Did Darwin get over the Second Hurdle?
(The Problem of Constancy amidst Change)

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Samevatting

Allereers word die altyd-terugkerende vrae rakende eenheid en verskeidenheid in met die verskil tussen 'n strukturele en 'n genetiese perspektief in verband gebring. Op die basis van 'n kernagtige bespreking van die ontdekking van die funderingsverhouding tussen konstansie en verandering word aandag aan die teoretiese probleem van die na vore tree van nuwe aspekte gegee – byvoorbeeld soos wanneer die fisiese aspek geboorte skenk aan die biotiese aspek. Dit gee aanleiding tot 'n ontleding van die probleem van (on)herleibaarheid. In hierdie verband word dan meer omvattend rekenskap gegee van die verhouding tussen konstansie en verandering – met appèl op die relevante probleme uit die fisika. Daar word aangetoon dat, ten spyte van die klem op verandering, die Neo-Darwinisme dit nogtans nodig gevind het om 'n toevlug te neem tot twee onderliggende konstante *faktore wat in kombinasie werksaam is, naamlik natuurlike seleksie en mutasie. Aandag word aan die aard en beperkings van mutasies gegee, alvorens die verhouding tussen konstansie en verandering binne die paleontologie bespreek word. Dit het geblyk dat, in stryd met die verdraaide, heersende (Neo)Darwinistiese interpretasie, die dominante tema van die fossielrekord (en daarmee derhalwe van die paleontologie)* konstansie *is – en nie* verandering *nie. Naas die erkenning van hierdie gegewe moes Neo-Darwinistiese paleontoloë sedert die 70-erjare van die 20ste eeu toegee dat evolusie tussenvorme benodig, maar dat*

*die paleontologie nie hierdie tussenvorme oplewer nie. Op die basis van die onderskeiding tussen die modale universaliteit van die biotiese aspek en biotiese tipe-wette word aandag aan die bydrae van Schindewolf gegee, en die verstommende feit dat lewende dinge ongewysigd voortbestaan het vir miljoene en selfs biljoene jare – 'n feit wat die bioloog Thorpe daartoe beweeg het om op te merk dat die probleem van "fixity" (*konstansie*) soos 'n seer duim in die moderne teorie van evolusie uitsteek.*

1. Unity and diversity in the light of constancy and change

Scholarship within the various academic disciplines is always confronted with *diversity*. The latter may first of all be observed in *diverse* (kinds of) *entities*, but it may also be discerned in the cognition of multiple *properties* or *characteristics* of things, normally experienced in terms of the relationships between different kinds of things. This reality accompanies our experience of the world from our early childhood.

Every child is increasingly fascinated by the new things one sees, hears and touches, by the new questions one asks and by the new discoveries one makes. This ever-expanding field of experience is ultimately guided by the many-sidedness of the universe as such. Our empirical world is not merely populated by the same kinds of things. There are not only flowers, only animals or only human beings.[1] Even if we would abstract from all other kinds of entities and concentrate only on entities of a specific kind – like humans – our first awareness more often is not concerned with the *similarities,* but with the *differences* between them. If, however, our attention is focused on entities belonging to different categories, we are compelled to disregard the uniqueness of different entities while lifting out that which is common between all of them. For example, if we want to distinguish between humans and animals we only have to pay attention to that which constitutes the *being-human* of each individual human being and that which constitutes the *being-an-animal* of each individual animal. In other words, in order to accomplish this we solely have to lift out the shared properties between different human individuals (resp. different animals). Only what is (universally) present in all humans *as* humans (respectively animals *as* animals) is then of importance.

1 In another article, on: "Did Darwin get over the first hurdle? (lacking evidence for the assumed origination of 'life')" it is argued that notwithstanding the practice to distinguish up to five realms ('kingdoms') of living things, living entities are ultimately still merely differentiating into plants, animals and human beings.

The awareness of *diversity* therefore appears to presuppose the *unity* of each different type (of diverse) entities. The combination of these two elements constitutes one of the classical problems of Western thinking – that of *unity and diversity*. However, this problem may be positioned within the context of two distinct perspectives, namely (i) a *structural* perspective and (ii) a *genetic* one.

(i) The term *structure* is ambiguous because it can either refer to the *conditions for* the existence of something or to the way in which something *is structured*, i.e. in which it conforms to the conditions for its existence. In addition this distinction implies that an *invariant structure for* can lie at the foundation of *varying responses* to its conditioning role.

(ii) A *genetic perspective* brings to light the dynamic process of becoming encompassing everything within the universe.

When the problem regarding the unity and diversity of reality is combined with that of the distinction between structural conditions and the genetic process of becoming, a *dynamic* element is introduced. Considering this element entails an awareness of *change* – already found in early Greek philosophy when Heraclitus (535-475 B.C.) asserted that *everything changes* (and for that reason one cannot step into the same river twice).[2]

> One may immediately relate this emphasis on *change* with the basic orientation of Darwin's 1859 work on *The Origin of Species* because in this work the term 'change' occurs 268 times, the term 'variation' 281 times, and the plural 'variations' 162 times – altogether there are 711 instances in which change in some or other form is asserted.

In his dialogue with the name *Cratylus* Plato (427-347 B.C.) argues that *if* everything changes nothing *could be known*. Yet he wanted to uphold the possibility of knowledge and as a result introduced the "own essence" (*auto to eidos*) of everything making possible our knowledge of it. These ideas (*eidè*) were supposed to be located in a super-sensory realm of eternal, static forms (*eidè*) only accessible to intellectual knowledge (*episteme*) and they have their copies within the world of the senses which is characterized by *change*.

2 His pupil, Cratylus, claimed that it is not even *once* possible, for the river is never the same! However, what is not realized is that the assertion of *not being the same* is applied to a river – implying that all rivers are constantly changing. This shows that denying the *sameness* of *this river* presupposes its existence (and possible identification) as *a river*!

What Plato realized is that *change* can only be detected on the basis of *constancy*. That is to say that whatever changes presupposes persistence. Without an awareness of *endurance* (persistence), the very notion of *change* becomes problematic, for the difficult question then is: 'what' is it that changes?! Another question concerns the functional characterization of change: what *kind* of changes do we have in mind? Are we talking of *physical* changes, *biotic* changes, *emotional* changes, *historical* changes, *social* changes, *economic* changes, *legal* changes or changes in *morality*? The underlying condition of persistence implicitly surfaces in each one of these functional qualifications. Precisely because the *functional structure* of the physical, the biotic, and so on, remains intact (i.e. the *same*) is it possible – on that basis – to discern *changing instances* of physical phenomena, biotic phenomena, etc.

Of course the deeper level question is if it is meaningful to contemplate that one function can *change* into another function – an assumption that is inherent, for example, in the conviction that *physical* entities were transformed into *biotic* (i.e. *living* entities). The problem here is a quite serious theoretical issue, for if we accept that the physical function can *change* (can be "transformed") into the *biotic* aspect, the next problem is if there will still exist a physical aspect of reality *after* the change of the physical into the biotical? This seems to be impossible if the physical aspect turned into the biotical aspect?! A less rigorous version may contemplate the question whether or not it is possible for one aspect to give rise to the existence of another aspect? For in this case the continued existence of the initial aspect may be affirmed. Yet, if this transition does not *eliminate* the initial (or primary) aspect, it is incorrect to claim that it *changed* into a different aspect. While holding on to the idea of "transformation" the only other option seems to be to defend some or other view of *emergence* in terms of which it is claimed that an on-going process eventually gives rise to various new aspects of reality. It is often asserted that once these additional aspects *emerged* (came into existence) they are irreducible. Emergent evolutionists (such as defended by Lloyd-Morgan, Whitehead, Alexander, Woltereck, Bavinck and Polanyi) indeed wants to have it both ways: *continuity* in descent (in the *process* of origination) and *discontinuity* in existence (in *structure*). *Structure* thus becomes the product of the *genetic process of becoming*.

