activity, which penetrates all individual stages of development and levels of organization (organs, tissues, cells and molecules), cannot be perceived sensually, but can only be experienced in active thinking. The living thinking activity is closely related to the organic living

[144] Hueck (1993).

activity, yes, one could say, one and the same, only once seen from the inside, the other time from the outside (cf. Fig. 7, p. 57).[145]

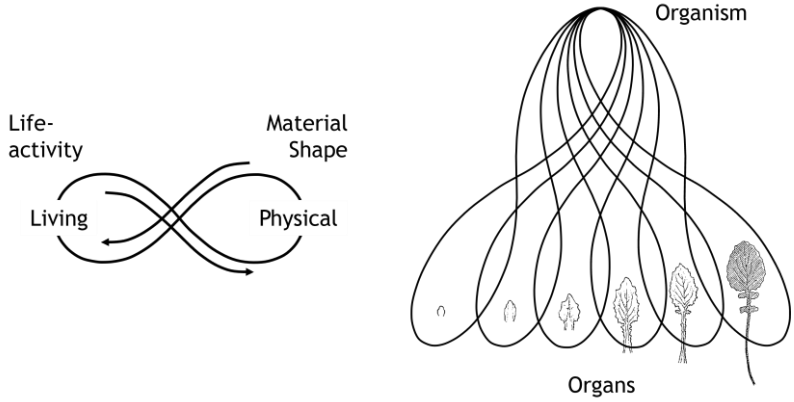

Fig. 35. The relationship between the spiritual organism and its individual physical-material stages of development and parts.

7.5 Genes and Evolution – the Invisible Tree of Life

The past of organisms remains present in their genes. Thereby, the DNA sequences of two organisms are all the more different, the earlier their ancestors separated from each other in evolution. If one assumes that certain DNA sequences change with a certain regularity in the course of generations, one can calculate from the difference in the DNA of two organisms the approximate period in which their 'last common ancestor' must have lived. In this way, a family tree can be derived, which is used as a supplement to the study of fossils. In most cases, the theoretical age calculated from DNA analyses significantly exceeds the age of fossil finds, and the further back into the past one goes, the more so.

Genetic analyses show that the lineages leading to humans and chimpanzees diverged 5 to 7 million years ago, while the common ancestor of humans and wolves lived in the Cretaceous period about 100 million years ago, of humans and reptiles in the Carboniferous period about 325 million years ago, and of humans and the earliest fishes in the Cambrian period about 550

[145] Cf. Appendix *Rudolf Steiner: Perception of the Vital Force by Strengthening the Power of Thinking,* p. 180.

million years ago. If we even compare the DNA sequences of humans with those of the simplest living beings, bacteria and archaebacteria, we come back to the beginnings of physical life on Earth.[146]

We are related to all living beings. The diversity of life forms probably sprang from a single source, as the human organism sprang from a single cell. The majority of our gene sequences are also found in unicellular organisms, and therefore were present at the beginning of life on Earth.[147] The whole Earth can be viewed as a maternal organism for the emergence of the first delineated living things.[148]

As might be expected, many of the 'oldest' genes that we share with today's bacteria are involved in basic metabolic processes, cell division and protein biosynthesis. To these are then added those that we share with all multicellular organisms, and which are primarily related to interactions among cells. Other genes we share with all bilaterally symmetrical animals, still others with all chordates, then with all vertebrates, quadrupeds, amniotes, mammals, and finally with primates. So in the genes of man we find a kind of imprint of the evolutionary stages that preceded his appearance. We carry all the earlier evolutionary stages of life within us like a memory. This also means that everything that appears around us today in living nature also lives in us in a sublimated way; we recognize ourselves in nature as in a living mirror.

[146] Hedges & Kumar (2009). www.timetree.org allows the calculation of age differences of almost any species.
[147] Domazet-Loso & Tautz (2008). In prehistoric times, there was probably a pool of genes that was exchanged between unicellular organisms as if within a living sea, and from which the gene sequences of higher organisms were recruited.
[148] Frisch (1992).

8 The Evolution of Animals

In the becoming of the world there is a precursorship, which must be considered in the light of what is to come.[149]
(Hermann Poppelbaum)

8.1 Higher Development and Segregation

The world of living beings is hierarchically structured. Organisms form groups with common characteristics, which again belong to super-groups, etc. (Fig. 36). The highest concept under which all living things fall is life itself. All living things can then be divided into three major domains, the bacteria, archaebacteria and eukaryotes (which have cells with a true nucleus). The eukaryotes are divided into organisms that photosynthesise and produce oxygen (algae, plants) and those that feed on organic material and breathe oxygen. The latter together form the kingdom of animals (*Animalia*). The animals can be unicellular or multicellular organisms (subkingdom *Metazoa*). The Metazoans can be divided into sponges and animals that form real tissues (*Eumetazoa*). The Eumetazoans are divided into animals with radial symmetry (such as polyps and jellyfish) and those with bilateral body symmetry (*Bilateria*). The Bilaterians can be divided into the *Protostomia*, which include molluscs, annelids and other worms, and the arthropods (crustaceans, isopods, spiders, insects, etc.), and the *Deuterostomia*, the group that leads to the vertebrates. The Deuterostomes include the chordates (*Chordata*, as opposed to the hemichordates and echinoderms such as crinoids and starfish), the skull-bearing vertebrates (*Vertebrata*, as opposed to the skullless chordates and tunicates), and the jawed mouths (*Gnathostomata*, as opposed to the jawless ones such as hagfishes and lampreys).

Fig. 36. (next page) Systematic structure of the animal kingdom. The numbers in the vertical columns indicate the time of the branching of the respective group according to DNA sequence comparisons (www.timetree.org) and fossils for extinct groups (†).

[149] Darwin (1871), p. 184.

Taxon (first occurrence, million years)	Group
Prokaryota: Archaea 3036 · Bacteria 3036	Bacteria, Archaebacteria
Amoebozoa 1092	Amoeba
Archaeplastida (Plantae) 1404	Plants
Fungi 1272	Mushrooms
Choanoflagellata 908	Collar Flagellate
Para-, Mesozoa 757: Porifera · Placozoa	Sponges
Radiata 685 (?): Ctenophora · Cnidaria	Polyps, Jellyfish, Comb Jellies
Protostomia 694: Spiralia (Platyzoa · Lophotrochozoa), Ecdysozoa (Cycloneuralia · Panarthropoda)	Mussels, Snails, Annelids, Insects
Hemichordata 619 · Echinodermata 619	Sea Urchins, Starfish, Sea Cucumbers
Tunicata 603	Coat Animals
Cephalochordata 556 (?)	Lancelet
Agnatha 599	Hagfish, Lampreys
† Acanthodii [440] · † Placodermi [419]	† Spiny Sharks, Armoured Fish
Chondrichthyes 464	Sharks, Rays
Actinopterygii 431	Ray Finned Fish
Coelacanthimorpha 414 · Dipnoi 408	Latimeria, Lungfish
Amphibia 353	Frogs, Amphibians
Sauropsida 319 · Aves 319	† Saurians, Reptiles, Birds
† Pelycosaurier [311]	† Pelycosaurs
† Dinocephalia [272] · † Anomodontia [268] · † Biamorsuchia [265]	† Mammal-like Reptiles
† Therocephalia 268	† Mammal-like Reptiles
Monotremata 180	Echidna, Platypus
Metatheria (Marsupialia) 160	Possum, Kangaroo
Afrotheria 99 · Xenarthra 99	Elephants, Manatees, Armadillos, Anteaters
Laurasiatheria 94	Bat, Cats, Dogs, Odd- and Even-toed Ungulates
Glires 87	Mice, Rabbits
Scandentia 85	Tree Shrews (Tupaias)
Dermoptera 79	Giant Gliders
Strepsirrhini 74	Lemurs, Loris
Tarsiiformes 69	Tarsiers ('half Monkeys')
Platyrrhini 43	New World Monkeys (Howler, Capuchin)
Cercopithecoidea 28,9	Monkeys, Macaques, Baboons, Proboscis Monkeys
Hylobatidae 19,6	Gibbons
Ponginae 15,2	Orangutan
Gorilla 8,6	Gorilla
Pan 6,4	Chimpanzee, Bonobo
Homo	H. erectus, Neanderthals
H. sapiens	Man

	Systematics	Fossil age (first occurrence, million years)	Geological period/era
	Species	0,3	Pleistocene
Homo	**Genus**	2,8	Pliocene
Hominini	Tribe	7,0	
Homininae	Subfamily	12,5	
Great apes	**Family**	17	Miocene
Apes	Superfamily	25	Oligocene
Narrow-nosed monkeys	Parvoder	35	Eocene
Higher primates	Infraorder	40	
Dry-nosed monkeys	Suborder	56	Paleocene
Primates	**Order**	66	
Primatomorpha	Miroder	66	
Euarchonta	Grandorder	66	Cretaceous
Euarchontoglires	Superorder		
Epitheria			
Placental animals	Infraclass	66	
Viviparous animals		160	Jurassic
Mammals	**Class**	225	Tiassic
Eutheriodontia and Cynodontia		260	
Therapsida		273	Permian
Mammal-like reptiles (Synapsida)	Class	318	
Amniote animals	Clade	320	Carbon
Tetrapods	Superclass	360	
Lobe-finned fish	Subclass	425	
Bony fish	Class	425	Devonian
Jawed vertebrates	Infraphylum	435	Silurian
Craniata, vertebrates	Subphylum	518	Ordovician
Chordates	**Phylum**	518	
Deuterostomes	Superphylum	540	Cambrian
Bilaterally symmetrical animals	**Clade**	560	
Tissue animals	Subkingdom	680	
Animals	**Kingdom**		
Holozoa		1.000	
Opisthokonta		1.300	
Nucleated cells	**Domain**	1.850	
Living beings (first cells)		3.500	

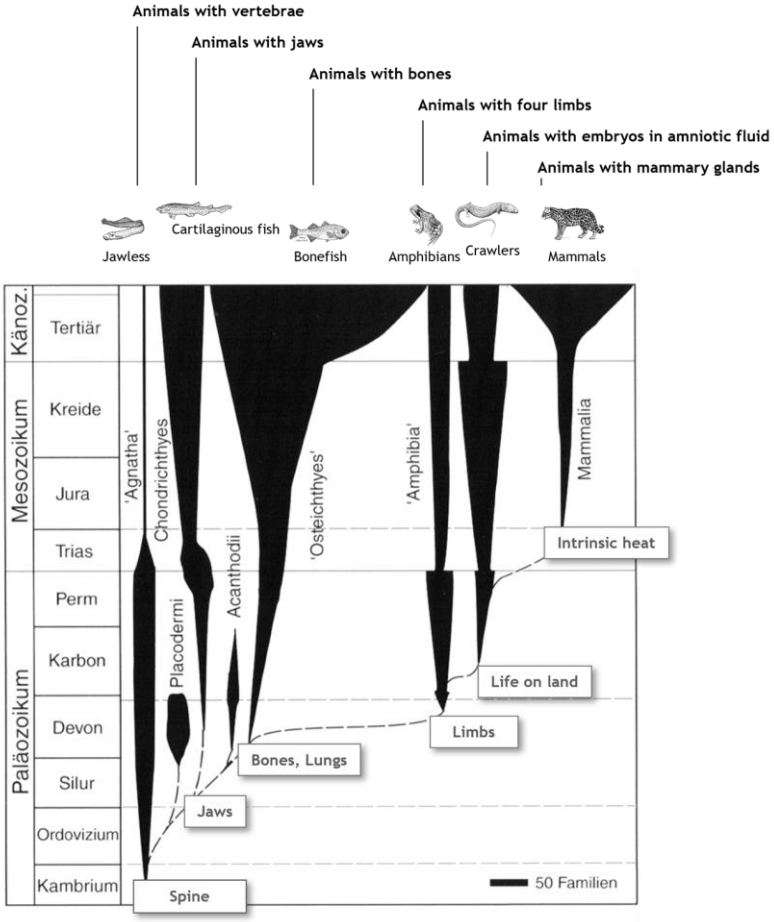

Fig. 37. The relationship between systematics and phylogeny of vertebrates with important evolutionary innovations. Horizontal lines indicate mass extinction events (after Benton[150], modified).

To the jawed animals belong the flesh-finned fishes (*Sarcopterygii*, opposite to the ray-finned fishes, which do not form limbs), to those the land vertebrates (*Tetrapoda*, opposite to the lung-fishes), the *Amniota*, whose embryos develop in the amniotic fluid (as opposed to the amphibians, whose reproduction depends on water), and the mammals (*Mammalia*, as opposed to reptiles and birds). To the mammals belong the placentals (*Placentalia*, as opposed to the marsupials and cloacal animals), to these the primates, then the dry-nosed monkeys

[150] Benton (2005), p. 48.

(*Haplorrhini*), to these the Old World monkeys (*Catharrhini*), to the Old World Monkeys the Hominoids, to the Hominoids the Apes (*Hominidae*), to those the genus man (*Homo*), and to man the species *Homo sapiens* (Fig. 36). Fig. 37 shows the systematic relationship of the vertebrates and its evolution over time.

We share with all organisms the property that we are alive; we have in common with a somewhat smaller group of living beings that our cells possess true nuclei; with another somewhat smaller group we share the two-sided symmetrical body structure; with yet another smaller group we have four limbs supported by bones, and so on. Each higher animal group integrates the preceding developmental steps. The general life of the unicellular organisms came first, the most individual life of man last. In this individual, the general appears again on a higher level – in the form of mental abilities and inner free activity, through which man can recognise, feel and act to change himself and (almost) everything else. Evolution proceeded, as it were, from the outside to the inside, from the physical to the spiritual.

The first single-celled organisms occurred in unimaginable masses, from which all other organisms developed. One can therefore imagine evolution as a gradual specialisation or branching of this original, undifferentiated life, which was accompanied by gradual higher development. Phylogenesis is in this respect an organism of higher order, a *super-organism* living through the ages, the development of which embraces all living beings and which finally led up to man. Man gradually differentiated out of a living environment which still appears around him in the various animal forms.[151]

What aspects differentiated in the course of phylogeny? What is characteristic of unicellular organisms, of multicellular organisms, of old and new organisms, of chordates and vertebrates, of land animals, etc.? Let us try to 'read' these aspects in the light of inner experience.[152]

[151] In his monumental synopsis of the scientific and anthroposophical view of evolution, Dankmar Bosse has dealt in detail with the principle of higher development through segregation and has compiled many points of view on this. Bosse (2002).

[152] Particularly vivid and understanding descriptions of the animal groups can be found in the book *Tierwesenskunde*. Poppelbaum (1937).

8.1.1 Unicellular Organisms

The nucleus-free unicellular organisms (prokaryotes) are the most primitive and thus probably the oldest organisms. They are mainly characterised by their ability to metabolise and reproduce, i.e. by the *most general life processes*. The cells are undifferentiated, all processes take place in a single compartment. They reproduce by division and are therefore – under favourable external conditions – potentially immortal. They represent a life stream that flows continuously and unbroken from the past into the future. As a rule, the cells are mobile by means of flagella and can react, for example, to nutrients – here an intentional 'striving' is already indicated, which is later expressed more and more consciously in the animals.

In eukaryotes, the cell is divided into nucleus and plasma with various organelles. In connection with this differentiation of the cell, death occurs for the first time. Sexual reproduction begins, the parental cells die. *Differentiation* and *death*, separation and reunion – in eukaryotes the life process is structured intervallically. The astral time stream from the future intervenes in the life processes in a differentiating way.

Unicellular organisms such as calcareous algae and diatoms or cyanobacteria, which form thick rock layers (stromatolites), secrete mineral substances through which they are significantly involved in the formation of the earth's surface. The unicellular organisms are close to the *mineral world*. In all multicellular organisms, the unicellular organisms reappear in a transformed way, namely as their cells. And just as they convert and secrete physical substance as unicellular organisms, so they form and process the physical substances of the body as cells of multicellular organisms. Unicellular organisms are, in the words of Eugen Kolisko, the 'living atoms of the animal kingdom'.[153]

8.1.2 Multicellular Organisms and Tissue Animals

The multicellular form rises from the general metabolic and life processes. The most primitive multicellular organisms are amorphous sponges, which are largely composed of flagellated single cells. The sponges (*Porifera*) form for the first time the *inner spaces* typical of all animals, which differentiate the body into an

[153] Kolisko (1930), p. 130.

outer and inner side. However, in sponges the inner spaces are only incompletely sealed off from the outer medium. They are pierced in many ways by pores through which seawater flows in and out of a central cavity. Like the unicellular organisms, the cells of the sponges also secrete substances, but these are now more 'organic' and form an essential part of the shape as spongins. They are also interspersed with skeletal elements that support the spongy body. Sponges are, as it were, nature's first attempt to assemble cells and form shapes from them. The interior appears as a basic animal principle of form, but no differentiated form can yet emerge; inorganic-amorphous formation predominates. The sponges fall out of the central stream of development, as they were not 'suitable' for higher development, while the formative principle 'form with an interior space' is further developed.

8.1.3 Hollow Animals

The hollow animals (*Coelenterata*) – corals, sea anemones, polyps, jellyfish – form the interior in a much more distinct manner than the sponges. The place where the embryonic tissue is inverted towards the inner space (primordial orifice) remains the only opening in the adult animal and serves both as a feeding and excretory opening. The *metabolic pole* of the animals is located in the interior, while *sensory organs* form on the outside – the nerve-and-sense pole of the organism. These animals have radially symmetrical shapes, through which – as well as through their colours and often sessile way of life – they are strongly reminiscent of plant formations (one group is actually called 'flower animals'). In the hollow animals, a plant-like formative element gains the upper hand, as it were, over the animal interior formation, which separates them from the stream of higher development, while the 'animalic' – organisms with cavities – then continues to develop in a purer form.[154]

[154] Apt characterisations of the hollow animals, the echinoderms and tunicates can be found in Poppelbaum (1937), Julius (1970); Kolisko (1930). Cf. on the hollow animals the 190 *The Life Cycle of Jellyfish as an Example of the Work of Etheric and Astral Formative Forces*, p. 188.

8.1.4 Two-sided Symmetrical Animals – Old and New Mouths

In addition to body cavities and interior organ formation, *directed locomotion* is an essential characteristic of animals. Locomotion shows the general characteristic of animate beings of having directed desires towards something (intentionality). In directed locomotion, the time stream from the future has a particularly clear effect: the animal strives and expects to reach a goal it desires. In the bilaterally symmetrical animals (*Bilateria*), the soul penetrates more strongly into the body than in the hollow animals. The organism now differentiates into *front and back*, into a shape with mouth and anus. The separation into mouth and anus, however, can happen in two different ways: The primordial opening can either remain a mouth (with a secondary anus), or the primordial opening becomes an anus and the mouth forms anew. The former is the case with the *Protostomia*, to which most worms, the molluscs, i.e. mussels and snails, etc., and the arthropods (insects, etc.) belong, the latter with the phylum leading to the vertebrates (*Deuterostomia*). Old and new mouthed animals are build and behave in a polar way in many respects. In the former, the nervous system lies on the ventral side, the heart on the back, and insofar as a skeleton is formed, it lies on the outside as a hard skin or shell. The Deuterostomes, on the other hand, form an inner skeleton, a nervous system on the back and a heart on the belly. Protostomes form protruding compound eyes, new mouths intruding lenticular eyes, etc. What is essentially new in both animal phyla is the formation of *internal organs*, which lie between the outer and inner skins. But here again a fundamental differentiation can be observed. In both lineages animals increasingly express a differentiated soul, but in the vertebrate phylum this soul works more and more inwardly and finally becomes free of instinctive fixation in man, while the worms, arthropods and insects remain attached to instinct as if controlled automatically from the outside.