Emergence evolutionists openly admit that this position is burdened by an inner antinomy. Richard Woltereck does so in his *Ontologie des Lebendigen* (1940:300ff.), while Michael Polanyi writes:

> We have reached the point at which we must confront the unspecifiability of higher levels in terms of particulars belonging

> to lower levels, with the fact that the higher levels have in fact come into existence spontaneously from elements of these lower levels. How can the emergent have arisen from particulars that cannot constitute it (Polanyi, 1968:393).

Some Neo-Darwinists tend to approximate this emergent-evolutionistic position. Simpson states:

> Man has certain basic diagnostic features which set him off most sharply from any other animal and which have involved other developments not only increasing this sharp distinction but also making it an absolute difference in kind and not only a relative difference of degree (Simpson, 1971:270).

Th. Dobzhansky calls the origination of a new level, i.e. discontinuity, "evolutionary transcendence" (Dobzhansky, 1967:44 – the term "transcendence" is derived from the theologian Paul Tillich)[3]:

> The flow of evolutionary events is, however, not always smooth and uniform; it also contains crises and turning points which, viewed in retrospect, may appear to be breaks of the continuity. The origin of life was one such crisis, radical enough to deserve the name of transcendence. The origin of man was another (Dobzhansky, 1967:50).

Furthermore, Dobzhansky holds that "the phenomena of the inorganic, organic, and human levels are subject to different laws peculiar to those levels" (Dobzhansky, 1967:43). At this point something intriguing could be noticed. This quote from Dobzhansky sounds very much like the reformational philosophical idea of *sphere-sovereignty*, embedded in the perspective of an unbreakable correlation between law and what is subjected to that law. One important implication of accepting this principle, as applied both to the various aspects of reality and the diverse (kinds of) entities found within it, is the idea of *irreducibility*.

However, it appears there are two perspectives possible when it comes to an account of irreducibility. Dobzhansky, arguing from the "bottom" to the "top" immediately relativizes the idea of different laws peculiar to different levels: "It is unnecessary to assume any intrinsic irreducibility of these laws, but unprofitable to describe phenomena of an overlying level in terms of those of the underlying ones" (Dobzhansky, 1967:43). The

3 Van Huyssteen refers to Stewart who argues on the basis of the "notion of *emergence*": "Life is flexible, life is free, life seems to transcend the rigidity of its physical origins. And it is this kind of transcendence that is called 'emergence' " (Van Huyssteen, 2006:55).

reverse path is pursued by Van Huyssteen when he looks back on what emerged, for example, at the level of cognitive and cultural evolution. On the one hand he refers to Darwin who stressed the *continuity* between species in respect of instincts or rational abilities (Van Huyssteen, 2006:81) as well as to the continuity of organic evolution from "unicellular organisms to humans" (Van Huyssteen, 2006:87). But on the other hand he discerns something *unique* within human cognition, culture and religious world views, something *irreducible*:

> On the one hand, then, organic evolution – particularly the evolution of the human brain – can be seen as the basis of cultural evolution. On the one hand, the latter can never be reduced to the former. Cultural evolution requires explanations beyond the biological theory of evolution in its strictest sense. Therefore the term "evolution" applies to both the development of the organic world, from unicellular organisms to humans, and the development of culture. Or in Wuketits's words, biology offers the necessary conditions of culture, but it does not offer the sufficient conditions. Cultural evolution (including the evolution of ideas, scientific theories, and religious worldviews) cannot be reduced to biological evolution (Van Huyssteen, 2006:86-87).

He continues to explain his view that within (as part of) the "grandiose universal natural history" once *cultural evolution* commenced it "obeyed its own principles"! This almost sounds like what Dobzhansky had to say about *different laws peculiar to different levels*. However, whereas Dobzhansky rejects *irreducibility* Van Huyssteen upholds it: *culture is not reducible to biological entities*.[4] While distinguishing between *laws of nature* (Van Huyssteen, 2006:55) and *cultural evolution* with its "own

4 "If we should ask whether we are justified in speaking of cultural evolution as we do of biological evolution, the answer, as we saw in our discussion of Plotkin's work, should be yes. We are not only justified to do this, but it is necessary, since there is one common trait here: both organic and cultural evolution can be regarded as complex learning processes, with human cognition as the crucially important mediator between them. Culture can therefore be understood as the most sophisticated learning process requiring particular modes of explanation and a particular type of evolutionary epistemology that goes beyond strict Darwinism. Wuketits, therefore, correctly argues that although there are biological constraints on cultural evolution, culture is not reducible to biological entities. Cultural evolution indeed depends on specific biological processes, and our cultures therefore are part of a grandiose universal natural history, but cultural evolution, once it started, obeyed its own principles and gave human evolution an entirely new direction, even acting back on organic evolution" (Van Huyssteen, 2006:98; regarding the irreducibility of human consciousness, see page 78).

principles", as well as alluding to "particular modes of explanation" (Van Huyssteen, 2006:98), one may ask the question what the *origin* of these (irreducible) laws[5] and principles are? Since laws *condition* (in the sense of *making possible*) what is subjected to them these laws cannot originate in a process presupposing them. Likewise, if there are "own principles" for culture, these principles, making possible cultural activities, cannot originate in cultural processes.

From a different angle Julian Huxley actually supports Van Huyssteen's idea regarding a "grandiose universal natural history" that gave rise to higher levels that cannot be explained in terms of lower levels. He struggles with the inherent tension between *continuity* and *discontinuity* and what he does may be called an "emergentistic retreat". Huxley warns us against the "nothing but" fallacy:

> We begin by minimizing the difference between animals and ourselves by unconsciously projecting our own qualities into them ... Though early scientific thinkers, like Descartes, tried to make the difference absolute, later applications of the method of scientific analysis to man have, until quite recently, tended to reduce it again. This is partly because we have often been guilty of the fallacy of mistaking origins for explanations – what we may call the 'nothing but' fallacy: if sexual impulse is at the base of love, then love is to be regarded as nothing but sex; if it can be shown that man originated from an animal, then in all essentials he is nothing but an animal. This I repeat, is a dangerous fallacy (Huxley, 1968:137).

All varaints of an emergent-evolutionistic perspective appears to suffer from the problematic tension between *continuity* and *discontinuity* or *reducibility* and *irreducibility*. Since the problems involved in these orientations are crucially dependent upon an account of the relationship between *constancy* and *change* we first proceed by exploring this issue in some more detail.

2. The foundational coherence between constancy and change

Owing to the discovery of irrational numbers the initial Pythagorean conviction that *everything is number* switched to an exploration of the

5 He also mentions *regularities* (see Van Huyssteen, 2006:89, 90, 91). This term, which is equivalent to lawfulness and law-conformity, reflects a feature of whatever is subjected to law. Exhibiting the "measure of law" (Afrikaans and Dutch: *wet-matig* – having the *maat* of the *wet*) is a feature of whatever is subjected to a law.

spatial aspect as an alternative principle of explanation. This new space metaphysics extended up and well into the modern era (including Descartes and Kant) and also provided the foundation for the medieval conception of the chain of being with God as the highest being (*ipsum esse*).

Galileo formulated his law of inertia with the aid of a thought experiment. Suppose a body moves on a friction-free path extended into infinity, then this movement will simply continue endlessly. Opposed to the traditional Aristotelian-Scholastic conception according to which the movement of a body is dependent upon a causing force, the law of inertia implies that motion is something given, and that therefore, instead of trying to deduce or explain it, it should be accepted as a mode of explanation in its own right. Motion is original and unique; indeed, it embodies a distinct mode of explanation that is different from those used by the Pythagoreans (number) and the Eleatic school of Parmenides (space). If motion does not need a causing force, then at most, it is possible to speak of a *change* of motion (acceleration or deceleration) – which does need physical force. A well-known German physicist remarks:

> Since the law of inertia has shown that no force is required for a change of place the most natural thing to do is to accept that force causes a change of speed, or, as Newton says, the magnitude of motion ('Bewegungsgröße') (Von Weizsäcker, 2002:172).