8.1.5 Echinoderms

In the line of the Deuterostomes now appear the echinoderms (*Echinodermata*), to which belong crinoids, brittle stars, starfish, sea urchins and sea cucumbers. What a strange appearance these five-rayed symmetrical animals give! At first, it seems again like plant-like organisms which are being separated here from the

stream of the becoming of man, but in a different form from the hollow animals. The animals live on the ground, but can actively move around by means of hundreds of suction-cup-like little feet. In brittle stars, the arms are highly mobile. The mineralised body surface, which is composed of individual plates, is covered with mobile spines, pincers, tactile and chemosensors. The spines can take on very different shapes in a variety of specialisations. The body consists of a water-filled cavity in which a rich *differentiation of internal organs* can be found. – If one looks at these peculiar animal forms in the light of inner experience, one is struck above all by a certain seclusion and at the same time complexity of outer and inner organisation. While the *Coelenterata* appear light and open to the environment like plants, transparent, ethereal, rhythmically floating and resonating with the water currents, the echinoderms live on the ground, hardening themselves on the outward and withdrawing, as it were, into their own interior. One experiences an almost excessive organ-forming tendency in them which closes itself off from its surroundings. One could say that the formative and differentiating tendency of the animalic astral becomes overpowering in this group of animals. The further ascending evolutionary line cannot 'use' this surplus, it ends in a side branch. (It is perhaps no coincidence that these organisms are called 'starfish' as the astral means 'starlike'.)

8.1.6 Tunicates

The next forms of the evolutionary line already belong to the chordates, the actual precursors of the vertebrates. The development of the dorsal *chorda*, the flexible axial rod that lies below the neural tube, gives the whole animal an *inner support* and is at the same time an inner abutment for the locomotor muscles of the trunk. The development of the chorda thus enables *free and purposeful swimming locomotion*. However, the chordate type does not appear completely at once, but only as a larval form of the tunicates. The later shows itself here, as so often, as an earlier. The adults form sessile (sometimes also free-swimming) forms, a kind of plump but upright feeding sacs, which let seawater flow in through a mouth opening into a voluminous, reticulated gill gut and out again after filtration from a siphon. The animals are surrounded by a thick-walled, tough, cellulose-like jelly layer. –

Once again, a partially sessile group of forms is separated from the evolutionary lineage. What is peculiar about these animals is their *upright posture*. The tough mantle has less of an outwardly closing effect (as in the echinoderms) than a supporting one. The inner support function of the chorda is, as it were, taken over by an outer mantle. We encounter here for the first time the motif of erection, which, however, is segregated from further development in order to now begin the long journey to erection from within, which man finally realises.[155]

The four groups of animals discussed so far appear to be related to the *mineral* (the protozoa with regard to their metabolism, the sponges by their shapes), then additionally to the *plant-like* (the hollow animals with regard to their radial symmetry, predominantly sessile way of life and plant-like colourful design), then to the *animal* (the echinoderms with regard to their differentiation and inner organisation), and finally in a certain sense also to the *human* (the mantle animals with regard to chorda and erection). One characteristic of animal organisation, the internal organism, is thus already widely differentiated in these basal animal groups, while the other characteristic, the free ability to move, only appears in a hint.

8.1.7 Chordates

The next systematic group to appear are the chordates, which retain the axial rod even as adult animals. They first form the group of the skullless *Acrania*. The lancelet (*Branchiostoma*) with its metameric body structure is their best known representative. Thus a free-swimming animal form is achieved, which has overcome all echoes of sessile, plant-like formations. (Nevertheless, *Branchiostoma* still likes to burrow into the sandy soil in order to swirl food into its always open mouth). The similarity between *Branchiostoma* and the tunicate larva suggests

[155] The tunicates show a tripartite structure into the sessile and metabolic sea squirts, the swimming salps, which form huge, translucent bands of rhythmically repeating and synchronously pulsating organisms, and the tiny, also free-swimming, head-like and extremely complex larvaceans or appendicularia. Simon (2001). It is as if the threefold structure of the human being is already being echoed here, although its three members are not yet connected to each other, but are distributed in the ocean.

that the skullless fish may have evolved from a tunicate that did not develop into an adult.[156]

8.1.8 Fishes

Like the lancelet, all other organisms in this evolutionary lineage develop a chorda dorsalis. In the more primitive forms (such as the jawless hagfishes and lampreys, as well as the cartilaginous fishes) it is retained throughout life, but in the more highly developed ones it is replaced in the embryonic period by the *vertebral column*, which forms around the chorda by means of complicated, rhythmically articulated ossifications. This is the central *supporting organ* of vertebrates, which provides support and is at the same time mobile in itself, and which provides the basis for all further development. Vertebrates therefore always go through the same elementary stages of chorda formation and its segmentation to form the vertebral column, as well as the metameric structure of the trunk, during their embryonic development.

At the same time, vertebrates develop a true *skull*, a cartilaginous or bony capsule that protects the now developing brain. In fossil fishes this outer bony mantle still forms an armour-like covering of the front end or even larger parts of the whole animal, but gradually the exoskeleton retreats to the region of the skull.[157] With the formation of skull and brain, the *integration centre of the central nervous system*, the actual head pole of higher organisms, emerges. Head and spine lie horizontally in the direction of active desire. In the fish-type the intentional directionality of the soul is embodied.

8.1.9 The further Evolution of Vertebrates

From the fish onwards, the tripartite vertebrate type is gradually developed, as we have already outlined above.[158] First the *head region* differentiates. A skull with brain and sensory centre is formed, and this differentiates into a nerve-sense region (brain, eyes, organs of smell, taste and equilibrium), a nasal opening and cavity (the later middle region of the head belonging to the

[156] Garstang (1928), cf. Fig. 41, p. 144.
[157] Cf. Suchantke (2002)
[158] *Evolution of the Tripartite Organization*, p. 97.

rhythmic organisation) and a mouth region with jaw (the metabolic and limb region of the head). As a side branch, the jawless fish separate from the central developmental stream.

With the formation of a gas-filled hollow organ, which becomes the swim bladder (fish) or *lungs* (terrestrial vertebrates), as well as the ossification of the skeleton and the formation of ribs, the *torso region* is then further shaped. Cartilaginous and bony fishes, as side branches, are lasting witnesses to these changes. They are head-torso creatures; limbs in the true sense are still missing.

In a certain group, the flesh-finned fishes (*Sarcopterygii*), *limbs* developed in the next great evolutionary step (cf. Fig. 28, p. 97). As a side branch remaining attached to the water, the amphibians stopped at this stage. With the amniote animals (including reptiles), whose embryos develop in the amniotic fluid, complete *independence from life in water* was then achieved; and finally, with the mammals, among other things, the ability to keep *the body temperature constant* even in the face of external fluctuations developed.[159] The last great segregation thrust occurred with the appearance of the primates. In the great apes, which (preferably in their youth) show *intelligent learning* and *social behaviour*, much of human-like, mental flexibility and expressiveness is already visible.

Evolution can thus be characterised by a total of seven major developmental steps. Up to the vertebrates there are initially *four*:

1. living, tripartite cells,
2. formation of an inner space,
3. front-back orientation and internal organs,
4. supporting skeleton for directed movement.

The organisational form of the chordates thus achieved is then further developed in a *tripartite* manner (cf. Fig. 30, p. 101):

1. first the head,
2. then additionally the hull and the trunk, and

[159] The mammals show a threefold division into a group in which the nervous-sensory system dominates (rodents), a group with a dominant metabolic and limb system (ungulates), and the middle group of predators. In their entirety, the mammals thus already represent the human being. Schad (2012).

3. finally the limbs are differentiated.

8.2 Evolution of the Tripartite Type

The evolutionary path from the lower animals to man can be surveyed as an organic whole (Fig. 38). The organisms of the four lower phyla (protozoa/sponges, hollow animals, echinoderms and tunicates) appear as 'head-like beings', which preferentially develop the *nervous and the sensory system*. Similar to the skull, they form inner spaces, which in many cases are protected and supported by outer skeletons. The senses are already differentiated in many ways (light, touch, chemo, gravity receptors), nervous systems are present. There is as yet hardly any movement of its own.

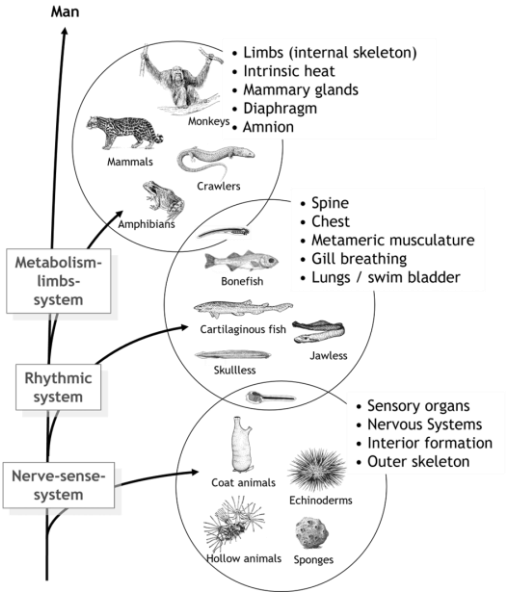

Fig. 38. The formation of the three human organ systems in the course of evolution. In the overlaps of the circles, a tunicate larva is shown at the bottom, an amphibian larva at the top. (The aspects listed on the right do not apply to all animal groups within the respective circles.)[160]

In fishes, the trunk is formed and rhythmically segmented. Gill respiration is separated from feeding (in the lower forms of

[160] Steiner, 1922, GA 303, p. 177–196, 01.01.1922. A comparable classification can be found in the Protostomes: The molluscs (mussels, snails, octopuses) can be regarded as 'head animals', the segmented worms as 'hull animals', and spiders and insects as 'limb animals'.

tunicates and echinoderms, respiration and digestion are still combined in the gill gut), and the circulatory system develops to a first stage of maturity (directed blood movement). In fish, the *rhythmic organisation* is formed.

The *metabolic-limb system* is fully differentiated only in the four highest groups (amphibians, reptiles, mammals and primates). Limbs do not appear until amphibians, and the metabolic system does not reach full maturity until mammals. The whole system of absorption, digestion, storage and combustion of nutrients, heat regulation by hair, contractility of blood vessels, sweat production and muscle trembling etc. becomes so efficient that the body temperature can be kept constant against the environment. Reproduction (which must also be counted as part of the metabolic-limb system) is gradually internalised.

Thus, the three groups of organisms can be regarded as traces of the becoming of man. First, the radially symmetrical or spherical 'head animals' living preferably on the seabed, whose central motif of formation is a differentiation into *outside and inside*. Then the weightless, cylindrical and rhythmically structured 'head-and-torso animals' swimming in the water, which add the *horizontal dimension of front-rear*, and finally the 'head-and-torso-and-limb animals' living under the full influence of gravity, in which the *vertical dimension of up and down* is added. But it is only man who is really organised vertically.

It is significant that just those forms which directly border on the middle group, namely tunicates and amphibians, form fish-like larval stages. Just as the rhythmic system is connected upwards with the nervous-sensory system and downwards with the metabolic-limb system, so these three groups of animals are connected by their larval forms. (Here, quite in the sense of the double current of time, the so-called 'early larva'[161] of the tunicates, from which the adult form differs greatly, already anticipates the fish type, while the 'late larva' of the amphibians, which already contains most of the essential organ systems of the adult form, still resembles the fish type).

[161] Fioroni (1987), p. 293.

9 Evolution as the Becoming of Man

The human is the starting point,
the dominating centre and the goal of earth-life.[162]
(Karl Snell)

9.1 Phylogeny in Phenomenological Perspective

Not long after Charles Darwin had published his epoch-making work *On the Origin of Species*[163] in 1859, a small book by the Jena mathematician Karl Snell *The Creation of Man* (1863) appeared, in which he vigorously advocated the idea of evolution, but also formulated a fundamental critique of the idea of descent, understood in purely external terms: "*Man, though nourished and brought up on the earth's breast, nevertheless carries within himself an activity of the par excellence general, in his thinking, and a faculty of the unconditioned, in his moral will. We shall call both together, as has already been done elsewhere, in one short word reason. In man, the general essence of reason has come to appear in a concrete form. Reason, however, can never emerge from a narrow, lower bondage and limitation. Reason eternally presupposes a rational faculty.*"[164] And so the "*germ of reason*" must have already been present at the beginning of creation and must always have preserved itself through the series of developing animals as a potential for further higher development up to man, while the animals came into being through "*falling away and stepping out of the common stream of development, and an early fixing in the periphery of an equally narrow and small external world*"[165]. In Snell's *Lectures on the Descent of Man*, published posthumously in 1887, it is said, "*that the series of creatures capable of becoming man must run like a golden thread through the multiply interwoven fabric of creatures, and that this series, bound together by the inner bond of a common faculty, forms precisely the said basic trunk of creation, which has dismissed everything else as branches from itself for the reasons already stated above.*"[166]

[162] Snell (1887), p. 159.
[163] Darwin (1859).
[164] Snell (1863), p. 141.
[165] Ibid., p. 79-80.
[166] Snell (1887), p. 145.

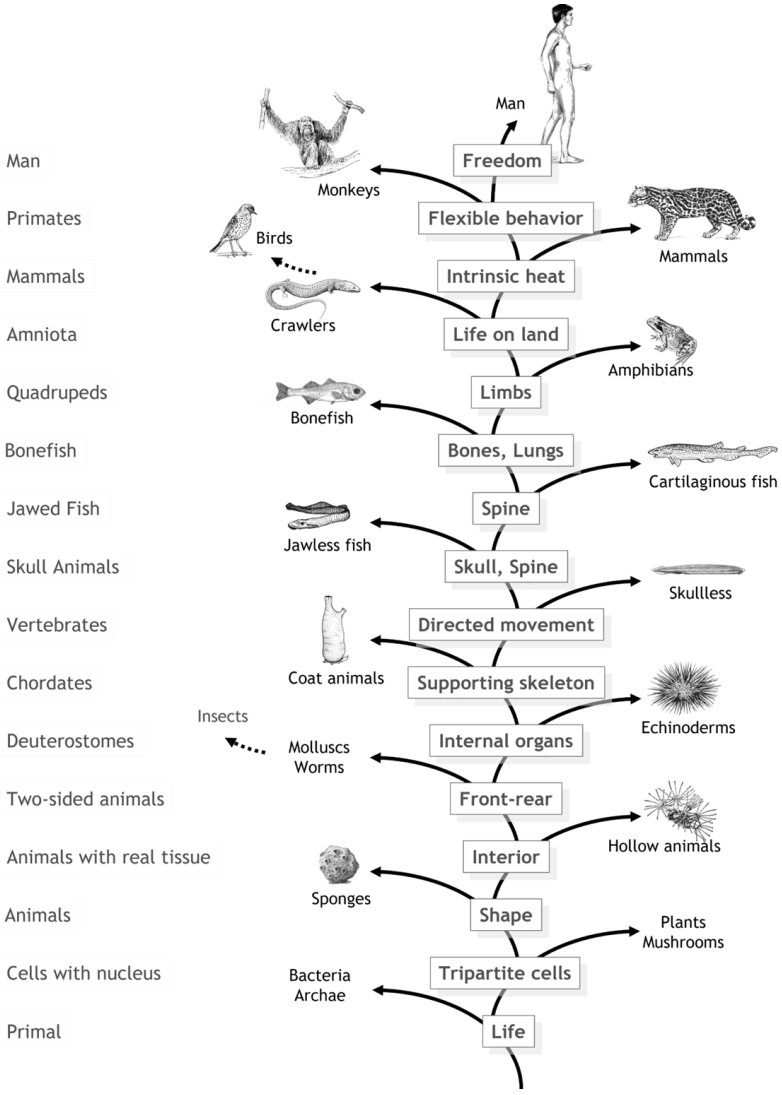

Fig. 39. Evolution as a stream of the becoming of man, with some essential innovations, separating out the various animal forms that still exist today.

One can represent the 'golden thread' that Snell spoke of as the sequence of evolutionary innovations that made human becoming possible. In the previous chapter, these innovations were outlined in the vertebrate evolutionary line. In Fig. 39, essential aspects of higher evolution are summarised.

The palaeontologist Edgar Dacqué (1878-1945) wrote in a similar vein: "*If we wish to adhere to the basic idea of natural evolution … we must necessarily take man as the 'archetype' of all living things. And this … in the following sense: No present-worldly or primeval species and form known to us is so formed that it could be included in the family tree of man as the highest creature. Everything is developed laterally from the path to this height. But if everything is developed sideways, and if there is nevertheless, as we believe, a connection in the history of development between all living creatures and man, then man, as the last highest, is at the same time also the continuous 'archetype' of the organic kingdom.*"[167] –

Let us follow once again the 'golden thread' from the perspective of the becoming of man. First of all, man needs *life*. Even the first life flows in the double current of time, is in its simplest processes an outer expression of the CROSS OF TIME (cf. Chpt. 7, p. 103). In the knowing consciousness of man this structure will later appear mentally. The primordial cells differentiate into nucleus, plasma and a system of inner membranes. Here the *tripartite differentiation* of the human organism into the information pole, the metabolism and movement pole, as well as into a mediating, rhythmic system is already laid out. Then, one after the other, the abilities develop to form a multicellular, *inner space-forming shape*, an alignment in the front-back axis as well as *inner organs*, characteristics which later become the basis of the physical existence of the human being, his inwardness and his interaction with the outer world. Further, a supporting skeleton develops as an *inner support and abutment*, the basis of uprightness.

The head with the *encapsulating brain* becomes the basis of the later, thinking consciousness. The chorda becomes a mobile support through segmentation as a *spinal column*, the basis of uprightness. The development of limbs, which is now imminent, also begins at the head, with the formation of a *jaw*. The evolution of jaws is usually explained by the fact that food intake became much more efficient. However, a mobile jaw is also a prerequisite for the development of language. The formation of the jaws of prehistoric fish already hints at the future ability of humans to speak. In the next major stage of development, the skeleton ossifies and thus forms a resilient support, a prerequisite for later walking on land and the *inner skeleton* of the human being,

[167] Dacqué (1948), S. 193.

which makes upright posture possible. The shoulder girdle and pelvis are formed, to which the arms and legs will later attach. An air-filled cavity develops, the precursor of the *lungs*. The being takes the air into itself and with it the whole future significance of breathing for physical performance, for emotional life and for speech. Then follows the formation of *limbs*: man's future organism of movement appears as the basis and tool of his will.

Man could not have achieved his fully awake world- and self-consciousness in the water, but only through a *life on land*. During the transition from the reptiles to the early mammals, an ossifying *palate* and the *diaphragm* were formed, the *middle ear* differentiated from one to three auditory ossicles – again prerequisites for the later ability to speak. The stage of the mammalian organisation corresponds to a variety of organic differentiations, which are primarily related to stable *body heat*. Without their own warmth, humans could not develop a continuous inner life and could not shape their actions independently of the influences of the environment. It is also only now that the thoracic cavity and the lower abdomen with the metabolic organs close off from each other through the *diaphragm* – a prerequisite for human feeling and willing to later exist in a certain independence from each other. Finally, in order to be what he wants to be, the human being needs the possibility to *flexibly shape his behaviour* and to change it through social interaction and learning, a developmental step that is marked by the appearance of primates.

9.2 Phylogeny as Development of Freedom

Every organism is more or less dependent on its habitat, although the degree of dependence varies among organisms. The most autonomous being is undoubtedly man.[168] In him all organ systems are developed to such an extent that they become the basis of a mental and practical creativity by which he can live in the most diverse environments and populate large parts of the earth.

The 'golden thread' of evolutionary innovations that finally led to the appearance of man can therefore be understood as an increasing development of freedom. Wolfgang Schad has described how the increase in autonomy goes hand in hand with

[168] Rosslenbroich (2018), p. 202.

the development of organ systems: "*Pure sensory animals are actually the invertebrate lower animals. … High specialisations of the sense organs can be found. Let us only think of the compound eyes of insects and their perceptive abilities, which go far beyond those of vertebrates. We can consider them to be the animals that have the best sensory system. But because they are still completely absorbed in the environment through their sensory system, they lack everything that the higher animals, the vertebrates, have: the ability to separate themselves from the environment, the stronger emancipation, individualisation, independence and autonomy from the direct influence of the environment. In fish, the fully centred nervous system, which is separated from the other soft tissues by bone shells, is present for the first time. Most invertebrates also possess a nervous organisation. However, this consists either of diffuse nerve networks, ring-shaped nerve rings or rope ladder-like nerve strands and not, as in the fish, of a single, fully centred nerve tube* [with the central organ of the brain]. *In amphibians, the respiratory system slowly detaches from the environment; they can already walk on land. The lungs are formed. The fish already have the corresponding organ, but it does not yet serve internalised respiration, but as a swim bladder. Only the amphibians gain a respiratory system, which now moves into the anterior body cavity and makes breathing possible on the inside. In reptiles, a further step towards environmental independence occurs. The skin surface becomes scaly. Lizards and snakes can live in dry, moisture-deficient environments and still maintain their fluid balance. Here, the fluid system is fully independent. In birds, the organism becomes further independent through an independent heat system. However, their embryonic development still takes place in the nest outside the mother's womb. Only the mammals also take the reproductive processes completely inside. Have they thus reached the highest degree of biological emancipation? In mammals, we still find a last close functional 'growing together' with the respective environment in the limb system: a horse cannot move in the water like an otter, the latter cannot climb trees like a squirrel, a bat again has certain limbs formed for its habitat. Only in humans does the last remaining organ system show itself emancipated from an all too specific environment. In the human body organisation, the greatest degree of bodily independence from the environment is achieved. Step by step, the independence from environment-dependent to independent life processes took place.*

The sensory system is everywhere where there is a surface. We have the centre of the nervous system in the brain, of the respiratory system in the lungs, of the fluid system, especially the circulatory system, in the heart. All the internal organs are connected to the heat organisation as a so-called 'heat core'. The reproductive processes extend into the uterus. We may call

the foot a particularly characteristic organ for the emancipation of the limbs: the little toe shows the greatest backlog! In which direction has evolution obviously taken place? From the organisation of the senses to the organisation of the limbs, from the formation of the head to the formation of the foot. The steps of emancipation have taken place first in the nervous-sensory system, then in the middle and only last in the metabolic-limb system."[169]

Bernd Rosslenbroich has shown in detail that phylogeny was accompanied by a continual increase in organismic autonomy in metabolism, locomotion, the rhythmic system (respiration and circulation), the nerve-sense system and in behavioural plasticity.[170] Evolution did not lead – as would be expected according to Darwin – to ever better adaptation to external living conditions, but on the contrary to ever greater autonomy.

In the chapter *Understanding through inner Experiences* (p. 30) we pointed out that concepts are based on a volitional experience. This also applies to the concept of 'autonomy'. It is conceived against the background of experience of one's own spontaneity and freedom.

In the increasingly autonomous organisation of animals, one can recognise the sequence of stages that prepared the physical appearance of the human being. The higher development, the 'golden thread' of phylogeny, can therefore be understood as the becoming of man. In the (recent and fossil) animals, the stages which have been run through have been preserved. They are, as Rudolf Steiner once put it, "*the traces left behind of the human being.*"[171] The animal world can be seen as an *image of the becoming of man*.

Man thus appears as the centre of evolution, surrounded by concentric circles of the animal world. Man and animals emerged from a common origin, from the once unseparated unity of an all-embracing life. Through gradual separation, this unity diverged into circles. The central being, man, which as a principle runs through the whole of evolution, finally appears in physical form after the spread of the animals into all spaces of nature.

From what has been said arises a viable concept of higher development, for whether evolution means higher development

[169] Schad (1969), p. 180-181 [transl. CH].
[170] Rosslenbroich (2007, 2018).
[171] Steiner, 1906, GA 095, p. 79, 29.08.1906.

or not is a question of debate.[172] *Higher development means increasingly becoming human. Accordingly, a being is the more highly developed the later it branches off from the line of becoming human, i.e. the more similar it is to man.*[173] That animals are in many respects not higher, but more highly developed than man, will be shown below.

9.3 Phylogeny in Inner Observation

In an older view of nature, created nature was distinguished from creating nature (*natura naturata* vs. *natura naturans*). At first sight, one is confronted with nature that appears to be 'created' or to have become, and which is so mysterious because one was not involved in its creation or becoming. As long as one merely looks at its forms, one does not know the forces that produced them. But if one 'recreates' the forms in inner volitional activity, then one penetrates into the creative side of nature.[174]

The history of life begins to speak when one thinks of it not only progressing from the past into the future, but also being shaped from the future. Why did a chorda, a brain, jaws, lungs, limbs, etc., come into being? At some point they appear for the first time, and the human mind demands an explanation. Darwinism (i.e. 'chance') or a 'divine creation' are being offered. Both views look at the phenomena from the perspective of a spectator. Darwinism even implies that evolution would have proceeded in the same way if man had not appeared at all.

One's attitude to nature is different if one considers evolutionary innovations as implications of those human abilities that later develop from them. Take, for example, the appearance of jaws in early fish. Did a 'coincidence' bring them forth, or an otherworldly 'creator'? Whichever side one chooses, the matter remains external – one cannot *see* whether one thought or the other is true, but can only decide on the basis of certain considerations. For one *is* not the 'chance', nor the 'creator'. This is different when one approaches the history of development in

172 Vgl. Rosslenbroich (2008).
173 Kipp (1948).
174 "*Nature creates, where it unfolds in vitality, in forms that grow out of each other. One can come close to the creative power of nature in artistic sculpture if one lovingly and sympathetically grasps how it lives in metamorphoses*." Steiner, 1921-1925, GA 036, p. 336, 25.03.1923 [transl. CH].

an inwardly recreating and experiencing way. Then it becomes apparent that one is not *in* the 'accident' and also not *in* the 'creator', but – in the jaw! Because you yourself have a jaw and therefore you know what a jaw is and what it is good for. You can 'slip into' the fossilised bones of prehistoric fish and experience the catching and eating movements that their former owners carried out with them. And this is what one actually does whenever one forms the idea of the 'jaws of primeval fish'! Without the sympathetic experience of one's own jaw activity, the expression 'jaws of primeval fish' would not be comprehensible at all.

We have repeatedly emphasised that the self-observation of cognition and the consideration of the knowing 'I' are inescapable prerequisites of a viable evolutionary understanding. In the chapter *Understanding through inner Experiences* (p. 30) we have also described that knowledge of nature is accomplished through inner wilful 'gestures'. We can now extend this insight to say that *the wilful experience of one's own body mediates the concepts through which one thinks the developmental steps of evolution*.

Neil Shubin, a leading American evolutionary biologist, in his 2008 book *Your inner Fish*, described the discovery of a fossil fish with incipient hand formation: "*We had a 375-million-year-old fish in front of us, staring at the origin of one of our own body parts*."[175] – Shubin here clearly states what is the case with all thinking about evolution: One necessarily relates it to oneself. I cannot but imply myself, for it is me who thinks about them. Evolutionary innovations come up to me in the time stream from the past and are illuminated by my self-experience as a human being. My inwardly experienced bodily activity already shines (as a light of understanding) in the animal forms of the earth's history. Before my inner gaze, a wonderful play of states of equilibrium and developmental thrusts arises in the double stream of time, in which the image of the human being, initially only mentally, felt and wilfully experienced, gradually and ever more clearly appears in physical form.

A solution to the enigma of evolution requires the inclusion of the process of cognition and its human bearer. As long as man wants to explain himself by principles that are alien to him, he will not get anywhere. One will never be able to understand how the

[175] Shubin (2008), p. 50.

spiritual of man is supposed to have emerged from an unspiritual nature and evolution. Only when the inwardly experienced life and the tripartite differentiated being of man himself become the criterion by which evolution is understood, can satisfactory solutions arise. We actually draw the concepts with which we understand evolution from our inner self-experience. We presuppose our knowing, embodied self. The new theory of evolution will take the knowing I into account. Steiner: "*Nothing in the cosmos is considered at all without the human being present in it. Everything is only given meaning and at the same time a basis of knowledge by considering it in relation to the human being. Nowhere is the human being excluded. Anthroposophically oriented spiritual science leads our view of the world back again to a view of the human being.*"[176]

[176] Steiner, 1921, GA 338, p. 114, 15.02.1921 [transl. CH].

10 PHYLOGENY AS A META-ORGANISM

Grey, dear friend, is all theory,
and green the golden tree of life.
(Goethe)

10.1 Ontogeny and Phylogeny

Phylogenesis results from the stringing together of uncounted ontogeneses, and the ontogeneses are subject to phylogenetic change. One generation follows another. But the living keeps its past present. Individual organisms always return to the origin of all organisms: to the first, divisible cell. From there, they go through embryonic development, which is very similar in phases in animals of different evolutionary stages.

The relation between embryonic development and evolution is an important problem in biology. As early as the beginning of the 19th century, Johann Friedrich Meckel (1781-1833) had paralleled embryonic development with the comparative-anatomical, systematic order of the animal kingdom: "*The development of the individual organism takes place according to the same laws as that of the whole series of animals, i.e. in its development the higher animal passes essentially through the permanent stages below it, whereby, therefore, the periodic and class differences are reduced to one another.*"[177]

Louis Agassiz (1807-1873) then added to this parallelism the course of phylogeny: "*The phenomena of animal life correspond to each other, whether we compare their rank, determined by structural complications, with the phases of their growth, or with their succession in past terrestrial ages. … Everywhere the same series*!"[178]

Ernst Haeckel (1834-1919) coined his famous 'biogenetic law' on the basis of this triple parallelism: "*Ontogenesis is the short and rapid recapitulation of phylogenesis. … The organic individual repeats during the rapid and short course of its individual development the most important of those changes of form which its progenitors underwent ... during the slow and long course of their palaeontological development.*"[179] In the parallelism of embryological, palaeontological and systematic

[177] Meckel (1821), p. 396 [transl. CH].
[178] Agassiz, 1859, p. 130 [transl. CH].
[179] Haeckel (1866), p. 300 [transl. CH].

development he saw "*one of the greatest and most instructive series of appearances in organic nature*"[180].

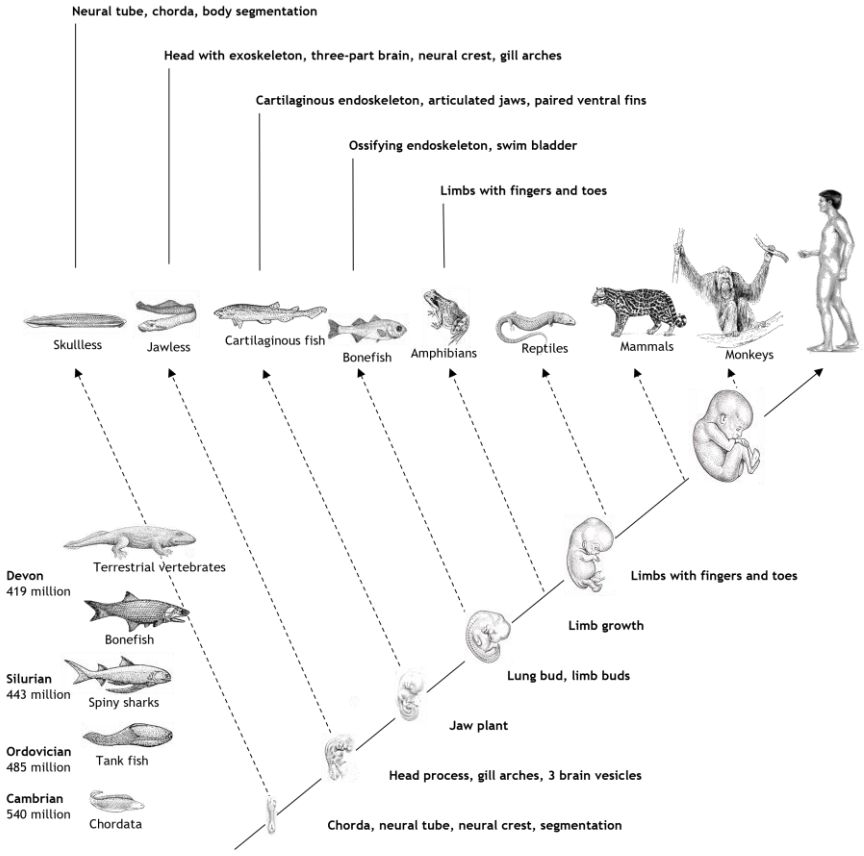

Fig. 40. Parallelism between embryonic development, systematic order and evolution of chordates.

The human embryo is never a fish or a reptile. However, it is confusingly similar to the embryos of fish, reptiles and other vertebrates. The great embryologist Karl Ernst von Baer (1792-1876) wrote on this subject: "*I possess two small embryos in spirit of wine, for which I have neglected to note the names, and I am now quite unable to determine the class to which they belong. They may be lizards, small birds, or very young mammals. So similar is the formation of the head and trunk in these animals. The extremities, however, are still missing in these embryos. Even if they were there, in the first stage of development, they would still teach nothing, since the feet of lizards and mammals, the wings and feet of birds,*

[180] Ibid., p. 31.

as well as the hands and feet of human beings, develop from the same basic form. The further back we go in the history of the development of vertebrates, the more similar we find the embryos as a whole and in the individual parts. Only gradually do the characters which designate the larger, and then those which designate the smaller divisions of the vertebrates emerge. From a general type, therefore, the more particular one is formed. ... Every embryo of a certain animal form, instead of passing through the other certain forms, separates itself from them. ... Only in that the least developed animal forms depart little from the embryonic state, do they retain some resemblance to the embryos of higher animal forms."[181]

Ontogenesis is thus not a mere 'mechanical' repetition of the phylogenetic stages once passed through, but an organic branching off from the basic process of vertebrate evolution. This consists of the fertilised egg cell dividing and initially forming a cell sphere (Haeckel's 'morula'). The cell mass forms an inner cavity and then inverts at one point to form a cup-shaped structure ('gastrula'), the outer layer of which is called 'ectoderm', the inner layer 'endoderm'. The organs of the body surface and the nerve-sense system later develop from the ectoderm, and the inner linings of the digestive system in particular from the endoderm. Between the outer and inner layer, cavities and a middle layer of tissue ('mesoderm') forms, from which the skeleton, musculature, cardiovascular and lymphatic systems develop. With these three so-called germ layers, the motif of threefoldness, which we have described above as the archetype of animal and human formation, already appears in early embryonic development.[182]

Oscar Hertwig (1849-1922) described the early development of vertebrates dynamically and vividly: "*Those who are familiar with the basic features of vertebrate development know how the germinal vesicle emerges from the mulberry ball and from this again the cup larva, how this then further subdivides itself by producing a middle germinal layer and the anlagen of the nervous system and the axial skeleton by special processes from the two primary germinal layers. As the embryo then stretches more longitudinally, a head and tail end can be distinguished and on both sides of the nerve tube in the region of the middle layer it separates into the trunk segments, the number of which increases slowly and continuously at the rear end, it only gradually acquires the form characteristic of the vertebrate type. Thus, in the sequence of stages of metamorphosis, as Carl Ernst v. Baer put*

[181] Baer (1828), p. 221 [transl. CH].
[182] For a detailed discussion cf. Schad (2003).

it in a formula in the law named after him, 'from the most general of the form relationships the less general develops, and so on, until at last the most specific occurs'."[183] *"The ontogenetic theory of metamorphosis becomes a source of even deeper knowledge, which also gives us an insight into the causal connections of many developmental processes, if it is also pursued as a comparative science. ... Through it we learn that not only the first embryonic forms arising from the fertilised egg (morula, blastula, gastrula etc.), but also almost all the individual organs without exception are laid out in a basically very similar way in all classes and orders of vertebrates and can therefore be understood as the expression of a general law of development. Then the differences which emerge between comparable stages in individual divisions reveal themselves to us as various modifications of a basic form.*"[184]

From the sponges to the vertebrates, all classes pass through an embryonic development which is markedly similar in its formative gestures. It corresponds approximately to the sequence of innovations in the course of evolution. The various groups branch off from the common path sooner or later and then stop at the stage of development they have reached: The sponges and hollow animals at the two-layered gastrulation stage, the echinoderms at the stage of a third germ layer (from which they form skeletal elements and internal organs), the tunicates at the first chordate formation (which they show only in their larval stages), the lancelet at the rhythmically articulated pharyngula stage, the jawless fish at the spine and first brain vesicle formation stage, the bony fish at the jaw formation stage, the amphibian terrestrial vertebrates at the first lung and limb formation stage, etc. The higher a group is organised, the longer it shares its embryonic development with its successors.

This principle of 'branching off' is clearly seen in the invertebrate ancestors of the chordates, the sponges, hollow animals, echinoderms and tunicates (Fig. 41). Although the adult forms are very different in design, they are placed in the vertebrate evolutionary series because of the similarities of their larval stages.

[183] Hertwig (1918), p. 175 [transl. CH].
[184] Ibid., p. 177 [transl. CH].

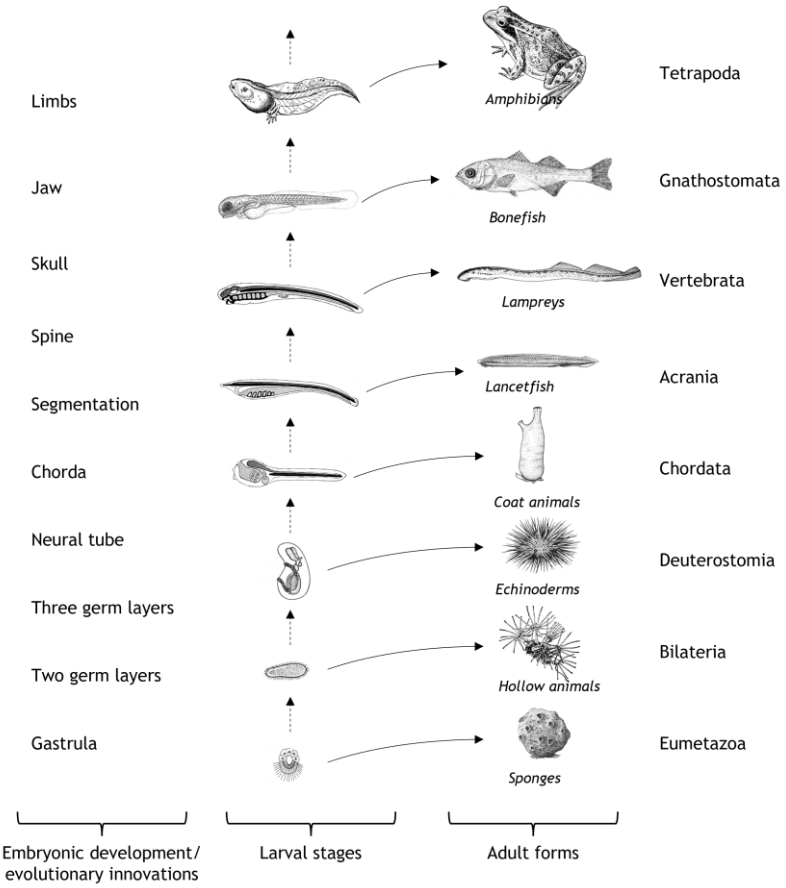

Fig. 41. Developmental stages (left, from bottom to top), evolutionary line of larval stages (middle) and lateral 'branching' of adult forms (right). (In the larva of echinoderms the intestine, in the larvae of tunicates and fishes the chorda dorsalis is drawn in black).[185]

Fig. 42 gives an overview of the overall context of the animal kingdom. Shown at the bottom centre is the gastrula, from which all multicellular animal forms arise both embryologically and evolutionarily. Both embryo and phylogenesis can be described as a tripartite process (cf. Fig. 38, p. 127). First, a unilaterally open hollow form is formed, from which, if not further developed, animals with a predominantly sessile, 'head-like' character emerge.