The idea of a uniform (rectilinear) motion on the one hand expands the inherent limitations attached to number and space as modes of explanation, and on the other, it at once opens the way to consider the above-mentioned problem regarding constancy and change. In terms of the core kinematic meaning of uniform motion the relational problem at hand could be reformulated as concerning the relation between *persistence* (think about the nature of inertia) and *dynamics* (consider the change of motion requiring a physical force).

The proper elaboration of Plato's above-mentioned insight, namely that change presupposes constancy, is found in Galileo's formulation of the law of inertia and in Einstein's theory of relativity. The core idea of Einstein's theory is after all the constancy of the velocity of light in a vacuum. Although he often merely speaks of "the principle of the constancy of the speed of light", he naturally intends "the principle of the vacuum-velocity" ("das Prinzip der Vakuumlichtgeschwindigkeit" – see Einstein, 1982:30-31; 1959:54). It follows that Einstein primarily aimed at a theory of constancy – whatever is in motion moves relative to an element of constancy. It was merely a concession to the historicistic *Zeitgeist* at the

beginning of the 20th century that he gave prominence to the term "relativity" – all movement is relative to the constant *c*.

According to Janich, the scope of an exact distinction between *phoronomic* (subsequently called *kinematic*) and *dynamic* arguments can be explained by means of an example. Modern physics has to employ a dynamic interpretation of the statement that a body can only alter its speed continuously. Given certain conditions, a body can never accelerate in a discontinuous way, that is to say, it cannot change its speed through an infinitely large acceleration, because this would require infinite force (see Janich, 1975:68-69).

Since the introduction of Niels Bohr's atom theory in 1913, and actually since the discovery of radio-activity in 1896, and of the energy quantum *h* (1900), modern physics has already realized that matter is indeed characterized by physical energy-operation. It is therefore understandable that 20th century physics eventually had to reach a general acknowledgement of the decisive significance of energy-operation for the nature and understanding of the physical world, as it is strikingly captured in Einstein's famous formula $E = mc^2$. Furthermore it was realized that physical processes are *irreversible*. In itself, this observation justifies the distinction between the kinematic and physical aspects of reality. Both Planck and Einstein knew that, in terms of a purely kinematic perspective, all processes are *reversible*. Einstein refers to Blotzmann, who already realized that thermodynamic processes are irreversible. Even as early as 1824 Carnot discovered *irreversible processes*. This discovery was elaborated independently in terms of the second main law of thermodynamics (the law of non-decreasing entropy) in 1850. This law accounts for the fundamental irreversibility of natural processes within any closed system. Clausius introduced the term *entropy* itself only in 1865. In 1852, Thomson explained that, according to this law, all available energy strives towards uniform dissipation (see Apolin, 1964:440 and Steffens, 1979:140 ff.). Planck remarks that "the irreversibility of natural processes" confronted "the mechanical conception of nature" with "insurmountable problems" (Planck, 1973:55).[6] Writing on the foundations of physics, David Hilbert refers to the *mechanistic ideal of unity* in physics, but immediately adds the remark that we now finally have to free ourselves from this untenable ideal (cf. Hilbert, 1970:258).

6 Einstein is equally explicit in his negative attitude towards "the mechanistic framework of classical physics" (see Einstein, 1985:146).

However, Stephen Hawking more recently still writes: “The eventual goal of science is to provide a single theory that describes the whole universe” (Hawking, 1988:10).

Remark on the first main law of thermodynamics

> The foundational coherence between the kinematic and physical aspects implies a different formulaiton of the first main law of thermodynamics. Constancy in the physical aspect after all appears as a structural reminder of the meaning of uniform motion. In terms of the inter-modal connections between aspects, we may say that, in the configuration of *energy constancy* we find an analogy of the kinematic aspect on the law side of the physical aspect.

Since modern physics underscores the fact that *change* has its foundation in persistence, then one may ask what caused Darwin to emphasize change largely at the cost of constancy? We have mentioned that in his *The Origin of Species* Darwin 711 times used terms related to change. We can now add that the term ‘constancy’ only appears *twice* and ‘persistent’ (or: ‘persistently’) merely *three times* in this work!

From our preceding brief overview it is clear that the history of the natural sciences highlights the exploration of four *distinct*, *unique* and *irreducible* modes of existence that at once served as ultimate *modes of explanation*,[7] namely *number*, *space*, *movement* and *energy-operation*. This outcome is reflected both in our experience of time (*succession*, *simultaneity*, *duration* and *irreversibility*) and in the four basic units of measurement employed by physics (bringing to expression the said first four *modes of explanation*): *mass*, *length*, *duration* and *charge* (see Lorenzen, 1976:1 ff.). Since whatever there is in a *physical sense* exhibits a concrete function within everyone of these four modes of existence – also known as *modal functions* or *modal aspects* – one may speak of their *modal universality*.

The philosophically informed physicist, Von Weizsäcker, implicitly draws upon the modal universality of the physical aspect of reality when he appreciates *quantum theory* as the central theory of contemporary physics. His explanation indeed highlights the *modal universality* of the physical

7 In a quotation from Van Huyssteen we found the expression “modes of explanation” (Van Huyssteen, 2006:98). Unfortunately nowhere in his book does he contemplate an analysis of the modes of explanation found in reality – these modes are all correlated with the ontic modes of existence within which all concrete (natural and social) entities and processes function.

aspect, for this modal universality is not restricted by the *typical nature* of any (kind of) entity – it cuts across *all* typical differences. Von Weizsäcker says:

> Quantum theory, formulated sufficiently abstract, is a universal theory for all classes of entities (Von Weizsäcker, 1993:128).[8]

While *modal laws* hold universally (for all classes of entities), *type laws* are limited to a specific group of entities. Such a typical law holding for a specific kind or type of entities still has its own *universality*, although this universality is *specified*. The law for being a state is universal in the sense that it holds for all states. But because not everything is a state, this type law is specified – it only applies to states. Likewise the law for being an atom is a type law that only holds for atoms and not for all other kinds of physical entities.

The existence of type laws enable us to classify physical entities and place them in various categories. The *typical nature* of an entity specifies the modal meaning of the aspects in which it functions. These typical natures of entities provide a peculiar "colouring" to their modal functions. But most importantly, type laws do not hold for each and every possible kind of entity – they apply to a limited class of entities only. Stafleu explains this distinction as follows:

> Hereby we distinguish laws which are valid for a limited class of subjects (typical laws) from those which are valid for all kinds of subjects (modal laws). Typical laws, in principle, delineate a class of subjects to which they apply, describing their structures and typical properties. Examples of such laws are the Coulomb law (applicable only to charged subjects), the Pauli principle (applicable to fermions), etc. Often the law describing the structure of a particular subject (e.g., the copper atom) can be reduced to some more general laws (e.g., the electromagnetic laws in quantum physics). On the other hand, modal laws are those which have a universal validity. For example, the law of gravitation applies to all physical subjects, regardless of their typical structure. We call them modal laws because, rather than circumscribing a certain class of subjects, they describe a mode of being, relatedness, experience, or explanation (Stafleu, 1980:11, cf. pp.6 ff.).

8 When he explains, on the next page, that one cannot deduce the kinds of entities of experience from the universal scope of quantum theory, he has in mind what we will call *type laws*.

In general, one can therefore say that modal laws encompass all possible entities, whereas typical laws (type laws) only hold for a *limited class* of entities. We shall see below that this distinction lies at the core of the theoretical problems of Neo-Darwinism.

3. The problem of constancy and change within (Neo-)Darwinism

In their functioning material entities are guided or qualified by the physical aspect of reality. In this sense, such entities are indeed *physical subjects* and not 'objects' – as we are used to say. Therefore, insofar as material entities are *physical* they are *subjects* and insofar as they are considered according to some or other non-physical (post-physical) property, they are *objects*. This term "object" actually applies to the possible *object functions* of any physical entity. These latent object functions that may be disclosed by subjects actively functioning within any post-physical aspect. Consequently, insofar as material things are objectified in some or other post-physical aspect – such as the analytical (where their analytical object function is made manifest in that they are identified and distinguished), the lingual (having been assigned a name, as sign objects), the jural (as legal objects, having become the property of a legal subject), and so on – they are no longer appreciated according to any one of their subject functions.