[185] Kovalevsky (1866); Garstang (1928). For further discussion of the relation between ontogenesis and phylogenesis see Gilbert (2003).

Fig. 42. Overview of the evolutionary context of the animal kingdom (after Heintz, from Toepfer[186]).

[186] Toepfer (2011), p. 67.

The spherical hollow shape of the gastrula stretches out, becomes rhythmically segmented and forms a second opening, so that a differentiation into anterior and posterior arises. From this shape (in deuterostomes) free-swimming animals with internal skeleton, head and trunk (fish type) develop. They then form limbs during the transition to terrestrial life. Development generally proceeds from the head to the trunk to the limbs. In this sense, phylogenesis can be seen as a meta-organism evolving in time.[187]

According to Goethe, the archetype of the plant is the 'leaf'. The archetype from which all animal formations emerge is the inverted hollow sphere. Haeckel wrote: "*I consider the gastrula to be the most important and significant embryonic form in the animal kingdom. … From this identity of the gastrula in representatives of the most diverse animal phyla, from the Spongia to the Vertebrates, I conclude, according to the basic biogenetic law, a common descent of the animal phyla from a single unknown ancestral form, which was formed essentially like the gastrula: Gastraea.*"[188] Whether this 'gastraea' ever really existed as a distinct animal form is uncertain; that it represents the *primordial form* of animal formation is beyond doubt.[189] The plant-leaf is two-dimensional and surface everywhere. The three-dimensional, hollow animal sphere has an interior. This represents the organic basis for the life of the soul, that is, for the separation into an outer and an inner world by which animals differ from plants.

In a pictorial way, Michael Brestowsky has merged the relation between ontogenesis and phylogenesis (Fig. 43)[190].

[187] This idea is already found in the work of the French physician and embryologist Étienne Serrès (1786-1868). He considered "*the whole animal kingdom … seen ideally as a single animal which … stops here and there its own development and thus determines at each point of interruption, on the basis of the very stage it has reached, the distinguishing characteristics of the tribes, classes, families, genera and species*." Serrès (1860), p. 833, quoted from Mayr (1984), p. 377 [transl. CH].

[188] Haeckel (1872), p. 466-467.

[189] Similar to Haeckel, Carl Ernst von Baer wrote, "*that the bubble form is the general archetype; for what would be more common to all animals than the contrast of an inner and outer surface*?" Baer (1828), p. 224 [transl. CH].

[190] Brestowsky (2014).

Fig. 43. Human evolution as a pictorial synopsis of ontogeny, phylogeny and recent animal forms. Drawing by Michael Brestowsky.

As above in the chapter on Goethe's theory of plant metamorphosis (p. 47) we can thus also speak of four stages for the individual, systematic and evolutionary metamorphosis of animals:

1. the individual, concrete forms – embryonic, systematic and evolutionary;
2. the metamorphoses of the forms out of and into each other, which can be followed most clearly in embryonic development;
3. the laws according to which these transformations take place and which lead to the formation of an organisation differentiated into head, trunk and limbs;
4. the nature or essential being of the animal, which remains the same in its various manifestations, with its organisation differentiated into external and internal world.

10.2 Evolution as Metamorphosis

According to Charles Darwin, evolution was a random and purposeless event and could therefore have proceeded completely differently. Although there were[191] and are[192] various alternative theories of evolution, Neo-Darwinism remains the dominant view for the time being. Modern biology seems to be largely in agreement: Teleological thinking, which thought evolution leading to man, is considered to have been overcome. Ernst Mayr wrote: "*An explanation for the working of a ... teleological principle could never be found, and the findings of genetics and palaeontology finally discredited teleology completely. The well-known American philosopher Willard Quine once told me that he considered it Charles Darwin's greatest achievement that he had disproved Aristotle's final cause by showing that development towards a certain goal could be explained by natural selection. Apparently purposeful processes are often found in nature, especially in biology. Only they are no longer explained by occult teleological forces, but can now be explained by scientifically accessible chemical-physical factors.* "[193]

We have discussed in detail in the chapter on molecular genetics (p. 103) how the explicability of life and its changes of

[191] Levit et al. (2008).
[192] Rosslenbroich (2018), S. 208 ff.
[193] Mayr (2002) [transl. CH].

form by such chemical-physical factors stands. They are necessary, but by no means sufficient. But can evolution be understood as a purposeful process leading towards the human being as its highest form? Certainly not from the point of view of objective, scientific cognition.

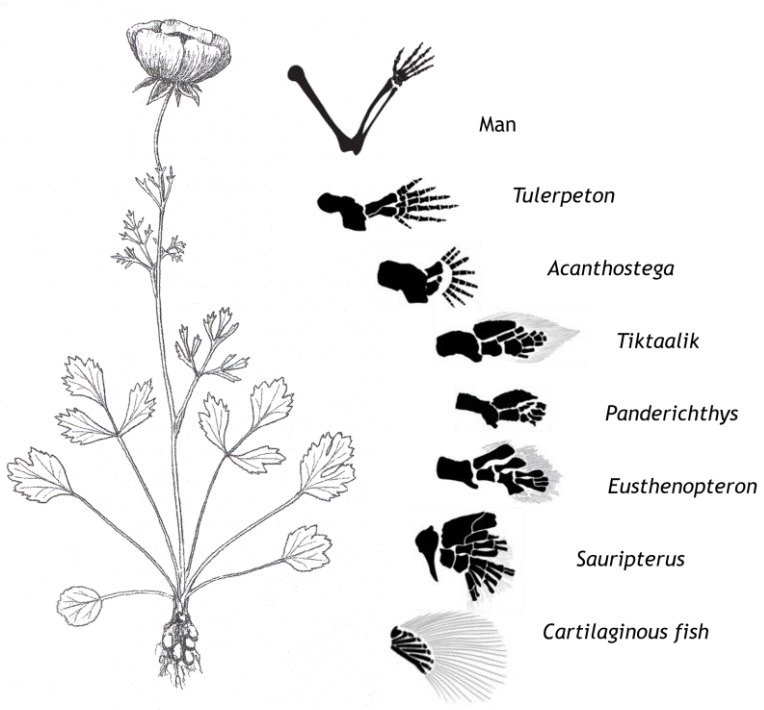

Fig. 44. Metamorphosis in the examples of the leaves of an annual flowering plant and the limbs of vertebrates in the course of the evolutionary transition from fish to land animals (cf. Fig. 28, p. 97).

However, we have shown that – and why – one must go beyond objective cognition to explain life. The same is true of evolution, though here it is less obvious, for Darwin's theory of chance lies paralysing like a leaden block on understanding. One can, of course, claim that the development of limbs, which made possible the transition of fish to land life, was based on the functional selection of *random* mutations. This cannot be proven, but neither can it be falsified. The idea thus does not even fulfil the most basic criteria of a scientific theory. But the opposite, i.e. the effect of an inner teleological principle of development, cannot be proved in this sense either.

However, like the development of an individual organism, evolution can be viewed as a metamorphosis process (which is illustrated in Fig. 44 using the example of the development of limbs from fish to terrestrial vertebrates), which, like organismic metamorphosis, proceeds according to superordinate laws. Such laws are, for example, the repetition of similar elements described above and the transformation of metameric elements into holistically integrated shapes, which develop according to an archetype (cf. p. 94 and p. 98).

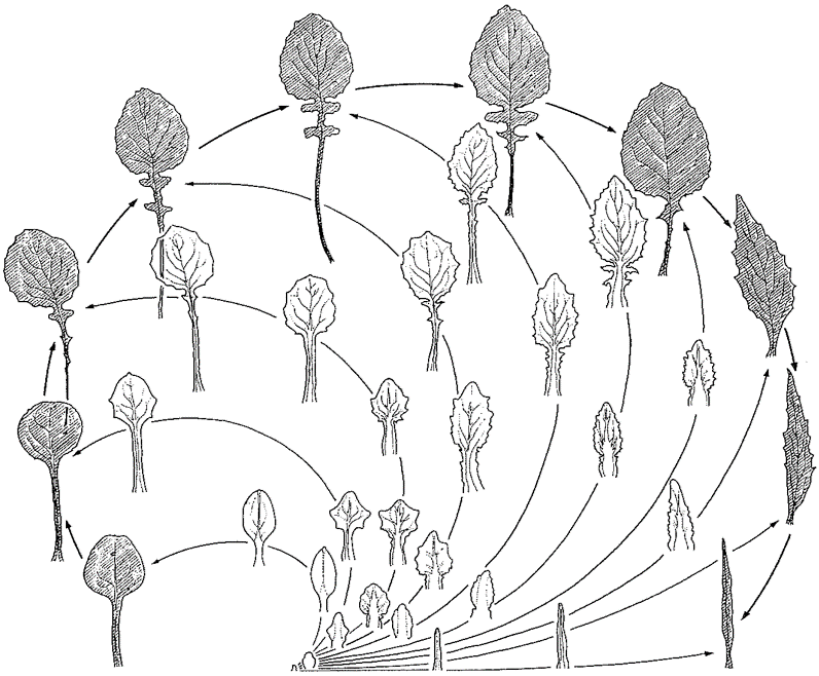

Fig. 45. Overview of the leaf metamorphosis of ragwort (*Lapsana communis*). Dark: sequence of fully grown leaves on the stem. Light: development of the individual leaves (Bockemühl, 1966).

The relation between ontogeny and phylogeny can also be compared with the development of the leaves of an annual flowering plant. In many herbs, the sequence of leaves on the stem shows a gradual metamorphosis (Fig. 44 and Fig. 45, outer arch, dark). Jochen Bockemühl (1928-2020) also studied the individual development of each leaf (Fig. 45, inner, light). He arranged the juvenile forms in such a way that the common, still quite undifferentiated form from which they all emerge is at the

centre of spiral lines of development whose respective endpoints are the 'adult' leaves. Each individual leaf undergoes a continuous transformation of form, while the successive leaves show a discontinuous series of development, which in the literal sense represents phylogenesis. This relationship corresponds to the continuous descent of animals with a discontinuous sequence of adult forms (cf. Fig. 41, p. 142)

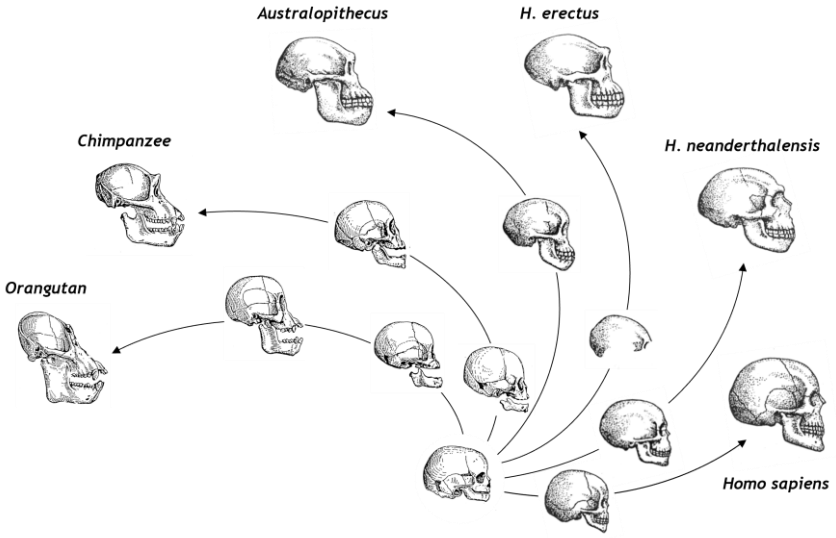

Fig. 46. Overview of ontogenetic developments and phylogenetic series of hominid skull forms.

Corresponding relations can also be found when comparing the development of the skulls of human ancestors and humans, which we discuss in more detail below (p. 160). Fig. 46 shows phylogenesis (outside) and ontogenesis. We see an opposing developmental dynamic of ageing of individual forms and phylogenetic juvenilisation. The origin of the spiral is, of course, only constant in form; in phylogeny it always arises anew from an inherited germ.

The embryonic developmental stages of various vertebrates can be depicted accordingly (Fig. 47). Just as all primate skulls develop from a morphologically similar, approximately spherical 'archetype', so all vertebrates develop from a similar basic embryonic form. However, this is mainly a further and higher development of the metabolic and limb poles of the organisms.

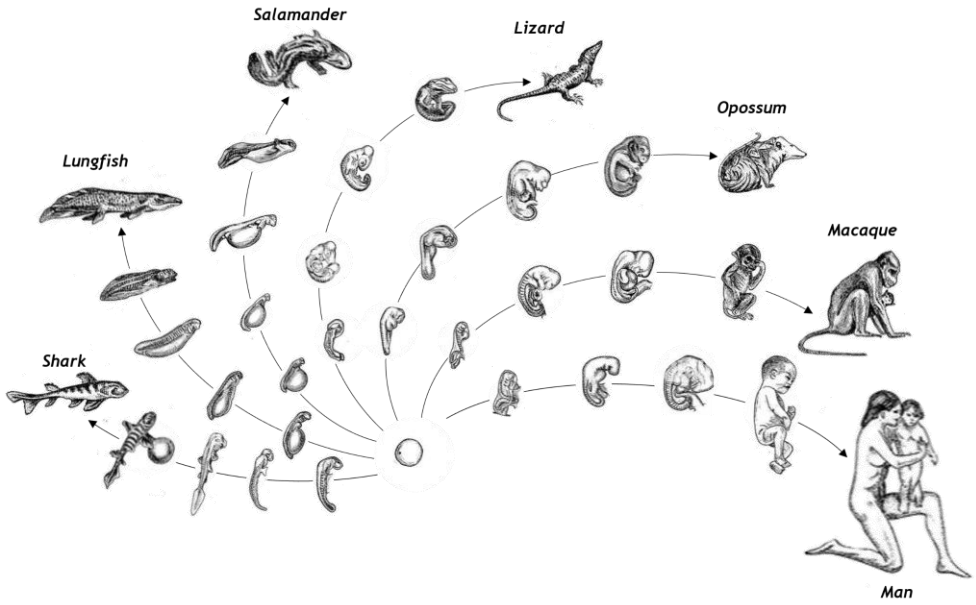

Fig. 47. The development of various classes of vertebrates from egg to adult. (A drawing from the Dept. of Comparative and Human Anatomy at the American Museum of Natural History from 1932, modified (cf. Ernst Haeckel's embryo chart, Fig. 23, p. 90.)

As the leaf forms appear successively on the stem, so do the various animal forms in the course of phylogeny. There are spatial gaps between the leaves, spatial and temporal gaps between the animal forms. However, all leaves, like organisms in evolution, are also related to each other through common descent. Just as one leaf form does not transform into another, so the animal forms do not transform into each other. The connection occurs via the common embryonic stages or the undifferentiated egg cell, respectively, which can be compared with the growth cone of the plant. Thus, the phylogeny of organisms can be viewed as one single meta-organism.

10.3 The Influence of the Environment

Evolution was an often dramatic, endangered event. Due to geological, ecological and cosmic influences, huge catastrophes occurred time and again, in which changes in global living conditions led to the extinction of large parts of the animal world

(sometimes between 50 and 80% of all marine and terrestrial species).[194] But the dying made room for the new (Fig. 48).

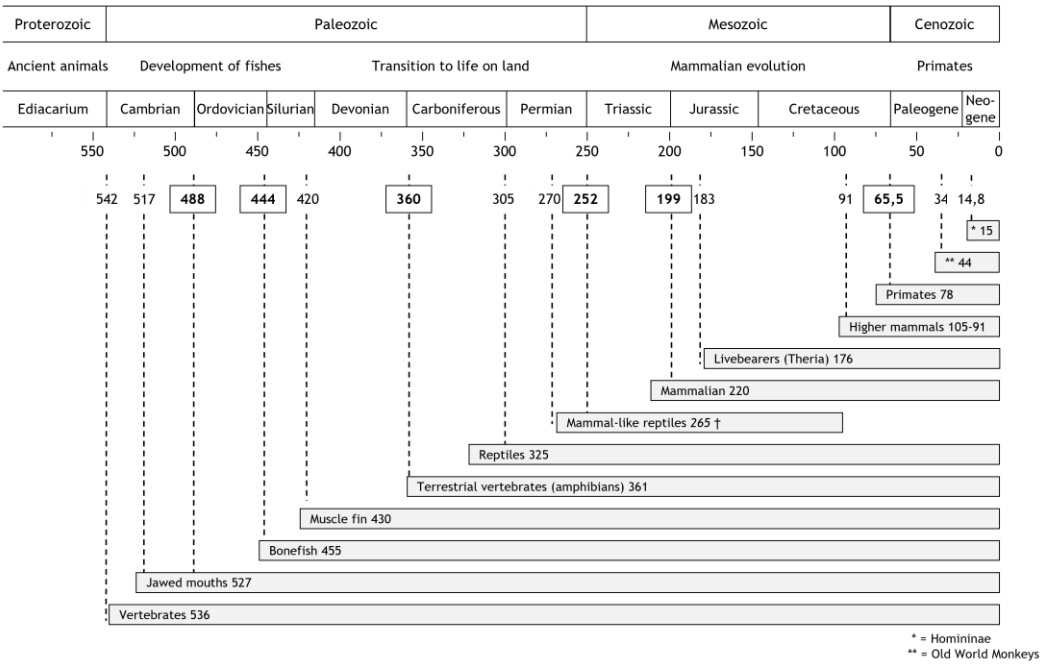

Fig. 48. Earth history with extinction events (bold: in each case over 50% of all animal species became extinct, at the Permian-Triassic boundary even over 95% of all marine and about 70% of all terrestrial species). Below, times of occurrence of evolutionary innovations from DNA sequence comparisons according to www.timetree.org.

There is an astonishing synchronicity when comparing times of mass extinction with those when major evolutionary innovations occurred. A well-known example is the extinction of the dinosaurs at the end of the Cretaceous period about 65 million years ago. Strong volcanism on the Indian subcontinent and the impact of a meteorite in the Gulf of Mexico led to a poisoning of the atmosphere and a worldwide drop in temperature, which the alternately warm giants were unable to cope with. Close to this catastrophe, however, lies the origin of the primates.[195] The first appearance of mammals at the end of the Triassic 200-220

[194] Stanley (1989); en.wikipedia.org/wiki/Extinction_event.
[195] en.wikipedia.org/wiki/Primate.

million years ago[196] was accompanied by two enormous mass extinctions 252 million (transition Permian-Triassic) and 199 million years ago (transition Triassic-Jurassic), the causes of which are also assumed to be worldwide volcanism. The mammal-like reptiles appeared after a catastrophe in the Middle Permian (270 million years ago). The appearance of terrestrial vertebrates is also characteristic of the time when the Devonian ended with major extinction events (about 360 million years ago). Other catastrophes coincide with the appearance of lobed-fin fishes 420 million years ago at the end of the Silurian, bony fishes at the transition to the Silurian 450 million years ago, jawed mouths 530 million years ago in the middle Cambrian, and vertebrates 550 million years ago at the beginning of the Cambrian.[197]

Also of interest is the worldwide extinction of large mammals (such as the mammoth, sabre-toothed tiger and giant deer) at the end of the Pleistocene of about 10,000 years after the last ice age, which coincided with the settling down of humans and the beginning of agriculture. – Like every development, evolution also occurred in a constant rhythm of dying and becoming new.

10.4 The TIME CROSS of Evolution

The structure of the organism, as we have shown above, can be described by the four aspects of the TIME CROSS (cf. Fig. 17, p. 78). Phylogeny can also be understood in this sense (Fig. 49). A continuous stream of inheritance from the past connects all living beings. The organisms that emerge from this stream are differentiated by a shaping current acting from the future until they reach the tripartite organism of mammals (cf. Fig. 30, p. 101). The threefold structure does not arise by chance and as an adaptation to environmental conditions, but is the archetype of animal and human formation, which is already active in the simplest cell life (Fig. 34, p. 109).

Higher development is at the same time characterised by an increase in organismic autonomy (cf. p. 132). While threefoldness is a differentiating design principle, development of autonomy describes the change in the relationship of organisms to their environment. Both developmental principles

[196] en.wikipedia.org/wiki/Mammal.
[197] According to Wikipedia und www.timetree.org.

work together and yet are not identical. The principle of the increase in autonomy cannot explain why mammals and humans are tripartite, any more than the bodily tripartism explains autonomy. We had already shown in the first presentation of the TIME CROSS (Fig. 4, p. 44) that every organism lives in a tension between autonomy and environmental adaptation, and that this dimension of the organic is to be thought orthogonally to the direction of development from descent and formation. The same applies to the relationship between development of the tripartite organism and development of autonomy in evolution (Fig. 50).

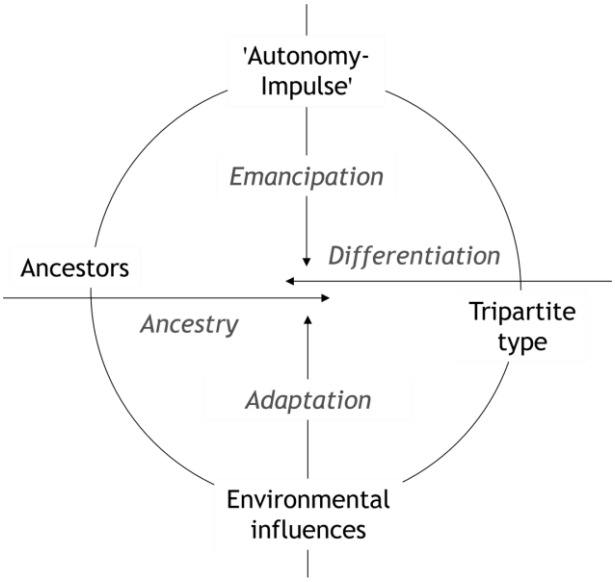

Fig. 49. The TIME CROSS of evolution.

Of the four aspects of the TIME CROSS, Darwin saw two: descent and adaptation to environmental influences. Creationists emphasise the other two: 'God' (the creative spirit principle acting from 'above') and man as the God-set goal of evolution. Darwinism cannot say why man appeared, creationism cannot say why the diversity of animals was needed. Darwinism describes a mechanism of diversification, but it lacks an inner, organic principle of higher development. For Darwinism, all formation is 'happenstance' (Stephen J. Gould). Creationism sees the principle, but it cannot say why the diversity of forms arose.

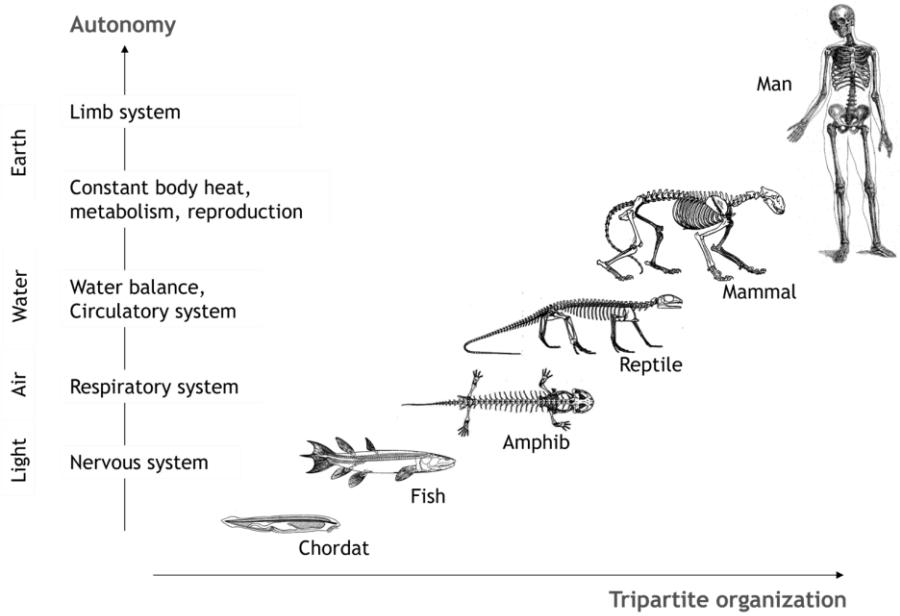

Fig. 50. Tripartite structure and autonomy development in the course of vertebrate evolution. cf. p. 132.

If, on the other hand, phylogenesis is understood as an organism of a higher order, then man appears as its central developmental motive and its final goal, the animals as its necessary precursors and at the same time side branches from its developmental line. In each animal species a part of man is realised in a one-sided way, while in each part of evolution the whole of man lives and works.

10.5 The Principle of Internalisation

In the course of evolution, a successive internalisation of elementary conditions from the environment takes place (Fig. 50, left). What lives and works on the outside appears increasingly as an autonomous function inside of the organisms. With the formation of a gradually centring nervous and sensory system, the world of light, in a broader sense the sensually perceptible environment, is internalised in the invertebrates and the fish. The amphibians form the basis for the internalisation of the air element in the lungs, the reptiles internalise the water element as an autonomous physiological function. In mammals, on the basis

of a highly effective metabolism, the formation of heat is also completely absorbed into the organism as an autonomous function. Finally, man internalises the effect of gravity through his limb system, against which he develops his autonomous will and transforms it into the upright posture of the body, and later into his freely impulsive action. In addition, it is possible for the human being, through his perfectly developed brain, to inwardly grasp the laws that shape the world and life on the outside.

11 Essence and Evolution of Man

In man, the animal is raised to higher purposes
and put in shadow for the eye as well as for the spirit. [198]
(Goethe)

11.1 Man in Space – the Upright Posture and the Autonomous Essence of the 'I'

Humans differ from animals in their upright gait, language and thinking. Although there are many approaches to upright posture in the animal kingdom, and although animals communicate in a differentiated manner and also display impressive feats of memory and intelligence[199], there is nevertheless an irreconcilable difference in the quality, flexibility and complexity of the three abilities mentioned. Above all, man has the ability to freely combine his thinking, feeling and willing, which gives him an imaginative, communicative and cooperative gift far beyond any animal ability. Like no other creature, he can conceive complex scenarios, communicate about them with others and realise them cooperatively.[200]

The human being must raise himself up by his own strength and actively maintain his balance in an unstable static. If the inner will activity slackens, the body sinks into itself or falls to earth. "*Always the upright posture is counter-direction to the downward pulling forces; they are always at work; without them the upright posture would not be what it is. It is an overcoming without end.*"[201] In the upright walk, man has the experience of being entirely active out of himself and at the same time – in balance – resting in himself.[202] The upright posture depends on and expresses the autonomous nature and will of the 'I'.

When a child stands up in its first year, it performs a feat that does not rise instinctively from its biological nature, but is worked into it, as it were, from the top down.[203] Children who cannot stand up for medical reasons develop markedly different

[198] Goethe (1795, 1820).
[199] Detailed in Streffer (2016).
[200] Suddendorf (2014).
[201] Straus (1960) [transl. CH].
[202] Kranich (2003).
[203] Ibid., p. 19-70.

body forms than people who walk upright: The arch of the foot remains relatively flat, the heel does not strengthen so clearly, the slightly x-legged position of the knees does not develop, the angle between the thigh and the pelvis remains greater, the position of the pelvis relatively high, the spine does not form the typical double curve and does not sink as deeply as usual into the thorax, the cervical, thoracic and lumbar vertebrae do not differentiate so strongly from each other, etc. This remodelling of the body is only brought about by the active confrontation of the human being with the force of gravity.[204]

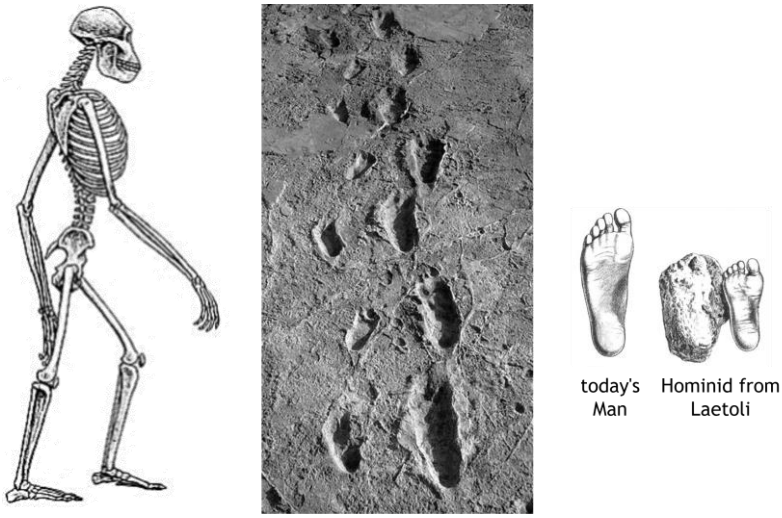

Fig. 51. Reconstruction of *Australopithecus afarensis* (left) with human foot (right) but ape-like arms and skull. Middle: 3.6 million year old footprints from Laetoli. The tracks are from one adult and two children. One child walked in the footsteps of the adult, the other probably by hand alongside, as suggested by the slightly oblique footprints – the early image of a human community!

The attempt to explain uprightness in terms of Darwinism reduces the grace and dignity of the upright posture, expression and image of the free human being, to a clumsy and supposed survival advantage. Such thoughts have contributed a lot to the desolation of culture, and sounded very different in the words of Johann Gottfried Herder (1744-1803): "*Look up to heaven, O man, and rejoice, shuddering, in your immeasurable advantage, which the Creator*

[204] Cf. Holdrege (1999).

of the world has attached to such a simple principle, your upright form. If thou wert stooping like an animal, if thy head were formed in just this voracious direction for mouth and nose, and if the structure of thy limbs were arranged accordingly: where would thy higher spiritual power, the image of the Godhead, remain invisibly lowered into thee?"[205]

In palaeoanthropology, the early upright walking beings are not spoken of as humans, but as apes ('Pithecus'); the status of a human being is only conferred when the brain is of a particular size. By this attribution, one transfers the humane to consciousness and not to the activity of the will, which always precedes the reflective faculty. The essential difference between humans and animals, however, lies in the origin of will activity – in humans freely determined from within, in animals instinctively determined from the outside – and only secondarily in different cognitive abilities! Thinking is also based on an inner, intuitive will activity. Not only in erection and action, but also in cognition, *the will is always primary*. Only it is easily overlooked, for one lives within one's own will activity; one simply carries it out without observing it. If one takes into account the will working in cognition, one is led to a new conception of evolution, indeed to a new and much more real knowledge of man and the world in general. In conscious activity one experiences the will as a self-supporting, spiritual reality. Materialism only survives because the autonomous will is so little activated and therefore remains unnoticed.

When the autonomous will becomes inwardly conscious, self-consciousness arises. It is the conscious will that looks at itself – as a spiritual force in man – in true self-knowledge.[206]

He who conceives of himself as 'I' finds a fact more true and irrefutable than any other in the world. With all other cognitions, empiricism and theory must first be put together. This always leaves a residual uncertainty about their actual fit. In self-knowledge, this uncertainty is completely overcome; in it, empiricism and theory are the same, they appear as one. The 'I' is the source of the will. It creates itself by knowing itself, and it knows itself by creating itself. "*The I cannot be shaken.*"[207]

In order to avoid an obvious misunderstanding, it should be expressly pointed out that the 'I' does not mean the 'ego'-

[205] Herder (1784), p. 56 [transl. CH].
[206] Steiner, 1910, GA 013, p. 66.
[207] Steiner (1923-25), S. 85.

conception. This is only a bodily mirrored representation, not a reality. The real 'I' lives in activity, it is a being of will and as such is initially free from referring back to itself. It is active attention, attentive activity. Precisely because it lives before its reflection, it remains unnoticed as a spiritual being in ordinary consciousness, for "*active bringing forth and contemplative confrontation do not get along with each other*" (Rudolf Steiner).

He who discovers (awakens) himself as a spiritual 'I' can no longer think that he has arisen from a 'non-I', from matter or lower organisms. He must think the whole evolution anew.

11.2 The Effect of Uprightness

The erection was accompanied by a reshaping of the skull from the apes through early man to present man. The facial skull became smaller, the cerebral skull grew (Fig. 52).

The regression of the facial skull is already evident in the infantile and juvenile forms of the preceding evolutionary stages, which consistently have a more human-like shape than the adults. Thus, the child skull of a Neanderthal already has the proportions of an adult *Homo sapiens*, while the child skull of an *Australopithecus* resembles an adult *Homo erectus*, and so on. The children already prophetically anticipate the adult forms of the following stage, as it were. – Moreover, the infant forms differ far less from each other than the adult ones. A young ape skull then soon grows into an animal shape, while the human skull remains much more similar to the common, approximately spherical embryonic form even as an adult.

In humans, the facial skull with the jaw region, which is specialised in animals, remains behind in growth, but the brain, as the organ of an unspecialised inner conscious life, is greatly enlarged. It remains longer in an embryonic state than the brain of the animals, for the strong growth and the ability to form of neurological interconnections, which are more or less completed in animals at birth, are preserved in man far beyond the embryonic period.[208]

[208] Liu et al. (2012); Somel et al. (2009).

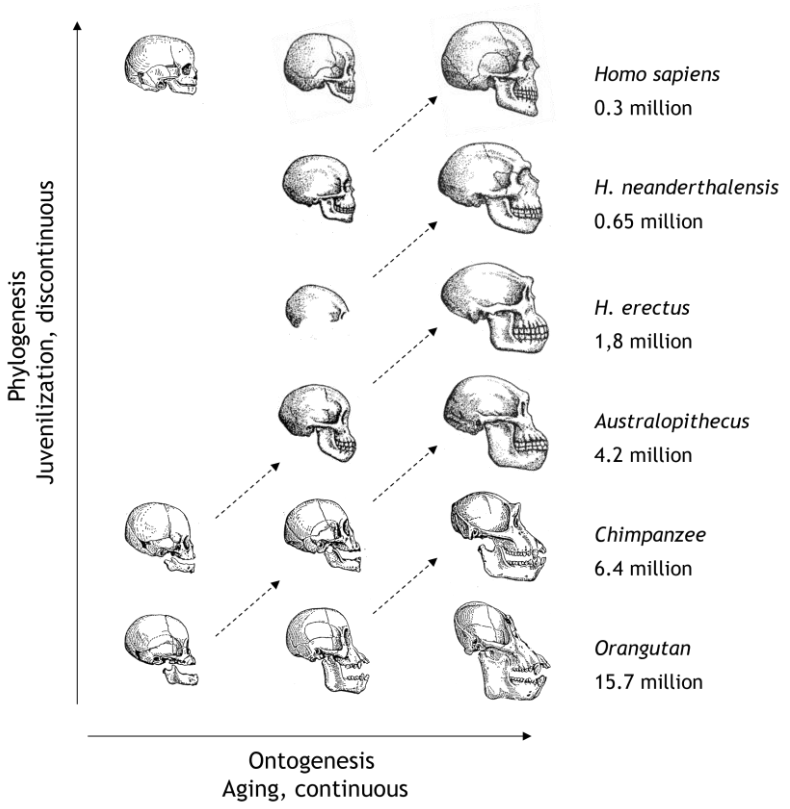

Fig. 52. Hominid skulls. Foetal forms, infant forms; adult forms (l.t.r., not to scale; after Schindewolf[209] and Schultz[210]). The numbers indicate the currently assumed times (in years before presence) of separation of the evolutionary lineages (Robson and Wood[211]; for the Neanderthal[212], the chimpanzee and the orangutan, results from DNA comparisons with *Homo sapiens* are given).

This 'juvenilisation' applies to a variety of human characteristics.[213] The Dutch anatomist Louis Bolk (1866-1930) summarised this phenomenon in his 'foetalisation theory'.[214] However, Bolk's hypothesis that man is 'a monkey foetus that has reached sexual maturity' is wrong. Man is obviously not an ape; his head does *not* look like that of a newborn chimpanzee. It

[209] Schindewolf (1972).
[210] Schultz (1940, 1941).
[211] Robson & Wood (2008).
[212] Green et al. (2010).
[213] Verhulst (1999)
[214] Bolk,

is true that man is more juvenile than the ape, because more original features appear in the adult man than in the adult ape. On the contrary, one could say that the ape is a human being who has overshot the mark and developed too far.

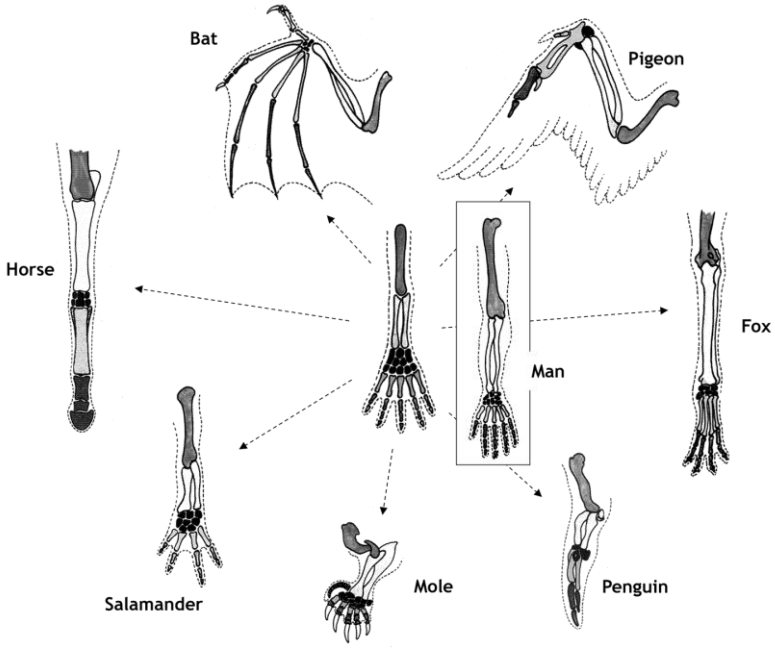

Fig. 53. The arm and hand of man come closest to the ideal archetype of the vertebrate limb.[215]

Due to the upright posture, the human upper limbs are not bound to a specific environment or function. They do not show any specialisations, as is the case in apes for swing shimmying and knuckle walking. The human arm and hand remain primitive. They therefore embody the *archetype* of the vertebrate limb, and this in a double sense. For on the one hand, the limbs are formed from an embryonic anlage that is similarly shaped in all quadrupedal vertebrates. While the animal limbs depart more or less from this common origin, the human hand remains most similar to the embryonic initial form. Because of this primitiveness, it is also universal; with its help, humans can achieve everything (and much more) that animals can do (using

[215] "*There is no more beautiful symbol of human freedom than human arms and hands.*" Steiner, 1919, GA 294, p. 104, 28.08.1919 Cf. also Poppelbaum (1928).

technical devices, which they in turn make with their hands). Precisely because it remains unspecialised, the hand becomes a culture-creating tool per se and serves man not only in action, in giving and receiving, but also in showing, in symbolism and gesture as an expression of his mental life. The hand is perhaps the organ in which the human 'I' is most strongly expressed. The human arm and hand also correspond to the archetype of the vertebrate limbs (cf. Fig. 1, p. 24). If one looks for the common basic form, one arrives at a scheme like the one shown in the middle of Fig. 53. This abstract archetype appears in the human form! The human hand sums up everything, it is the common archetype that has flowed out in the limbs of the animals into specialised forms, adapted to the most diverse habitats. From the hand, one can derive the specialised animal limbs through adaptation to certain environments, but from the latter, human universality can only be derived through despecialisation.