Since Neo-Darwinism foremost presents itself as a *theory of change* the question arises: are there any constants in the bio-world?

First of all every single living entity persists over time – and in this sense exhibits an element of constancy, making it possible to refer to its (relative) *identity*. Thus from a mechanistic or physicalistic point of view a living thing has to have a *physico-chemical identity* constituted by its atoms, molecules, and macro-molecules. However, since these "building blocks" of "life" are in a ceaseless flux, it is a hopeless task to try to specify which of these physico-chemical components should be considered to be constitutive of this supposed physico-chemical identity of living things. Do we have to think of those atoms, molecules, and macro-molecules, currently present, those present years ago, or those which will be present a few years hence!? When living things are physicalistically reduced to their material constituents, their *biotical identity*[9] is necessarily lost – since the supposed elements of identity continually vary.

9 Jones *et al*. points out that all "the atoms of our body, even of our bones, are exchanged at least once every seven years. All the atoms in our face are renewed every six months, all our red blood cells every four months and 98% of the protein in the brain in less than a month. Our white blood cells are replaced every ten days and most of the pancreas cells and one-thirteenth of all our tissue proteins are renewed every 24 hours" (Jones, 1998:40).

However, once the vital function of living things is taken into account, it is even possible to claim that a living thing, from a biotic point of view, is in a *stable state* (referred to as *health*), while simultaneously claiming – without any contradiction – that from a physico-chemical perspective (with a view to the flowing equilibrium of its physical-chemical constituents), it exists in an *unstable state*. If the physical-chemical substratum of living things approaches a state of higher statistical probability, biotical instability increases as a sign of the final *process of dying*.

If change cannot be detected except on the basis of persistence or constancy, then the question arises what are the conditioning constants underlying the (Neo-)Darwinian encompassing theory of *change*? Are there indeed any constant conditioning elements making possible this emphasis on *change*? Darwin proposed one such a conditioning element, namely *natural selection*. With "natural selection" Darwin had in mind the constant struggle for survival in which only the fittest will survive. He explains what he has in mind in the beginning of Chapter 4 as follows:

> On the other hand, we may feel sure that any variation in the least degree injurious would be rigidly destroyed. This preservation of favourable individual differences and variations, and the destruction of those which are injurious, I have called Natural selection, or the Survival of the fittest. Variations neither useful nor injurious would not be affected by natural selection, and would be left either a fluctuating element, as perhaps we see in certain polymorphic species, or would ultimately become fixed, owing to the nature of the organism and the nature of the conditions (Darwin, 1859a:131).

It should be kept in mind that Darwin did not know anything about the genetics of Mendel. The latter's insights into the process of genetic inheritance, after they were rediscovered by Hugo De Vries and Carl Correns in 1900, in fact did not receive a positive response amongst Darwinists, mainly beause Mendel's laws acted in a predetermined way. The inherited features discovered by Mendel proceed according to specific rules and occur as variations within set limits – thus excluding the idea of *random variations*.

The latter was introduced on the basis of the growing knowledge of *mutations*. It appeared that mutations occur indeed at *random*. After about twenty years of controversy between the saltationist and biometric schools of thought T.H. Morgan established a laboratory in which he attempted to show that new species in fruit flies (*Drosophila melanogaster*) could be produced through mutations. The outcome of his research did not account

for the creation of new species for it merely connected mutations with an increase in genetic variation within a population.

Morgan began his career in genetics as a saltationist, and started out trying to demonstrate that mutations could produce new species in fruit flies. However, the experimental work at his lab with *Drosophila melanogaster*, which helped establish the link between Mendelian genetics and the chromosomal theory of inheritance, demonstrated that rather than creating new species, mutations increased the genetic variation in the population (see WEB: *Modern Synthesis*, 2009).

In almost all cases mutations affect *genes* – and Darwinian biologists thought that the variation thus caused by it provides the basis upon which *natural selection* operates. This possibility turned the tide and as an effect we witness the origination of the *Modern Synthesis* which incorporated the role of mutations in the subsequent development of Neo-Darwinism. Huxley invented the phrase *the modern synthesis* (see Huxley, 1942) and names such as R.A. Fisher, Theodosius Dobzhansky, J.B.S. Haldane, Sewall Wright, E.B. Ford, Ernst Mayr, Bernhard Rensch, Sergei Chetverikov, George Gaylord Simpson, and G. Ledyard Stebbins are associated with it (see WEB: *Modern Synthesis*, 2009).

Since mutations appeared to be defective in 99% of the instances where it occurs, maintaining the idea of mutation as an independent condition for evolution would uproot the foundation of the entire Darwinian idea of "organic transformation". No one less than Dobzhansky, the well-known Neo-Darwinian geneticist, had to observe that "[M]utation alone, …, could only result in degeneration, decay, and extinction" (Dobzhansky, 1967:41). What is remarkable is that there is no single genetic mechanism that introduces, regulates or controls mutations (see Scheele, 1997:49). Yet, even though a mutation my cause damage to a gene or even eliminates it, it may produce an advantage in the chances of survival (Scheele, 1997:50). Mutations therefore differentiate in negative ones (99% result in degeneration, decay, and extinction), neutral ones (no effect on survival), and in a few cases changes that may be advantageous in terms of survival. At this point the modern synthesis opted for the *combined effect* of mutation and natural selection. Subsequently mainstream (Neo-)Darwinian evolutionary theory holds that these two phenomena, namely *mutation* and *natural selection*, always act in combination.

When natural selection is invoked, Neo-Darwinism holds that the (mutationally) disadvantaged living entity may emerge as being

advantaged – in the sense of having a better chance to survive. At the same time the combined operation of mutation and natural selection serves the claim that new kinds of entities emerged – as we have seen, from the level of unicellular entities up to human beings.

By and large Neo-Darwinians acknowledge that mutation alone results in *devolution* ("degeneration, decay, and extinction"). There is nothing *creative* attached to this devolutionary process, it is predominantly destructive. Nonetheless Neo-Darwinism is convinced that the *magic wand* that can turn devolution into evolution is given in die operation of *natural selection*. In the above-mentioned quotation from Dobzhansky regarding the degeneration, decay, and extinction caused by mutations alone, a part of the sentence was left out – the full quotation reads:

> Mutation alone, uncontrolled by natural selection, could only result in degeneration, decay, and extinction (Dobzhansky, 1967:41).

His account of variability has difficulties answering the following question: If living entities during the past three thousand million years have been governed by this universal evolutionary law that developed (without any purpose!) towards the human being, it cannot be explained why there still are, apart from the highly evolved animals, such primitive entities as bacteria, algae, mosses, amoebae, worms, etc. – why did the evolved animals not also remain stuck on these original levels? Eisenstein writes: "The simultaneous co-existence of the greatest variety of life forms, from amoeba to humans, anyway proves that from the perspective of nature these are all equitable and equally viable (existenzfähig = able to exist), without any necessity of further development" (Eisenstein, 1975:245).[10]

In order to understand the alleged co-operative action of natural selection and mutation we have to provide some background information. In 1896 the Buchners discovered alcoholic ferments which serve a catalytic function in cells, initially referred to as "zymase", it gradually became apparent that it is a mixture of enzymes and co-enzymes. Protein refers to macro-molecules consisting of 20 different amino acids. When an amino group (NH_2) of one amino acid is linked with a carboxyl-group (COOH) of another amino-acid, a peptide bond (NH-CO-) is formed – coupled with

10 We shall see below that the fossil record dominantly evinces form that (abruptly) appear and then continue to exist basically unaltered for millions of years.

the release of water (H_2O). Multiple amino acids are bonded in this way into a macro-molecule – a polypeptide. Enzymes have a protein structure built up out of amino acids and occasionally occurs in their thousands in a particular cell. This promotes chemical reactions in the cell, although each kind of enzyme catalyzes only a limited number of reactions. Enzymes are very sensitive to abnormally high temperatures – unlike inorganic catalysts, which normally perform better under warmer conditions. The entire metabolism of the cell depends on the functioning of enzymes.

In the nucleus of the cell nucleotides are formed through the bonding of a sugar and a nitrogenous base on the one hand and a phosphorous acid-remnant on the other. In this way polinucleotide chains are formed. In DNA four nucleotides are found, namely Adenine (A), Guanine (G), Cytosine (C), and Thymine (T). These spontaneously associate through hydrogen bonds in the links A-T and G-C. Out of this mutual attraction emerges two polinucleotide-strings with various possibilities. A series like ATG ACG is complemented by a series TAC TGC.

The so-called genetic code concerns the rule in terms of which a polipeptide series is linked to a given polinucleotide series. This linkage is made possible by RNA – a nucleonic acid differing from DNA in that the T is replaced by U(racil). To transfer the matrix of DNA to protein it appears that a combination of three letters is necessary in the DNA for every amino acid to be formed. This means that some amino acids are correlated with more than one triplet of nucleotides – i.e. different triplets are occasionally attached with only one amino acid. The triplets UAA, UAG, and UGA appear to be inoperative, since they are not correlated with any amino acids.[11]

It is estimated in mammals that "uncorrected errors (= mutations) occur at the rate of about 1 in every 50 million (5×10^7) nucleotides added to the chain". But with 6×10^9 base pairs in a "human cell" this implies "that each new cell contains some 120 new mutations". However, since up to "97% of our DNA does not encode anything" this should not be a cause for concern" (Mutations, 2009). Scheele points out that in respect of the amino acid sequence of certain critically specialized proteins no change is

11 There are 20 amino acids and if we consider only two possible combinations of 4 DNA nucleotides only 16 amino acids can be explained: 4x4 = 16. The mentioned nucleotides of A, G, C, and T can however be arranged in 64 combinations of triplets: 4x4x4 = 64.

allowed because it will compromise the functionality of the protein fatally, i.e. after one single change in such a protein it loses its total functionality and natural selection immediately eliminates it. The effect is that the bearer of the mutated gene cannot continue to be or to survive. Moreover, two thirds of the genes belong to this category, which means that two thirds of the genes do not change or evolve (Scheele, 1997:90-92).

Whereas *somatic mutations* – that occur within somatic cells by damaging them, making them cancerous or killing them – disappear when such a cell dies, *germline mutations* may be passed down, given certain conditions, to a subsequent generation of gametes (Mutations, 2009). Given the multiple-one mapping[12] between nucleotides and amino acids, a change of *one* letter of the genetic code may be neutral. Alternatively it may change the correspondence and therefore negatively affect the message of the code (these mutations are known as *point mutations*). The scenario gets worse when, in a sequence like ATGACG, one letter drops out (*deletion*) or one is added (*insertion*), because then the entire coding is disrupted. Losing the ordeliness of the code should be appreciated against the background of the fact that the possibilities of *randomly* combining amino acids – say in the case of a protein constituted by 300 amino acids – amounts to 20^{300}, a slightly larger number than the estimated total number of atoms in the universe – 10^{80}![13] Of course the presence of DNA (and protein) merely represents some of the required (macromolecular) physico-chemical substructures of living entities, and as macromolecules they are not alive.

Apparently the role of mutation and natural selection supports the main thesis of Neo-Darwinism, namely the assumption that the sole reality within "living" nature is that of *change*. Yet in fact the contrary is true, for if no *constancy* is attached to the (combined) *conditioning role* of *mutation* and *natural selection*, no single evolutionary change is conveivable.[14] In other words, only when mutation and natural selection

12 61 nucleotides specify 20 amino acids – see footnote 11.

13 The chance of randomly selecting the letters in a specific order (at five thousand flips per second) of *one page* of the genetic code is calculated to take 10 billion years. Since there are actually 500 000 such pages what it will take to "assemble" all of them, in their correct arrangement, is nothing less than 5 million billion years! (Keep in mind that present-day physicists and astronomers estimate our own universe to be less than 14 billion years old.)

14 With the intention to distinguish between a law and what is governed by such a law Avey questions relativism in a way that is relevant to our observation that change presupposes constancy: "There is, however, another aspect of Heraclitan philosophy which should not be ignored, and which relativist theory it does not always find convenient to emphasize. The law of change does not itself undergo change in the manner of the changing particulars" (Avey, 1929:521).

are operating as a constant (conditioning) law for the existence and variability of living entities, is it possible to account for the changefulness of the latter. This implies that it is not true to claim that everything *changes* within the bio-world, for the "law-effect" of mutation and natural selection is supposed to remain *constant*![15]

As far as the original position of Darwin is concerned, as presented in 1859, we have to return to his (above quoted) view of *natural selection*, while keeping in mind that – as Dobzhansky emphasized – mutation alone, uncontrolled by natural selection, could only result in degeneration, decay and extinction. The fact that almost all mutations are defective and harmful, make them solid candidates for elimination by natural selection. Darwin explicitly stated that we "may feel sure that any variation in the least degree injurious would be rigidly destroyed" by natural selection. For all practical purposes the combination of Darwin's original view of natural selection with the Neo-Darwinian understanding of mutation therefore rules out all Darwin's hope for evolution; what is left is nothing but *devolution*. The fact of the matter is that natural selection is a conservative process in the sense that it cannot produce or create anything – it can merely select from what is "presented". As Mortenson puts it: "natural selection can explain the survival of the fittest, but not the arrival of the fittest" (Mortenson, 2006).

What modern genetics opened up is an understanding of the variation that is possible within the *same* genetic theme. Mutations move within the same framework, except that in the 99% plus instances they cause degeneration – there is no single example known for a jump-wise functional adoption of new genes (Scheele, 1997:110-111). For that reason

15 When the combination of mutation and natural selection is applied in order to account for the origination of first living entities a vicious circle lurks. Von Bertalanffy remarks: "In contrast to this it should be pointed out that selection, competition and 'survival of the fittest' already presuppose the existence of self-maintaining systems; they therefore cannot be the result of selection. At present we know no physical law which would prescribe that, in a 'soup' of organic compounds, open systems, self-maintaining in a state of highest improbability, are formed. And even if such systems are accepted as being 'given', there is no law in physics stating that their evolution, on the whole, would proceed in the direction of increasing organization, i.e. improbability. Selection of genotypes with maximum offspring helps little in this respect. It is hard to understand why, owing to differential reproduction, evolution should have gone beyond rabbits, herring or even bacteria, which are unrivalled in their reproduction rate" (Von Bertalanffy, 1973:160-161). Depew underscores this objection by pointing out that natural selection "depends for its operation on the very sort of variation and heredity that exists only in organisms and so can hardly be used to explain how organisms came into existence in the first place" (Depew, 2003:448).

natural selection actually *conserves* the scope of variation within a population, which explains why it is indeed also described as a *conservative factor*.

John Davison states that natural selection, "the cornerstone of the Darwinian myth, never had anything to do with creative evolution. It served in the past as it does now only to prevent change. That is why every chickadee looks like every other chickadee. … There is not a single extant diploid organism on this planet that will ever become anything basically different from what it already is." Davison, apart from himself, calls upon a number of significant natural scientists in support of his claim that natural selection is "a conservative rather than a creative element".[16]

John Davison points out that there "is not a shred of evidence that any prokaryote ever evolved into anything but the same species and certainly not into any eukaryote" (Evolgen Archive, 2009). A similar verdict applies to the experiments done by Dobzhansky with Drosophila, which did not produce a new species – and "it is his credit that he admitted defeat".

> What I am saying is that allelic mutations are either deleterious or neutral and have little or nothing to offer in the way of advantage to the organism. More important, the experimental attempts to demonstrate speciation through selection for such changes have failed. I also do not regard prokaryotes as models for eukaryote evolution. Neither Lamarckian nor Darwinian models have received laboratory support and neither can be reconciled with the fossil record (Evolgen Archive, 2009).[17]

4. Constancy and change within paleontology

What is known as "phyletic gradualism" is basically the 19th century idea of Darwin that species evolve incrementally at a more or less steady rate. How did Darwin assess the paleontological record in the light of his gradualist starting point?