In this sense Karl Snell, already quoted several times, wrote: "*In expounding the unity of the type, one generally starts from man, because one sees that light and order are most easily brought into this doctrine by placing man in the centre and grouping the mammals around him, and now proving how the animal forms appear as modifications of the human form produced by manifold lengthenings, shortenings, displacements and adhesions. Thus the central position of man is implicitly presupposed and man is regarded and used as the giver of understanding, as the key of the creatures. … What here presents itself in the spiritual sphere as a derivation, will have to be grasped in the physical sphere as descent.*"[216]

The general type of the upper vertebrate limb appears in the human hand because it stops at an early stage of development. The connection between developmental delay and typological archetype is a basic motif of human development. Precisely because the hand of the upright human does not grow into specialised physical tasks, it can embody the archetypal form, which is not determined by external circumstances, but solely by *inner principles of formation*. These principles are inherent in evolution, but in animals they become overgrown, as it were, through entanglement with the physical environment – in man they come to appearance.

The human gestalt is formed according to inner principles, not out of adaptation to external circumstances. The bodily

[216] Snell (1887) [transl. CH].

entanglement with the physical environment is stagnated. Ernst-Michael Kranich formulated ingeniously: "*The body of animals is adapted to the environment, the body of man is adapted to the 'I'.*"[217] Man in his whole design remains closer to the common archetypal form. One may speak, like Richard Owen, of an incarnation of the type in the human form: Animals evolved, "*guided by the archetypal light, to the appearance of the [archetypal] idea in the glorious garb of human form.*"[218] The archetype is not an abstract scheme, but living, experiential reality.

Richard Owen sought the origin of the vertebrate type in the thoughts of an otherworldly creator (cf. chapter 2.2, p. 23). This Platonising idealism takes man away from the earth and from himself. It makes one see, but what one sees is only an abstract illusion. Charles Darwin wanted to remain 'down to earth'. But he had lost the sense of the archetype of the human form. To him it was one among many, physically derived from a common ancestor like all others. He had completely forgotten himself as a spiritual being. The materialistic world view makes one blind.

We, on the other hand, do not see the archetype of evolution in a distant beyond, nor in blind chance, but in man himself, whose inner, autonomous being appears in his outer shape and its principles of formation. The head, the hand, indeed the whole human form are not an expression of external necessity, but of inner, self-setting freedom. Man is not the best adapted of all vertebrates, but the least. His archetype is freedom. Charles Darwin was right in thinking evolution, but wrong in overlooking man.

11.3 Man as a Polarized Being

The head, arms and hands of man remain closer to the common embryonic origin than that of animals; the evolution of skull forms from apes to man shows increasing juvenilisation ('paedomorphosis'[219]). The lower limbs of humans, leg and feet, however, move further away from the common starting point than animal limbs do ('peramorphosis').[220]

[217] Kranich (1999) S. 84 [transl. CH].
[218] Owen (1849), p. 86.
[219] McKinney & McNamara (1991).
[220] Cf. Schad (1992), p. 95.

While the head and arms/hands of man are less developed than those of the apes, his legs and feet are more differentiated and built for springy gait and balancing carrying of body weight. What in apes is still a 'grasping hand' due to the opposable big toe, in humans is shaped into a foot in a struggle with gravity.

The differentiation of the upper and lower body-pole is caused by uprightness. The human being thereby places himself in a polarity of above and below, lightness and heaviness, consciousness and strength, intelligence and will, thereby developing a centre that is freely movable between the two poles. It is precisely through the strong expression of this polarity that he differs from the animals (Fig. 54).

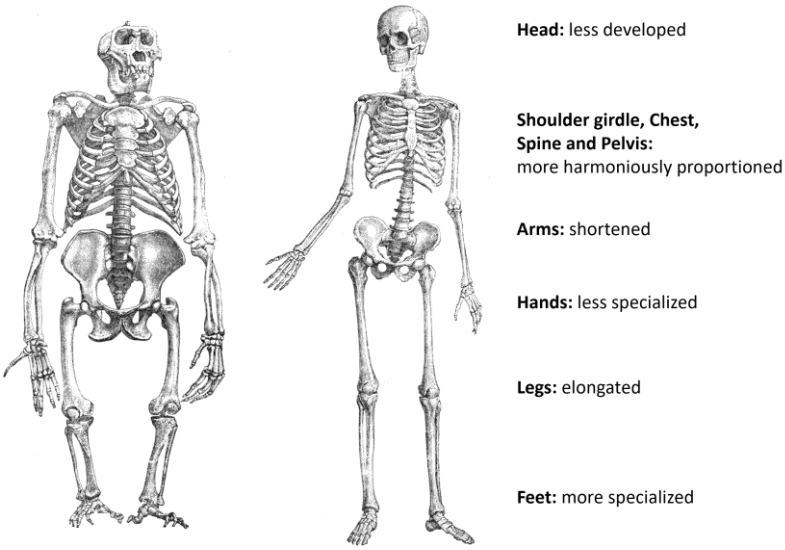

Fig. 54. Comparison between gorilla and human.

The free connection of consciousness and willpower makes it possible, on the one hand, to think up something new through imagination, and on the other, to create something new in the world. All scientific cognition, all art and culture, all creative-practical action of man is based on the free combinability of thinking and willing (Fig. 55, left).[221]

One can extend this view of man imaginatively. The human form can be seen as an image of the polarity of consciousness and will, of light and matter, of 'heaven' and 'earth' (Fig. 55,

[221] Suddendorf (2014).

right). The radiant legs and feet are formed in confrontation with the forces of the earth, while the spherical head shows an image of heaven. To the outer light of the sky corresponds the inner light of consciousness, thoughts move in relation to each other like stars according to their own unchanging laws. The human will, in turn, is formed and impulse by resistance to the earthly substances and forces. And in his midst man lives freely giving and receiving in his surrounding and fellow world.

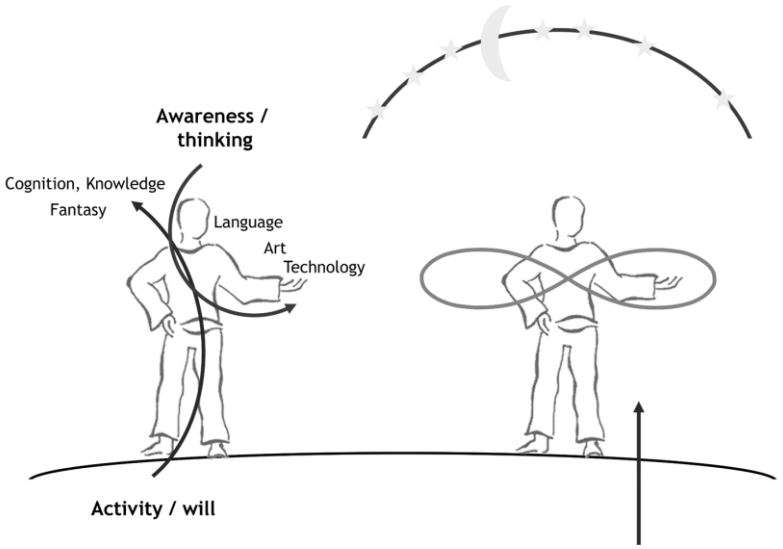

Fig. 55. Left: Man's cultural activities are made possible by the free combinability of thinking and willing. Right: Head, limbs and torso as images of the cosmos, forces of the earth, and man's relationship to his environment.

11.4 The Opposite Directions of Evolution and Hominization

Man's upright gait preceded the development of his flexible hand use and this in turn preceded the growth of the brain (Fig. 56). In an upright position, humans could observe the activity of their hands and thus gradually develop them from instinct-driven behaviour to consciously guided, learning work. Through the feedback between action and cognition, they visibly refined both abilities (as can be seen in the now beginning and soon differentiating use of tools and other cultural achievements), and in the same course the brain also grew.

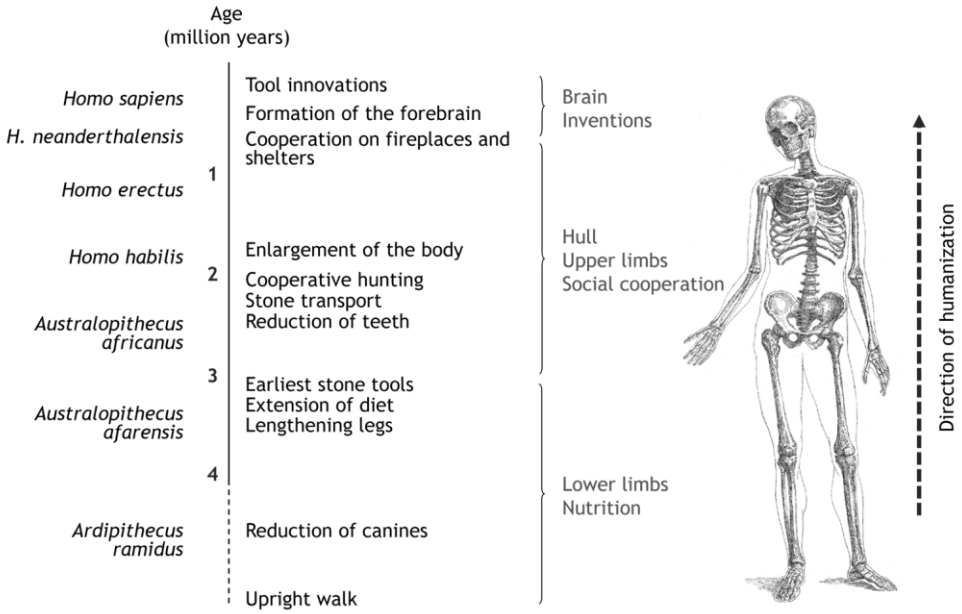

Fig. 56. Evolutionary steps of becoming human (from Antón[222], changed). The direction was from the feet to the head.

Wolfgang Schad described the evolutionary sequence of uprightness, use of hands, development of language and thought as follows: "*From 7 million years before our time mankind had already possessed upright gait as its first characteristic. From 2.5 million, the first stone artefacts appear as the results of awakened manual dexterity. From about 350,000 years ago, early archaic sapiens humans show the high arched palate for the ability to speak (Steinheim man). But it is only with the development of the blade culture and the appearance of many interchangeable shafted tools that we encounter characteristics of increasingly combinatorial, thought-planning abilities in the end of the last Ice Age and in the subsequent Middle Stone Age. It is the time of small-scale art and cave painting: the production of symbolising carved figures and those representations of inner ideas, i.e. rock carvings and rock paintings. Then, with the onset of the post-glacial period, mankind settled down, first in the Near East and then gradually all over the world, with the help of the beginnings of agriculture. Everyone defends their habitat against the others. The first depictions of war appear (Spanish rock paintings). The separation of mine and thine, of I and the world has occurred. Self-consciousness awakens.*"[223]

[222] Antón et al. (2014).
[223] Schad (2009), p. 37.

The direction of development from ape-like human ancestors to man (hominization) thus proceeded in the reverse direction than evolution, for in phylogenesis head-like animals arose first, then fish with head and trunk, and finally land animals with head, trunk and limbs (cf. Fig. 38, p. 127 and Fig. 42, p. 143). Interestingly, the individual development of the human body also proceeds in the same direction as evolution, namely from the head to the limbs (Fig. 57). The human being grows, as it were, from the head down to the earth.

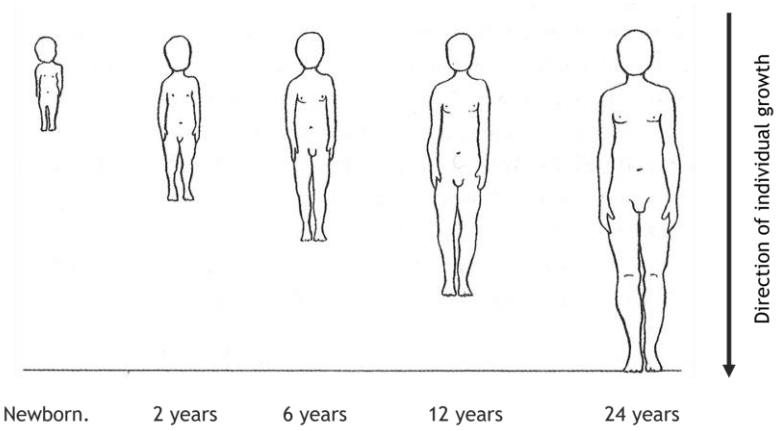

Fig. 57. Changes in the relative proportions of head, trunk and limbs during human ontogeny.

We must therefore distinguish two 'modes of becoming human'. One, evolutionary and ontogenetic, leads – in the direction 'from top to bottom' – to the formation of the human body. The other, 'from bottom to top', is a consequence of the efficacy of an individual 'I', the inner autonomous power of will, which, by its own inner strength, engages with the environment through this body, erects it against the forces of gravity, forms its organs of speech through imitation of the social environment and its brain through orientation in the world. One direction is embodiment, the other spiritualisation.

11.5 Man in Time – the Discovery of Slowness

Of all primates, man develops *slowest* and lives longest (Fig. 58). The same developmental steps take much longer in him than in

apes and other animals. The greatly extended juvenile period makes it possible for the instinctive learning of animals to be replaced in man by social imitation and cultural learning – a fact now generally recognised by science, the fundamental importance of which was already pointed out in detail by Friedrich Kipp in 1980.[224] Early forms of man (*Australopithecus*, *Homo erectus*, *Homo neanderthalensis*) also developed more rapidly than present-day humans.[225]

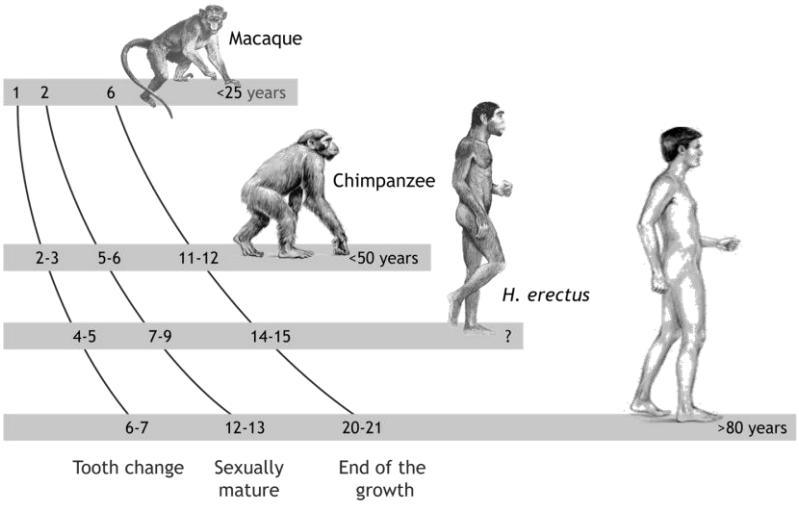

Fig. 58. Different durations of comparable developmental steps in macaque, chimpanzee, *Homo erectus* and *H. sapiens* (in years).[226]

The slower a primate develops, the longer it lives, and the more similar it is to present-day man. One can say: becoming human means slowing down, extending time. The 'juvenilisation' of cranial forms shown above (Fig. 52, p. 160) is also an expression of this fact: morphological retardation due to slowed ontogenesis.[227]

Increased speed of development means that in animals (or in early humans) similar features follow(ed) each other at shorter intervals. For *Homo sapiens*, time is less filled with physical and organic contents and necessities, he has more time for inner

[224] Kipp (1980).
[225] See Appendix *Life Histories of Humans and Apes*, p. 188.
[226] Vgl. Robson & Wood (2008). The life expectancy of wild chimpanzees is only 15 years. Hill et al. (2001).
[227] Gould (1977).

experience, in which his creative activity can unfold. Out of the void of boredom, creativity is born. This is another reason why humans develop art and culture – unlike animals, they have the time to do so.

Just as man, through his uprightness, frees himself from the entanglement with his physical surroundings and attains a spatial overview, so, through his slowed development, he rises spiritually out of the flowing time and attains a free overview of the past, present and future. It is, after all, characteristic of man that, in contrast to animals, he develops an awareness of his origin and tradition as well as of his death approaching him from the future.[228]

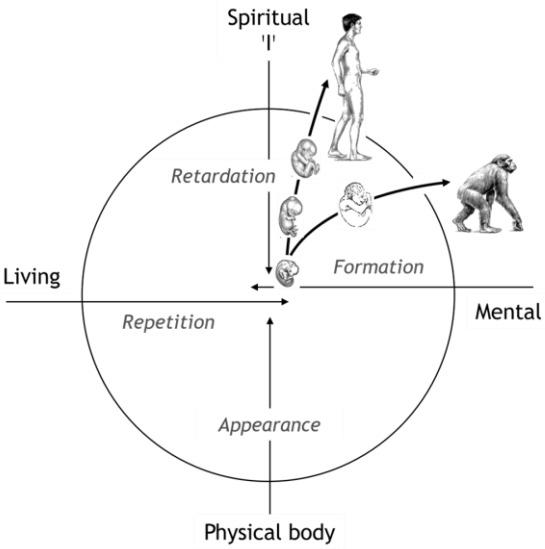

Fig. 59. The evolution of animal and human forms in the TIME CROSS.

These relations can now once again be pictorially grasped in the TIME CROSS (Fig. 59): Both man and the apes originate from the living stream of inheritance. In the development of animals, a soul ('astral force', cf. Chpt. 6.2, p. 93) coming from the future pushes itself into this stream of life and embodies itself

[228] In the course of human evolution, burial rites that point to an expectation of a future after death are known for the first time among Neanderthals and *Homo sapiens* – probably 120,000 years ago at the earliest. Apparently, the still relatively rapidly developing *Homo erectus* was not able to develop a conscious expectation of the future.

in the animal forms. In the human being *this* embodiment is slowed down and thus partially restrained; the soul remains freely mobile and can enter the inner sphere of the 'I'. Rudolf Steiner wrote accordingly: "*In the astral the animal form arises outwardly as a whole form and inwardly as the form of the organs. … If this formation is carried to its end, the animal is formed. In man it is not carried to its end. It is stopped at a certain point on its way, inhibited. … it is drawn into the realm of the I-organisation*."[229] Thus, on the one hand, man loses the wisdom of body-bound instinctual certainty, but on the other hand gains a free space for inner creativity.