He states that

> Geological research, …, yet has done scarcely anything in breaking down the distinction between species, by connecting

16 He mentions St George Jackson Mivart, Henry Fairfield Osborn, Leo Berg, Reginald C. Punnett, Pierre Grasse and Otto Schindewolf. He adds that there "is not a shred of evidence that any prokaryote ever evolved into anything but the same species and certainly not into any eukaryote" (Evolgen Archive, 2009).

17 In addition Davison refers to the "the total failure of the Darwinian fairy tale to explain anything in evolution beyond the production of varieties and subspecies" (Evolgen Archive, 2009).

> them together by numerous, fine, intermediate varieties; and this not having been affected, is probably the greatest and most obvious of all the many objections which may be urged against my views (Darwin, 1859a:307).[18]

The above-mentioned preoccupation with change, embedded in the overall idea of slow alterations of living entities over vast periods of time, prompted paleontologists under the spell of this paradigm not only to search for these "numerous, fine, intermediate varieties", but also to interpret whatever they found in advance in terms of gradual change. It is understandable that the revolutionary effect of Darwin's new ideas at once also generated substantial respect for his views amongst his followers and inspired them to help to remedy this shortcoming of missing transitional forms. Fossil findings were therefore constantly under the pressure to "bridge the gaps". Nonetheless, in spite of the sustained hope that transitional forms will be found, paleontologists were all along very well aware of the discontinuities within the higher systematic categories. Just more than 100 years after Darwin's 1859 book Simpson explicitly states that "every paleontologist knows, that *most* new species, genera, and families and that nearly all new categories above the level of families appear in the record suddenly and are not led up to by known, gradual, completely continuous transitional sequences" (Simpson, 1961:360).

One may suspect that this acknowledgement might have resulted in some caution and an attitude of tentativeness and uncertainty. Unfortunately the opposite appears to be the case, because Simpson did not doubt for one single moment that the sought after intermediate forms might not have existed at all. The question is: how does one account for these discontinuities? Simpson proceeds: "Almost all paleontologists recognize that the discovery of a complete transition is in any case unlikely. Most of them find it logical, if not scientifically required, to assume that the sudden appearance of a new systematic group is not evidence for special creation or for saltation, but simply means that a full transitional sequence more or less like those that are known did occur and simply has not been found in this instance" (Simpson, 1961:360). That means that Simpson responds to the mentioned question – namely how does one explain the discontinuities – not by explaining them but by *denying* them!

18 In 1859b this reads: "What geological research has not revealed, is the former existence of infinitely numerous gradations, as fine as existing varieties, connecting together nearly all existing and extinct species. But this ought not to be expected; yet this has been repeatedly advanced as a most serious objection against my views" (Darwin, 1859b:207).

About a decade later paleontologists started to realize that they have to take these discontinuities serious. The WEB article on the *Synthetic theory of evolution* says that by the beginning of the 1970's "Stephen J. Gould, Niles Eldredge, and other leading paleontologists" challenged the kind of approach exemplified in what we just quoted from Simpson. It states that they "asserted that there is sufficient fossil evidence to show that some species remained essentially the same for millions of years and then underwent short periods of very rapid, major change. Gould suggested that a more accurate model in such species lines would be *punctuated equilibrium*" (Synthetic Theory of Evolution, 2009).

Particularly significant is the way in which this statement is formulated: "some species remained essentially the same for millions of years and then underwent short periods of very rapid, major change". What is certain is what is embodied in known fossil findings – exhibiting *sameness* over millions of years, or as can also be said, *constancy* over millions of years. What is documented is *stasis*, *constancy* – what is *not* documented is *rapid change* – which is invoked to side-step the phenomenon of the *sudden appearance* of whatever new type that then remains constant over millions of years. The mere abrupt appearance does not reveal *anything* about what happened *before* the unanticipated appearance took place. The attempt to say something about it remains completely *speculative*. In principle there is not really a difference between what Simpson says and what the theory of *punctuated equilibrium* holds, for in both cases the *absence* of transitional forms is actually denied, either by claiming that the transition "did occur and simply has not been found in this instance" (Simpson), or by holding that these (quickly changing) forms do exist but simply was not recorded because, for whatever reason, they did not fossilize (Gould).

However, if we consider one of the authentic statements made by Gould in the seventies, the distinction between fact and fiction more clearly comes to the fore: "The extreme rarity of transitional forms in the fossil record persists as the trade secret of paleontology. The evolutionary trees that adorn our textbooks have data only at the tips and nodes of their branches; the rest is inference, however reasonable, not evidence of fossils" (Gould, S.J. 1977:14).[19] What Eldredge said is even more revealing in this context: "We paleontologists have said that the history of

19 Also see the reference of Stark to Gould found in Van den Beukel, 2005: "The extreme rarity of transitional forms in the fossil record (the professional secret of paleontologists) is the most prominent problem for Darwinism" (quoted by Van den Beukel, 2005:105).

life provides support for the interpretation of gradual development through natural selection while all the time we knew that it was not true" (see Van den Beukel, 2005:105).

After Gould and Eldredge first made their new idea public a siginificant article appeared in the Neo-Darwinist journal, *Evolution,* under the title "Paleontology and Evolutionary Theory". In it the paleontologist, D.B. Kitts, points out, however, that the spatial distribution and temporal sequence of organisms with which paleontology works is founded in the ordering principles of *geology*, and can therefore not be incorporated in any biological theory: "Thus the paleontologist can provide knowledge that cannot be provided by biological principles alone. But he cannot provide us with evolution. We can leave the fossil record free of a theory of evolution. An evolutionist, however, cannot leave the fossil record free of the evolutionary hypothesis" (Kitts, 1974:466). According to him the danger continues to exist that biologists are convinced of the acceptability of the evolutionary hypothesis by a theory which is already inherently evolutionistic: "For most biologists the strongest reason for accepting the evolutionary hypothesis is their acceptance of some theory that entails it" (Kitts 1974:466). His final verdict is devastating: "Evolution requires intermediate forms and paleontology does not provide them" (Kitts, 1974:467).[20]

The zoologist, Thorpe, highlights another instance of fixity (*constancy*) that is problematic to the Neo-Darwinian emphasis on *change*.

> [i]t seems to me that there is an outstanding problem raised by our discussion – namely the problem of *fixity* in evolution. What is it that holds so many groups of animals to an astonishingly constant form over millions of years? This seems to me to be the problem now – the problem of constancy; rather than of change. And here one must remember that the genetic systems which govern homologous structures are continually changing. Thus the control system is continually changing but the system controlled is constant, and constant over millions of years. This problem seems to me to stick out like a sore thumb in modern evolutionary theory (Koestler & Smythies, 1972:77).

Eldredge underscored the fact that stasis (constancy) is dominant in the "fossil record": "Gould and I claimed that stasis (= immutability, stand-

20 To this he adds the remark: "But most of the gaps are still there a century later and some paleontologists were no longer willing to explain them away geologically" (Kitts, 1974:467).

still), and not change, is the dominant theme of the fossil record" (quoted by Van den Beukel, 2006:106). Most species "enter the evolutionary order fully formed and then depart unchanged" (Berlinski, 2003:158). Eldredge adds the remark: "and this destroys the backbone of the most important argument of the modern theory of evolution" (as quoted by Van den Beukel, 2005:106). [21]

This situation clearly shows that the prejudiced and premature pre-occupation by Darwin and his followers with *change* prevented modern (Neo-)Darwinian biology to come to terms with the fact that change always presupposes something constant.[22] The one-sided emphasis on change actually denied constancy its rightful place. What Gould and Eldredge designated as the *dominant theme* of the fossil record, namely stasis (non-change) highlights another important view point. On the one hand change presupposes the constancy of *conditions* (in the sense of a *law* that determines and delimits those entities subject to it), and on the other those subjects may display, notwithstanding variability within certain boundaries, a relative persistence (or constancy/identity). The latter phenomenon is supported by the mentioned *dominant theme*.

Suppose it would turn out that important systematic units of animals appeared, instead of going through an extremely slow process, at the *same time* without common ancestors, what would it imply for the position taken by Darwin? He explicitly holds: "If numerous species, belonging to the same genera or families, have really started into life at once, the fact would be fatal to the theory of evolution through natural selection. For the development by this means of a group of forms, all of which are descended from some one progenitor, must have been an extremely slow process; and the progenitors must have lived long before their modified descendants" (Darwin, 1859:309).

Ironically enough this is exactly what happened during the "Cambrian explosion". Sterelny is therefore justified in his assessment that the

21 Gould quotes Prothero and Shubin, who wrote, in connection with the supposed evolution of the horse: "This is contrary to the widely held myth about horse species as gradualistically varying parts of a continuum, with no real distinctions between species. Throughout the history of horses, the species are well-marked and static over millions of years" (see Gould, 1997:68).

22 Steven Stanley raises a legitimate concern in this regard: "Since the time of Darwin, paleontologists have found themselves confronted with gradualism, yet the message of the fossil record has been ignored. This strange circumstance constitutes a remarkable chapter in the history of science, and one that gives students of the fossil record cause for concern" (Stanley, 1981:101).

standard (Neo-)Darwinian story runs "slap-bang into a nasty fact", the fact namely that about 530 million years ago most "major animal groups appeared simultaneously". He continues: "In the 'Cambrian explosion', we find segmented worms, velvet worms, starfish and their allies, mollusks (snails, squid and their relatives), sponges, bivalves and other shelled animals appearing all at once, with their basic organization, organ systems, and sensory mechanisms already operational. We do not find crude prototypes of, say, starfish or trilobites. Moreover, we do not find common ancestors of these groups" (see Sterelny, 2001:89-90).

Since paleontologists working *within* the Neo-Darwinian tradition started to concede that constancy dominates the fossil record (living entities persisted basically unaltered over millions of years), this phenomenon requires closer scrutiny. Particularly Schindewolf[23] was extremely critical of the wedding of population genetics and paleontology. He holds that the mode of thought and terminology of population genetics cannot be transferred to the fossil material that forms the chief foundation of phylogeny. He emphatically states that genetics as a discipline falls short of the actual process of evolution. The real issue by far exceeds what is accessible through experimental genetic research on recent organisms. "Evolution in its proper sense is a historical process that occurred in a bygone past" (Schindewolf, 1969:61-62).

Diverging theoretical paradigms caused alternative and even mutually contradicting assessments of fossil findings. As an example we may briefly refer to the account given of the *Archaeopteryx* (discovered already in 1861), which has both reptilian and avian characteristics. Although G.G. Simpson and O.H. Schindewolf largely concur with regard to the discovered state of affairs, they approach the factual information from radically divergent points of departure. Schindewolf is of the opinion that the transition from the *class of Reptiles* to *the class Aves* found expression in the appearance of *Archaeopteryx*. This animal was a *bird* with wings which could fly, the first representative of a new class – the *Aves* (birds). M. Grene characterizes Simpson's approach as follows: "Simpson says Archaeopteryx was a species like any other, originating by normal speciation from other reptilian species; only when we look back over the

23 He is the author of a standard text book on paleontology, *Grundfragen der Paläontologie* (1980). He developed his own theory, known as *typostrophism*, through which he accounts for the abrupt appearance of types (typo-genesis), their stabilized (and continued) existence (typo-stasis) and their final disappearance from the paleontological horizon (typo-lysis).

whole vista of evolution do we say, this particular species was the first of what turned out to be a new class" (Grene, 1974:130).

Grene points out that Simpson and Schindewolf accuse each other of essentially the same or similar mistakes, making use of unnecessary and mystifying presuppositions. She believes that each accepts as premise the negation of the other's conclusions – while hardly, if at all, differing with regard to the facts: "Simpson, wedding paleontology to the statistical methods of population genetics, sees a gradual change in populations such that the sharp divisions of traditional morphology become false. Schindewolf, basing his theory on the logical priority of morphology, concludes that the gradualist, statistical picture of Neo-Darwinism is false. To put it very schematically; Simpson argues: the Neo-Darwinian theory is true; morphology implies that Neo-Darwinism is not true; therefore morphology is wrong. Schindewolf argues: morphology must first be accepted as true; morphology implies that the Neo-Darwinian theory is wrong; therefore the Neo-Darwinian theory is mistaken. Or to put the matter another way, they agree on the major premise: traditional morphology and Neo-Darwinism are incompatible" (1974:132).

Schindewolf's insistence that morphology is the key to an understanding of the past is based upon his idea of the *structural design* of particular *types* of entities. He employs the German term *Bauplan* which is meant to capture what we have designated as *type laws* in an earlier context.[24] We have noted that Von Weizsäcker acknowledges the modal universality of the physical aspect of reality (quantum theory applies to all "Gegenstandklassen" – Von Weizsäcker, 1993:128), to be distinguished from type laws holding only for a limited class of entities (such as the type law for being an atom). The biotic aspect of reality displays its own *modal universality* since it holds for all *kinds* of living entities (plants, animals and human beings).

The most fundamental basic concepts of biology as a scholarly discipline constitute this modal universality of the biotic aspect. They actually reflect within the biotic aspect analogical structural moments referring back to the four aspects that are foundational to the biotic aspect, namely the numerical, spatial, kinematic and the physical aspect. Although the distinction between the one and the many derives from the numerical meaning of unity and multiplicity, this arithmetical feature analogically

24 It should be noted that Darwin, in one of his last letters, doubted that one can avoid the assumption of a *plan* (design) in nature (see Eisenstein, 1975:412).

appears in all the post-arithmetical aspects. The discipline of physics employs the concept of *mass*. It represents a numerical analogy within the modal structure of the physical aspect, since it relates to a "quantity of matter". Similarly, a biologist may speak about biomass.[25]

A spatial figure displays a spatial *unity* amidst its multiple parts – for example the three sides (*multiplicity*) of a triangle (*unity*), the triangle as a spatial unity and multiplicity. The moment the expression *organic life* is employed we encounter an example of a *biotic unity and multiplicity*. Every living entity (note the implied modal universality of the biotic aspect present in this way of addressing the issues) has *multiple organs* that are *united* in its biotic functioning. Every living entity is a *biotic whole* with different *parts*. This statement explores the *spatial analogy* within the structure of the biotic aspect, because as such it appears first in the aspect of space. The biotic endurence or persistence of any living entity analogically reflects the core meaning of the kinematic aspect within the biotic aspect. Although the vitalist tradition intended to reify the biotic mode into an *immaterial vital force* it did not realize that the term *force* is derived from the core meaning of the physical aspect, for when energy operates certain forces come into play, causing certain effects. The *biotic strength* of a living entity secures its *survival* potential. For that reason the widely known term *survival* displays the inter-modal coherence between the biotic aspect and the foundational physical aspect.

In other words, the modal universality of the biotic aspect comes into sight in each instance of a biotic function that applies to all possible living entities. Every living entity is bound to the biotic time order of birth, growth, maturation, ageing and dying. The moment the distinct type laws of living entities are included in our perspective we have to take notice of significant *typical* differences, for example displayed in the different life expectations of different kinds of living entities – from one year up to more than thousand years. *Biotic growth* is the embodiment of *increasing subdivisions*[26] accompanied by the specialization of distinct organs (or organelles in the case of unicellular entities). The numerical and spatial foundation of biotic entities therefore make possible basic biological concepts such as *biotic growth* that can be further specified by the

25 Jones, for example, refers to the fact that plants constitute 99% of the world's biomass, while fungi are estimated to have twice the total biomass of animals (Jones, 1998:54).