Hermann Poppelbaum has described the free space of the I in wonderful words: "*Only in the sphere of man is the spell of an indispensable past and an unavoidable future broken. Only to the human being is the present really open. Between the past and the future a narrow space has become free, which the I has created for itself. Here it unfolds its activity. Animal wisdom is still laden with past group experience and overhung with urgent foresight. The animal acts out of inherited instinct, even where it makes provisions for the future. In humans, such instincts recede. The innate preparation fails. … The animal fits its scene. In man, it is precisely the idea of not fitting in that is justified. … For man, the discrepancy between the skills he has brought with him and the current requirements of the situation is essential. He is not attuned or equipped. He must spontaneously create the harmony and choose the direction himself. What is ruinous for the animal being, the inadequate, becomes for the human being precisely the element of increased life. The I needs this sphere for its development. The incongruence of I and life situation appeals to the source of strength in the human being that the animal lacks. The scene, for the animal only a complement to the organisation, … acquires creative significance for the human being. It makes its moral demands on the developing human being, by virtue of the inadequacy that prevails in him. … Here human triumphs, but also tragedies and comedies, are produced. … It is precisely in human beings that the situation of life, unpremeditated and unique … appeals to the true presence of mind. The moment takes on sole and supreme significance. Success is not predetermined, and failure must be dared. In the 'narrow' space between the two stretches the immeasurable realm of human freedom.*"[230]

The presence of the I in the body thus has a spatially uplifting, temporally slowing and morphologically 'juvenilising' effect. The

[229] Steiner & Wegman, 1925, GA 027, p. 35-36 [transl. CH].
[230] Poppelbaum (1937) p. 24-26 [transl. CH].

evolution of the apes and early human forms prepared for and already heralded the entry of the I into the physical body.

11.6 Summary

We have shown by many examples that evolution as a whole can be compared to the development and metamorphosis of a single organism. Like ontogenesis, we can therefore also understand the transforming movements in phylogenesis in our own living thought. We can describe the cognition of evolution with the same four stages as the cognition of the individual organism (cf. p. 52):

1. the physical-objective cognition of the individual forms (fossil or recent),
2. the inner metamorphic activity through which we bring them into a transformation context,
3. the superordinate knowledge of the whole evolutionary context to which this activity is oriented,
4. the idea of the whole, which permeates everything.

For an individual living being, the superordinate idea is the species. It is present in all stages of development and appears most pronounced in the fully grown organism. But what is the overarching idea of evolution that pervades all individual forms?

To answer this question of all questions, let us summarise all that we have worked out so far. We have shown that the four stages of cognition are characterised by four different subject-object relations. This closes the circle to Thomas Nagel's quest that the knowing consciousness must be taken into account in a viable view of evolution. For the knowing consciousness is the human being and the knowing I (Fig. 60). It is we ourselves who, as human beings, have increasingly come to physical appearance in the course of evolution. The idea that permeates all evolutionary steps and that appears fully formed at the end is the human being. *Man is the alpha and omega of evolution, from the beginning its spiritual principle, appearing in the end in physical form. In the beginning this living idea spiritually encompassed everything else, in the end it appeared in bodily separation. In the future man will again unite spiritually with the world.*

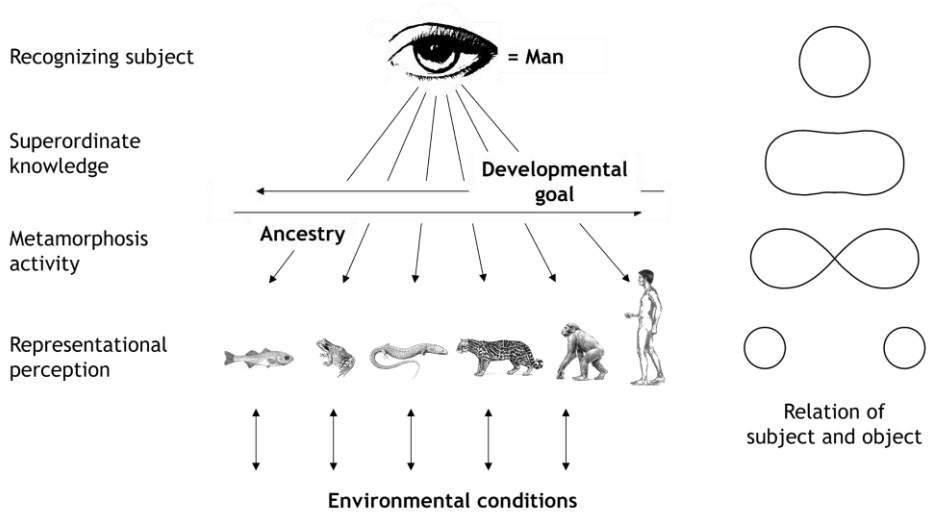

Fig. 60. Four levels of evolutionary knowledge.

Against such a comparison of ontogenesis and phylogenesis, the objection is obvious that in ontogenesis one knows from experience how development proceeds, but not in phylogenesis. One could never predict from the observation of a prehistoric fish that it represents a step on the way to man. But I cannot put myself in the place of a primeval fish without the at least implicit knowledge that it embodies such a step on the way to becoming human, *for it is me who is active here*. To say that one cannot predict man from the fish stage is, on the one hand, just as correct as it is, on the other hand, based on a misjudgement of the real events that underlie this thought. *When I think evolution, it is me who thinks it. As a knowing human being, I belong to evolution and can only ever look at it in retrospect, from the perspective of my own cognition and running towards it*. Natural science would again find a connection between nature and man (and be able to answer many of its puzzling questions) if it stopped ignoring its most essential asset: the knowing human being.

If one takes into account the knowing 'I' as the subject of evolutionary knowledge and as a self-supporting spiritual reality, then the question of a goal directedness of evolution appears in a new light. For then one need no longer seek the teleological principle of evolution outside the cognizing 'I' in any "occult teleological forces"[231], but in it and in the consciousness of the

[231] Mayr (2002)

world encompassed by it. In its perceptions, the I faces the outside of the world; in its concepts, it is united with its essential inside. Thus one recognises the human being as a microcosm and the evolution from the primordial cells to the human being as the ever clearer appearance of the spiritual human being in physical form under 'separation' of the world, which now appears physically. The animals then appear as premature separations from the evolution of the human being, because they are not yet fully spirit-penetrated and have become sensual-physical.

Man is a result of evolution and at the same time its stage. He is co-creator of the world, and at the same time its image, point and circumference in one. Whoever grasps the human being grasps the inner principle of the world.

In this sense Rudolf Steiner summed up his view of evolution at the end of his life: "*Imaginative contemplation brought me the realisation that in primeval times there was in spiritual reality a quite different beingness than the simplest organisms. That man as a spiritual being is older than all other living beings, and that in order to assume his present physical form he had to separate himself from a world-being which contained him and the other organisms. These are thus waste products of human evolution; not something from which he emerged, but something which he left behind, separated from himself, in order to assume his physical form as the image of his spiritual being. Man as a macrocosmic being, who carried all the rest of the earthly world within him, and who has come to the microcosm through the separation of the rest, that was for me a realisation which I … attained in the first years of the new century.*"[232]

A time may come when what is here at the end will be the beginning of every account of evolution. From here, from the true and spiritual reality of the human I, evolution is to be grasped anew. Everything that has been put forward here must be considered from the point of view of this spiritual self-knowledge.

11.7 Freedom and Responsibility

Through the thoughts developed here, one could think that the future is predetermined. Such a view would relieve man of his responsibility for further development of himself and the world, and it is in no way advocated here! It also does not result from

[232] Steiner, 1923-1925, GA 028, p. 403 [transl. CH].

what has been presented. For seen from the current experience of the 'I', the future is (at least partially) open; our actions and omissions will decisively influence the world's progress. – Conversely, one could conclude from the fact of human freedom that 'degrees of freedom' must have already prevailed in evolution, that its course could not have been determined either. In my opinion, both views are based on an imprecise determination of the origin of freedom. In the developmental series of animals, the capacity for freedom is indeed *dispositioned*, but the possibility of actual freedom only arises when man consciously confronts the world. One cannot say that a chimpanzee or a crow – however intelligently they may behave – are *free*. Only when consciousness falls out of the world-process does the separation of perception and concept, of will and imagination occur, which gives the possibility of their free and responsible reunion.

In the light of inner experience, the animals appear as embodied life of the soul. In the human being, this embodiment is held back and drawn into the realm of his spirit-connected 'I'. The head becomes the organ of spiritual overview and knowledge, the limbs remain unspecialised and enable free choice of standpoint, walk, and action. In the tension between spirit and matter and in the awareness of the limits of his existence, the human being is embodied freedom. The life current from the past is transformed in him into the light of knowledge, the creative current from the future into the love of responsible and devoted action. Love understood in this sense can only arise from freedom. The world is the skull-site of man, in which he can only generate freely created new life because it has died to him completely. In separation and death, the 'I' awakens and, if it can overcome paralysis and pain, calls itself to a self-imposed new beginning, to revitalising action.

11.8 The Common Structure of Life and Consciousness

Biologists are concerned with *life*. Every biologist knows the enthusiasm that seizes them when an insight into *life* reveals itself to them. We then usually express it stammeringly with words like 'interconnectedness', 'system', 'complexity', 'evolution', but the language hardly suffices to grasp the inner movement.

I have tried to show what underlies the understanding of life – it is the living in us. To gain insight into life is to become alive in ourselves. We feel numb when we get stuck on the dead details of reality, but invigorated and refreshed when the interconnections of life begin to pulsate within us. Today, in the age of intellectualism and materialism, dead thinking and the thinking of the dead have taken over to such an extent that more and more people are looking for ways out of the inner desolation that has come upon them as a result. This book is dedicated to them.

The ways out can be found. But to do so, one must return to the phenomena, the external and the internal. As long as one interprets the world as mere matter, life as a genetic product and consciousness as the result of brain waves, one blocks one's own access to reality. Many then seek the way out in a nebulous way. Rudolf Steiner showed how access to the reality of the living spirit can be found in a prudent and systematic, that is *in a scientific* way.

In detail, one may argue about the points of view represented here. Some mistakes might be found, some things will have to be added, and many things can certainly be presented much more precisely. On the whole, however, the path described here can lead to a spiritualisation of scientific research. The spiritual connection of phenomena can be found if consciousness is taken into account. What appears externally as phenomena of life is grasped by the inner life. *In living knowing consciousness one can observe life from within*. We are not the spectators of a finished, mechanical and material cosmos, but co-creators in its living being and becoming. We carry out this creation in the sign of the cross, which, symbolising unity, is enclosed in a circle. Thus is fulfilled what Friedrich Wilhelm Joseph Schelling (1775-1854) programmatically demanded: "*Nature should be the visible spirit, the spirit the invisible nature. Here, then, in the absolute identity of the spirit in us and nature outside us, the problem of how a nature outside us is possible must be resolved. The final goal of our further research into nature is therefore this idea of nature. The system of nature is at the same time the system of our spirit*."[233]

[233] Schelling, 1797 p. 706 [transl. CH].

PART III

APPENDIX

On the 'Evolutionary Theory of Knowledge'

In the Introduction (p. 13) we mentioned the so-called 'Evolutionary Theory of Knowledge'. It states that cognition can be true because cognition has been selected for its ability to be true. Gerhard Vollmer, one of its main proponents, wrote: "*Our cognitive apparatus is a result of evolution. The subjective cognitive structures fit the world because they have evolved in the course of evolution in adaptation to this real world. And they match the real structures (in part) because only such a match made survival possible*."[234]

The Darwinian conception of evolution (the truth of which is presupposed by Vollmer) is supposed to explain the truthfulness of cognition, by which again the Darwinian conception of evolution is recognised as true. A remarkable circular argument. But then why can one be wrong at all? And what would happen to this theory if the Darwinian idea of selection were perhaps wrong after all? As Ernst-Michael Kranich noted: "*Evolutionary epistemology is the paradoxical attempt to derive human thought from its views on evolution*."[235]

Rudolf Steiner has shown in his *Philosophy of Freedom* that thinking can only be comprehended and explained by thinking itself, and not by anything else, e.g., by brain activity or a selection pressure acting from outside. In fact, it is just the opposite of what is claimed by evolutionary epistemology: "*In thinking, we hold world events at a corner where we have to be present if something is to come about. And that is precisely what matters. That is precisely the reason why things are so mysterious to me: that I am so uninvolved in their coming about. I simply find them; but in thinking, I know how it is done. Hence there is no more original starting-point for the contemplation of all world events than thinking*."[236] "*A fixed point is gained from which one can seek with well-founded hope for the explanation of the remaining world phenomena*."[237] Something else is the fact that man must again and again bring his thinking and cognition into harmony with the external world. Even in scholasticism it was taught that the form of the concept (i.e. its transparency) comes from the subject, the content from the object.

[234] Vollmer (1975), p. 102 [transl. CH].
[235] Kranich (1989), p. 7 [transl. CH].
[236] Steiner, 1894, GA 004, p. 49 [transl. CH].
[237] Ibid., p. 49.

Rudolf Steiner: Extension of Natural Science by Observation of the Will in Thought

"*Therefore spiritual research must begin precisely where natural scientific thinking must end. That is to say, that which is will in thinking must be sought out in thinking. And this happens in all that the soul has to go through in those inner experiments … by inwardly strengthening thinking, so that the will working in thinking no longer remains unconscious to thinking, but this will becomes conscious, so that the human being really comes to experience himself in such a way that he lives and weaves, as it were, in thinking, is inside the life and weaving of the ideas himself and now no longer looks at the ideas themselves, but at that which he does. And in this the human being must become more and more … technician, must acquire more and more inner practice, must live into that which happens from himself as the life of the imagination takes place. Everything that the human being discovers in himself otherwise remains between the lines of life. It always lives in the human being, but it does not penetrate into the consciousness. ... If one develops such an inner vitality, such an inner liveliness in oneself, that one not only has ideas, but enters with one's experience into this weighing up and weighing down, into this becoming and passing away of ideas, and if one can carry this so far that one no longer even brings into one's attention the content of the ideas, but only this activity, then one is on the way to experiencing the will in the world of ideas, to really experiencing something in the world of ideas which one does not otherwise experience in life. That is to say, if one faithfully adheres to what the scientific mode of imagination itself leads to, one must go completely beyond the way in which natural science researches. To a certain extent, one must not take what natural science explores, but one must watch oneself doing natural science. And what is practised in this way, and what can really only lead to success if it is practised for years - all scientific results are, after all, only achieved through long work - what is achieved in this way is a settling of the consciousness really into a quite different world. That which is achieved can only be experienced; it can be described, but it cannot be shown externally, it can only be experienced. For that which is attained is … in practice that to which the scientific way of thinking already points. This scientific way of thinking tells us: If I continue on my way, I come to a limit. I go as far as I can still find something of the human being. I do not find a world in which there is will and feeling. – But this world, where one discovers feeling and will just as objectively as one discovers plants and minerals here, this world is found when one can make this inner experience of the ideas in the soul effective between the lines of*

normal representations. Only now one experiences that which otherwise one can only suspect."[238]

Rudolf Steiner: Goethe's Metamorphosis Thought Leads to the Spiritual View of the Reality of Living Things

"*Imagine how the human soul, which in Goethe's sense faces the outer living world, is compelled to think of such an organ as the plant leaf in transformation into the flower leaf, then again into the threadlike stamen, even transformed into the root, … and how necessary for this is what Goethe himself felt to be the inner mobility of his thinking. … He who has a rigid thinking, … which only wants to form sharply contoured concepts, forms the fixed concept of the green leaf, the petal and so on, but cannot pass from one concept to another. In so doing, nature falls apart for him into nothing but details. He has no possibility, because his concepts themselves have no inner mobility, of penetrating the inner mobility of nature. … While with many others cognition is a joining together of concepts which they form separately, with Goethe cognition is an immersion in the world of entities, a pursuit of that which grows and becomes and is continually transformed, such a pursuit that his thinking itself is thereby continually transformed, that it continually becomes, continually passes from one into the other. In short, Goethe brings into inner movement that which is otherwise mere thinking. … It is a question of the human being awakening to an inner life of thought that which is otherwise merely combining thought, as it underlies what is today often called 'science' alone. Then thinking is a life in thought. … Then thinking about thinking is transformed into a spiritual contemplation of thinking, then one has thinking before one as one otherwise has external sense objects before one, only that one has these before one's eyes and ears, while one has thinking before the soul filled with spiritual contemplation. Goethe wanted everywhere to pass from mere thinking to inner spiritual views, from mere consciousness, as it is saturated with thinking in everyday life, to the looking consciousness, as I have called it in my book 'Vom Menschenrätsel'.*"[239]

Rudolf Steiner: Perception of the Vital Force by Strengthening the Power of Thinking

"*Just as we strengthen a muscle when we continually use it in work, so we can strengthen the life of imagination … if we place certain easily*

[238] Steiner, 1916, GA 065, p. 379–382, 11.02.1916 [transl. CH].
[239] Steiner, 1918, GA 067, p. 81–83, 21.02.1918 [transl. CH].

comprehensible ideas in the centre of consciousness and in this way again and again give ourselves over to imaginative work to which we do not otherwise give ourselves. … By creating this more powerful imaginative life, by raising ourselves through meditation and concentration above what is actually merely pictorial in our ordinary imaginative life, we arrive at what I call in the books I have mentioned the substantial, imaginative imagining. This imaginative conception lives with such inner vitality in the mere thought as man otherwise lives in his outer perceptions. Through this, however, one gradually comes to the point that the life of the imagination is no longer this merely abstract, … merely pictorial, but one makes … the discovery that the soul … is inwardly filled with forces which, as it were, shoot into the life of the soul. The ideas are no longer merely this light fluid, when they are formed through meditation, through concentration, but they are penetrated, permeated by forces which I would like to call formative forces, by forces which make up an inner spiritual-plastic element. And after a time one discovers that through this formation of the life of the imagination one grows together with that which is the formative forces of the human body itself; after a time one makes the discovery that the life of thought is, so to speak, nothing other than the diluted life of force of human growth. What forms us inwardly plastically in the physical body from birth to death is, I should like to say in a 'diluted' state, our imaginative life in ordinary consciousness."[240]

The Knowing Will as the Real and Idealistic Basis of Evolutionary Knowledge

Rudolf Steiner drew on the philosophers of German idealism, especially Johann Gottlieb Fichte (1762-1814). Fichte had described the spirituality of the self-recognising 'I': "*Power, to which an eye is inserted, is the actual character of the I, of freedom, of spirituality*."[241] With the self-consciously grasping volitional activity of the I, an unshakeable ground of all knowledge had been found, but there was also the danger of losing the bridge to the world. For the I can bring itself into being, but not the world. Steiner saw a way out of this problem in Goethe's way of looking at nature. Goethe applied his volitional activity to natural phenomena by recreating them inwardly. In this re-creation, the phenomena can be experienced in their spiritual contexts. Steiner: "*If the human being ... wants to grasp the spirit in all revelation,*

[240] Steiner, 1921-1924, GA 297a, p. 93–94, 17.01.1922 [transl. CH].
[241] Fichte (1812), p. 17 [transl. CH].

he must do this in the same way as he grasps the I in the soul. He must turn the activity [!] which has led him to perceive this I towards the revealed world."[242]

In his book *The Riddle of Man* (*Vom Menschenrätsel*) (1916) Steiner described this process in more detail: "*One renders oneself special help in the pursuit of this goal by observing the life in nature with a more intimate part of the mind. For example, one tries to look at a plant in such a way that one not only takes up its form in one's thoughts, but in a certain sense feels the inner life which stretches upwards in the stem, unfolds in the leaves according to their width, opens the inside to the outside in the blossom, and so on. In such thinking the will quietly resonates; and it is there a will developed in devotion that guides the soul. … In experiencing the process … one recognises that through this reversal of the will an extra-mental spiritual is seized by the soul.*"[243]

One finds the spiritual in the world through activity! One must inwardly re-create the phenomena and penetrate them with conscious will activity, slip into them, as it were, and bring them forth oneself. Rudolf Steiner called this form of cognition intuition: "*What now lives in the soul is really the object itself. … The life of things in the soul is intuition. It is to be taken quite literally when one says of intuition: one creeps through it into all things. – In ordinary life, man has only one intuition, that of the 'I' itself. For the 'I' cannot be perceived in any way from outside, it can only be experienced within. … The perception of one's own 'I' is the model for all intuitive knowledge. In order to enter into things in this way, however, one must first step out of oneself. One must become 'selfless' in order to merge with the 'self' … of another entity.*"[244]

When the I thus immerses itself in the colours and forms, the movements, life-appearances and soul-expressions of the world-beings, recreates them within itself, then they reveal to it their soul and spiritual qualities. Anthroposophical knowledge of the spirits is an empathic-spiritual activity directed towards the world.

On the Inner Self-Observation of the Four Stages of Cognition

If you would like to observe more closely the four stages of cognition described in Chpt. 4.2, p. 52 you can do so by means

[242] Steiner, 1910, GA 013, p. 70 [transl. CH].
[243] Steiner, 1916, GA 020, p. 162-164 [transl. CH].
[244] Steiner, 1905-08, GA 012, p. 22 [transl. CH].

of the following small exercise: Draw a triangle on a piece of paper. It has certain angles, its sides have a certain length. You are on the level of objective consciousness. Now close your eyes and imagine the triangle as an inner image. Then set this image in motion (as slowly and concentratedly as possible) by first enlarging or reducing one angle, then another, or by letting first one side, then another, move outwards and back again, and finally several at the same time, until the whole triangle is liquefied, as it were (but it always remains a triangle). One now consciously moves on the stage of metamorphosis activity, on which the change between producing and looking at can be observed well (cf. Fig. 7, p. 53). – Once you have concentrated on this for a while, you move on to the next stage, actively putting aside all figurative ideas of the triangle, but still thinking of a 'triangle'. Concentration is now more difficult to maintain. In order to keep the content, one can speak the word 'triangle' to oneself. Finally, take the last step and also leave out the inner words and the thought *of* the 'triangle' and immerse yourself completely in the imageless and wordless being.

Seen exactly, the four steps do not exist next to each other, but within each other. If, in the slowly and consciously accomplished activity of metamorphosis, the lowest stage of objective perception can be faded out, the third and fourth stages are still contained within it. If one succeeds in consciously experiencing only the third stage, it still contains the fourth. The highest level is the last, deepest reason for all cognition; there is no cognition without it.

On the fourth level, everything external falls away; one feels outside of space and time, one with the object, everywhere. Just as the pure concept has no place and no time, so also the I has neither place nor moment – and yet it exists. There is nothing left to hold on to at this stage, the I merges with the other being. That is why it is so difficult to experience this level consciously. If one penetrates to it, then one experiences something of the inner unity that pervades all being. Rudolf Steiner therefore described the human 'I' (the active subject) as a "*drop from the sea of the spiritual which pervades the whole world*"[245].

[245] Steiner, 1910, GA 013, p. 70 [transl. CH].

Francis Bacon's Four Fallacies

In Chapter 5, p. 79 Francis Bacon's critique of Aristotle's four causes was described. But in Bacon, too, one encounters the 'four causes', albeit indirectly in the form of four possibilities of error. Since man could only master nature if he knew it, he had to get rid of various prejudices that clouded his knowledge. Bacon calls these prejudices 'idols', of which he describes four in all. First, prejudices connected with the general inadequacies of the human faculty of knowledge, 'prejudices of the species' (*idola tribus*): "*The prejudices of the species have their ground in human nature … itself. For it is incorrect that the human sense is the measure of all things; rather, all apprehensions of the senses and of the understanding take place according to the nature of man, not according to the nature of the universe. The human mind is like a mirror with an uneven surface for the rays of objects, which mixes its nature with that of the latter, distorts and defiles it.*"[246]

Then prejudices 'of the theatre' (*idola theatri*), based on false belief in authorities: "*There are prejudices which have entered into the souls of men from the various tenets of philosophy and also from perverse rules of evidence, and which I call the prejudices of the theatre, … which have made of the world a poetry and a stage. … I refer this … also to some principles and doctrines of the special sciences, which have acquired validity through convention, credulity, and carelessness*." Then the prejudices of 'the market' (*idola fori*) conditioned by language, which go hand in hand with the designations of things and dependence on the opinions of others: "*There are also prejudices … which, because of the intercourse … of men, I call the prejudices of the market. Men associate with one another by means of speech; but words are attached to things according to the opinion of the multitude; therefore the bad and foolish attachment of names impedes the mind in a peculiar way*." Finally, prejudices 'of the cave' (*idola specus*), which cause man to regard things not in and of themselves, but all too easily distorted, that is, prejudices through inaccurate observation: "*The prejudices of the cave are the prejudices of the individual man. For every individual has … a particular cave or grotto, which refracts and corrupts the natural light … in consequence of the difference of impressions in a biased and prejudiced mode of sense against a calm and even temper.*" – Bacon thus implicitly describes

[246] Bacon (1620) 2. Book, Aphorism 2. This and the following quotes: ibid., 1. Book, Aphorism 41-44 [transl. CH].

the structure of cognition by characterising its aberrations, arriving at the same four-membered structure we have in mind. For the prejudices of genus are obviously inherited, and are therefore connected with the current of time from the past; those of language and the market, as social prejudices, with what is to be expected ('What will the others say? How will I tell them?'). False belief in spiritual authorities clouds the immediate, intuitive cognition of concepts (in the time cross above), while inaccurate observation has a distorting effect on the impressions of the senses (below).

Surprisingly, Bacon's namesake Roger Bacon (1220-1294), a Franciscan, one of the first representatives of empiricism in natural science, also taught 400 years earlier four obstacles (*offendicula*) that block man's path to true knowledge of nature: 1. respect for authority, 2. habit, 3. dependence on the marketable opinions of the crowd, and 4. incorrigibility of our natural senses.[247] In Roger Bacon, the connection of the four obstacles with the structure of the time cross is even more evident than in Francis Bacon. It would be interesting to investigate whether the later Bacon was aware of the source of the earlier one.

Consciousness and Matter

The most stubborn resistance to a spiritual conception of evolution stems from the seemingly insurmountable conviction that there was a permanent matter outside of knowing consciousness. Was this 'matter' not apparently present for billions of years before human thought and consciousness appeared? Did not early organisms preserve themselves in this matter as fossils? How could a world outside consciousness exist if it were not sustained by permanent matter? The conviction of a material world outside of consciousness is so completely self-evident to modern man that the vast majority declare anyone who questions this to be crazy.

On the other hand, this conviction leads to insurmountable contradictions. Thomas Nagel has listed them: Life, consciousness and ethical values simply cannot be explained from matter. In 1872, Emil Du Bois-Reymond formulated the

[247] de.wikipedia.org/wiki/Roger_Bacon.

dilemma in his famous Leipzig lecture *Limits to the Knowledge of Nature*: "*It is quite and forever incomprehensible that a number of carbon, hydrogen, nitrogen, oxygen, etc. atoms should not be indifferent to each other, should not be indifferent to how they lie and move, how they lay and moved, how they will lie and move. It is in no way conceivable how consciousness could arise from their interaction*."[248] And it is therefore also impossible to understand how and why consciousness could have arisen from unconscious matter in the course of evolution: "*At some point in the development of life on earth, … something new, hitherto unheard of, occurs, something … incomprehensible. The thread of understanding, spun in negatively infinite time, breaks, and our knowledge of nature reaches a gulf over which no footbridge, no wing carries: we stand at the limit of our wit. This new incomprehensible is consciousness*."[249]

Even today, despite the most detailed brain research as well as manifold efforts in cognitive science and philosophy, this question remains unsolved.[250] And it *cannot* be solved either, because one is dealing with a category problem.

A solution is only possible if one conceives of 'matter' not as an ontologically independent substance, but as a phenomenon for consciousness. Rudolf Steiner already presented this in 1890 in his essay *The Primordial Phenomenon* (*Das Urphänomen*)[251] in his *Introductions to Goethe's Natural Science Writings*. There it says: "*The perceived world is nothing but a sum of metamorphosed perceptions. … We will now be replied: … 'Behind the [changeable] phenomena, … there must be a 'permanent matter'.*" But "*the concept of matter owes its origin only to a quite mistaken conception of the concept of time. One believes that the world would evaporate into an insubstantial semblance if one did not think that the changeable sum of events was subordinated to something that persists in time, something unchanging. … [But] only he who cannot complete [the] decline from appearance to essence … needs … an existence that outlasts the changes. As such, he conceives of indestructible matter. In this way he has created a thing that is not to be affected by time. … But actually he has only shown his inability to penetrate from the temporal appearance of facts to their essence, which has nothing to do with time*."[252] "*The sensuous conception of the world is the sum of metamorphosing perceptual contents without an*

[248] Du Bois-Reymond, p. 26 [transl. CH].
[249] Du Bois-Reymond, p. 16-17 [transl. CH].
[250] Bieri (1994).
[251] Steiner, 1884-1897, GA 001, p. 266-280 [transl. CH].
[252] Ibid., p. 272-273 [transl. CH].

underlying matter. … [This] is, of course, only the concept of matter on which physics bases its considerations and which it identifies with the old, equally incorrect concept of substance of metaphysics. Matter is something else … as a phenomenon, as an appearance. … For if I call that which fills space 'matter', this is merely a word for a phenomenon to which no higher reality than other phenomena is ascribed. I must thereby only keep this character of matter always present to me."[253]

What we perceive as the external world is an infinite sum of constantly changing phenomena. The concept of matter is added to these phenomena. If one were to experience the spiritual essence of phenomena as real, then 'indestructible matter' would turn out to be an auxiliary concept that the 'I' needs in order to be able to support and hold on to it. Steiner wrote that "*the belief in matter is only a preliminary stage for the realisation that even in space it is not matter that haunts, but spirit that rules. And the idea of 'matter' is only a provisional one, which has its justification as long as its spiritual character has not been seen through. But one must speak of this 'justification'. For the assumption of matter is justified as long as one faces the world perceptively with the senses. Whoever in this situation makes the attempt to assume some spiritual entity behind the sensory perceptions instead of matter, fantasises about a spiritual world. For him who first advances to the spirit in inner experience, that which first 'haunts' as matter behind the sense impressions is transformed, not dreamily, but exactly vividly, into a form of the spiritual world to which he himself belongs with the eternal of his being.*"[254]

[253] Ibid., p. 274 [transl. CH].
[254] Steiner, 1921-1925, GA 036, p. 266, 22.04.1923 [transl. CH].

Life Histories of Humans and Apes

	Gestation period*	Start of tooth change	Menarche	Breakthrough of molars+			Completion of growth	Lifespan
				M1	M2	M3		
Lemur	139		2				3	14
Macaque*	170	1,8	2	1	3,5	5,5	7	24
Gibbon	210		6-8				9	30
Organ-Utan	260	3,5	6-11				11	59
Chimpanzee[1)]	225	2,9	8-9	4	6,5	10,5	11	53
Gorilla	255	3	9				11	54
A. africanus[2)]				4				
Homo erectus[3)]				4	7,6			
H. neanderthalensis[4)]				5	8		15†	
Man[1)]	270	6,2	12-13	6	12	18	20	85

Gestation period in days, all other data in years. + Time of eruption of molars correlates with other development: M1 with completion of brain growth, M2 with sexual maturity, M3 with completion of length growth. Data except for molars[255] and http://pin.primate.wisc.edu/factsheets/entry/orangutan/taxon. Data for molars[256]. Further[257]. † Estimation[258].

Seven Aspects of the Organic

In Chapter 4.4 (p. 57) it was mentioned that an organism can be grasped by a total of seven aspects (see table). All of these aspects are always present at the same time. Each higher level presupposes and integrates the respective lower ones. A higher

[255] Robson & Wood (2008).
[256] Dean (2006). Dean & Lucas (2009), Dean et al. (2001), Smith et al. (2007), Smith et al. (2010).
[257] Bromage & Dean (1985). Lacruz & Ramirez Rozzi (2010).
[258] Ramirez Rozzi & Bermudez De Castro (2004).

level aspect cannot be explained or derived from lower ones, and none of the lower levels of the living can be without the higher ones.

Properties of the Living	**Aspects**	**Forms of Knowledge**
1. *Material*: concreteness, mass, weight, filling of space, substance with certain, sensually perceptible properties	Spatial appearance	Confronting observation
2. *Living*: temporal processual organisation, metamorphosisn	Development in the double stream of time	Active comprehension, (co-)movement
3. *Form-like and functional*: colour, form, size: form and its functions	Functional adaptation, threefoldness, physiognomic expression of form	Visual experience of form, comprehending experience of function
4. *Acting*: autonomous formative power on the one hand, behaviour on the other hand	Autonomously acting being (species)	Identification
5. *Ecological*: species-specific connection with the environment, reflection of the environment in the expression of form (spatial)	Functional and form-related connection of the organism with its environment	Recognising and experiencing the organism-environment relationships
6. *Typological-systematic*: micro-evolution, interrelation of the species with its variants (in the same and different environments), (temporal)	Variation of groups of organisms in different environments	Comparative grouping and active variation
7. *Macro-evolutionary*: Connection with all other organisms (at different times in different environments)	Comprehensive, spatio-temporal relations between different groups at different times in different environments	Comprehensive grouping, overviewing

These seven aspects themselves form systematic relations, which becomes particularly clear when one considers the position of the discerning observer in relation to them. Thus the

5th, 6th and 7th levels each represent reflections or transformations of the 3rd, 2nd and 1st levels. For example, just as the observer actively comprehends the transformations of the organism on the 2nd level, he does so on the 6th level with the variations in which a kinship group appears under different environmental influences. He applies the same comparative-transformative activity to the stages of development of a single organism, and to the variations of a species, a family, genus etc. And just as the observer experiences and functionally comprehends the forms of the organism on the third level, so on the fifth the interweaving of the species with its environment. Apart from the functional meaning of the form, on the 3rd level, as we have shown, the design motives must also be taken into account, and on the 5th level the same applies to the expressive reflection of the environment in the form of the organisms. (One thinks here, for example, of the colouring and costumes of animals; colourful butterflies in comparison to white-grey moths, etc.), which can be understood both as a Darwinian adaptation and at the same time as a physiognomic expression of form. The whole context of our discussion has shown that these two aspects of the organic, the wise functionality as well as the physiognomic motifs of the form, are to be regarded as belonging together. Like the motifs of the form, the reflection of the environment in the form is also experienced in a feeling way. The 1st and 7th stages represent, as it were, two end points of the organic: The individual, spatial-material form on the one hand, and the evolutionary context encompassing all organisms on the other. We thus find a connection between the 1st and the 7th, the 2nd and the 6th, as well as the 3rd and the 5th stage. In the middle, as the centre of all biological thinking, is the autonomy of the organic growth force and of the mentally (in humans also spiritually) impulsed behaviour.

The Life Cycle of Jellyfish as an Example of the Work of Etheric and Astral Formative Forces

In Chpt. 6.3, p. 94 it was shown that the organic formation of shape occurs in the interaction of living (etheric) and soul (astral) forces. The etheric principle of life is plant-like and primarily effective in the repetition of similar elements; the astral principle

is effective in the formation of animal, integrated overall forms. The etheric principle builds up, the astral one breaks down; the etheric one connects, the astral one separates. The etheric works in vegetative reproduction, the astral in generative reproduction through the two sexes. In the mutual attraction of the separate sexes, an inner life of the soul awakens even in the lowest organisms, however dark. The etheric principle works unconsciously, the astral one exists in a psychic interrelation of inner and outer world. Physiologically, the effect of the astral can be seen in the formation of sense organs and the nervous system as well as in the shaping of inner organs that are differentiated from each other. The colouring of organisms, which has a (psychological) effect on others, is also an effect of the astral. Finally, the formation of toxins is also to be understood as an effect of the astral.[259]

The action of etheric and astral formative forces can be seen particularly vividly in the life cycle of the horned jellyfish, which belongs to the *Cnidaria* (cf. p. 121; Fig. 61).[260] The polyp is a sessile hollow form composed of two layers of cells with a single mouth and anal opening. It reproduces purely vegetatively by budding or by so-called 'strobilation', by which a polyp forms a stack of medusae. The medusa is a free-swimming, inverted polyp. However, it is more complexly organised than the polyp, which can be seen, for example, in the heavy sensory organs at the edge of the umbrella and in the four ring-shaped sexual organs. The vegetative regeneration and reproduction ability of the polyp has been completely lost in the medusa. There are male and female medusae, fertilisation takes place externally in the water.

The sessile polyp stage thus shows similarity to vegetative plant life, whereas the medusa has an animal character with its perceptive and locomotor abilities, its more complex organisation and its sexual reproduction. The polyp form is dominated by etheric forces, the medusa by astral ones. Thus in the case of the polyp and the medusa one also finds Rudolf Steiner's characterisations: "*The most elementary principle of the etheric*

[259] Wolff (1998).

[260] Hermann Poppelbaum has given a remarkable description of this group of animals in his book *Tierwesenskunde*. Poppelbaum (1937).

body is that of repetition"[261] and "*the astral body counts, but it counts differentiatingly, counts the etheric body. It shapes it counting.*"[262]

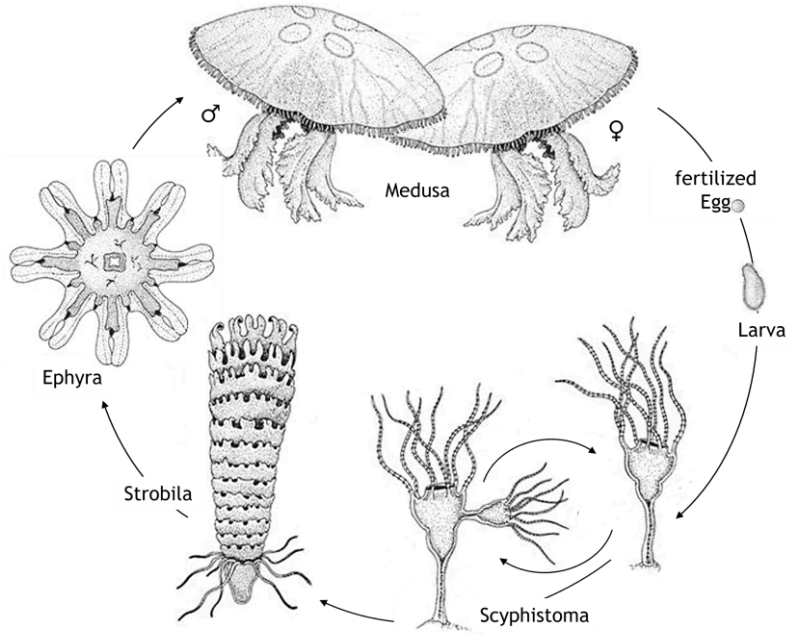

Fig. 61. Life cycle of the horned jellyfish *Aurelia aurita*.[263]

Thus, what appears successively in time in these lower organisms, takes place in more highly organised animals within the ontogenesis of a single organism.

[261] Steiner, 1908-1909, GA 107, p. 28–29, 21.10.1908 [transl. CH].
[262] Steiner, 1921, GA 204, p. 139-140, 23.04.1921 [transl. CH].
[263] This fascinating development can be seen in the following videos: www.youtube.com/watch?v=VDtJs6DPlVU
www.youtube. com/watch?v=Y_v9XLRDlXw+.

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