26 The term *increase* analogically reflects the numerical meaning of *more and less* while the term *subdivisions* analogically reflects the meaning of the spatial whole-parts relation (with its implied divisibility).

expressions *biotic differentiation* and *biotic integration*. The thermodynamics of physically *open systems*, that allow for a continuous interaction with a given environment (known as a *steady state*), is analogically reflected in the modally universal biotic trait of *feeding* (consider the metabolism – anabolism and catabolism taking place within the cell). In spite of the building up and breaking down that takes place, every living entity continues its existence, bound to its *typical* life-span.[27]

The legacy of idealistic morphology twisted the idea of a type law (*Bauplan*) into something supra-sensory and static (an element of the thinking of Ray and Linnaeus). Schindewolf does not fall into this trap, but still got accused of it by Mayr in 1963 in his book on *Animal species and evoloution* (p.673). In 1969 Schindewolf pointed out that typological thinking should not be identified with the platonic tradition (see Schindewolf, 1969:66), but as recent as 2002 we still find the same one-sided and misguided definition of "typological" in Mayr's work: *What evolution is* (see Mayr, 2002:319).[28]

Schindewolf quotes Van Valen who claims that Archaeopteryx is "precisely intermediate in structure between birds and reptiles" and then provides arguments why it in fact belongs to the Aves, including the fact that some of the 35 bird species known since the cretaceous period (derived from 13 families and 8 orders) existed up to the present (about 80 million years) (Schindewolf, 1969:73).[29] He is adamant that Archaeopteryx is a genuine bird and does not reside somewhere in "no man's land" (Schindewolf, 1969:79).

On a more general level he holds, against the nominalistic orientation of Neo-Darwinism, that the systematic types (from the species and genera up the orders and classes) are real, concrete entities open to *morphological*

27 Where Scheele employs the term *typological* he opts for both *constancy* and *variation*: "Our conclusion therefore must be that much rather we have to mention that there is a typological *variation* or *differentiation* that cannot exceed its own boundaries, but which does provide within those limits a large number of possibilities" (Scheele, 1997:117). Also Eisenstein holds that within the concept of *constancy* the concept of variability is enclosed (Eisenstein, 1975:278).

28 In passing we may note that on page 30 of this work from 2002, Mayr still uncritically included the original (1874) illustration of vertebrate embryos by Haeckel – which turned out to be fraudulent. Wells mentions the dishonesty in Haeckel's sketches: "Haeckel entirely omitted the earliest stages of development in which the various classes of vertebrates are morphologically very different. Biology teachers should be aware that Haeckel's drawings do not fit the facts … it ignores groups that did not neatly fit into Haeckel's scheme" (Wells, 2003:179, 181).

29 He refers to the fact that the wing of Archaeopteryx had the same number of "Handschwingen" than the modern flying birds (Schindewolf, 1969:75).

research, for otherwise it would be untenable nonsense (unhaltbarer Unsinn) (Schindewolf, 1969:83). He reminds us that amongst paleontologists it is since long ago known that the development of phyla did not proceed in a uniform, continuous tempo (Schindewolf, 1969:88). During the last 50 million years nothing essentially new occurred with the mammals (Schindewolf, 1969:89). But the abrupt appearance of new types must be representative of an exceptional acceleration, for otherwise not enough time would be available. Schindewolf gives the example of *Chiroptera* (a bird). Its *Bauplan* is complete and known since the middle Eocene, but during the subsequent 45 million years no significant changes took shape. If the large distance between this radically new type and its predecessors would have been accounted for in terms of the minute, small changes envisaged by Simpson, then the beginning of this development would have been pushed back to long before the origination of the earth (Schindewolf, 1969:90).

He then continues his argument by mentioning numerous examples of forms that remained constant over millions of years. For example: *Rodentia* – since the Paleocene they did not change for more than 50 million years. In all the cases of enduring existence the essential features remain typically constant (Schindewolf, 1969:115).

The *Coelacanth*, that was supposed to have died out 65 million years ago, until it was found in 1938 off the coast of Madagaskar – still being identical to the fossils of 65 million years ago. Scheele mentions sharks that did not change over millions of years (Scheele, 1997:93). Army ants did not change during 100 million years.[30] *Pleisiosaurus* exhibits little changes during a period of 135 million years.[31] Sea turtle, 110 million years old, did not change during this period.[32] Blue-green algae (*Cyanobacteria*) are known as the oldest "living fossils", dated to be 3.5 billion years old, yet "they are essentially identical to the blue-green algae that are still living today".[33]

What is of course pre-supposed in the relative constancy of the fossil record is the invariance (constancy) of physical laws. The supposition that the laws and law-conformities currently in force also apply to the past is known as "actualism" (see Schindewolf, 1969:106).[34] However, the overall problem presented to paleontology and biological theory is that the

30 This example and the following 3 are also mentioned by Mortenson, 2006.
31 Dixon, *et al*., 1988: 76-77.
32 "Fossils shed light on sea turtle evolution." Animal.discovery.com Feb. 24, 2005.
33 See the Web site of the *Museum of Paleontology* of the University of California, Berkeley.
34 Gould points out that this assumption formed the basis of Leyll's 1830 work on the *Principles of geology* where it is presented as Leyll's uniformitarian principle.

assumed rapid changes (such as those intended by the idea of *punctuated equilibria*) are not currently observed and therefore would remain pure speculation.

Gould mentions Charles Oxnard who "studied the shoulder, pelvis, and foot of australopithecines, modern primates (great apes and some monkeys), and *Homo* with the rigorous techniques of multivariate analysis" and who concluded that "that the australopithecines were 'uniquely different' from either apes or humans, and argues for 'the removal of the different members of this relatively small-brained, curiously unique genus *Australopithecus* into one or more parallel side lines away from a direct link with man'" (Gould, 1992:60).[35] This instance is just one of the many others known to us, which Gould in general describes as "the 'sudden' appearance of species in the fossil record and our failure to note subsequent evolutionary change within them" (Gould, 1992:61). It sounds pretty strange to designate the constancy in terms of a negative qualification, namely "our failure to note subsequent evolutionary change within them"! Apparently the paradigmatic commitment to *change*, at the cost of *constancy*, still burdens Neo-Darwinian thought.[36]

5. Concluding remark

The general pattern of the fossil record, *discontinuity* and the *stasis* or *constancy* of whatever appeared, leave us without any data on the basis of which we can account for the gaps that can no longer be explained away

35 Gould concedes that "we must recognize three coexisting lineages of hominids *(A. africanus,* the robust australopithecines, and *H. habilis),* none clearly derived from another" and "none of the three display any evolutionary trends during their tenure on earth: none become brainier or more erect as they approach the present day" (Gould, 1992:60).

36 The embarrassment with constancy as dominant pattern of the fossil record caused Gould to take refuge to the allopatric theory according to which at "another place" "new species arise in *very small* populations that become isolated from their parental group at the *periphery* of the ancestral range". This gives rise to "[S]peciation in these small isolates" that occurred in a way that is "*very rapid* by evolutionary standards" (Gould, 1992:61). Without any *factual support* this speculative claim then serves to side-step the said embarrassment with "sudden appearance of species in the fossil record and our failure to note subsequent evolutionary change within them" as "the proper prediction of evolutionary theory as we understand it" (Gould, 1992:61).This assumption of Gould is similar to the embarrassment with the origination of the first living entity. Wilhelm Troll, who wrote a standard text book on Botany, categorically states that the question concerning the origination of life on earth, owing to its speculative nature, does not belong to the domain of biology as an empirical science (Troll, 1973:8-9).

geologically (Kitts). The answers to the most burning questions therefore lie hidden below the surface of abrupt appearance and continued (unaltered) existence, and if we do not want to become victims of idle speculation, intellectual honesty may help natural scientists to honestly confess our *docta ignorantia* – acknowledging that in the natural scientific sense of the term *we do not know what really happened*. We have to conclude that Thorpe was indeed right: *fixity* (*constancy*) indeed sticks out like a sore thumb in Neo-Darwinian evolutionary theory.

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