

Of Bones and Beasts: Christian Heinrich von Pander (1794–1865) on Transformation of Species¹

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Christian Heinrich von Pander, a Russian scientist of German-Baltic origin, devoted all his life to the problem of development in embryology, comparative anatomy and palaeontology. In 1817 he outlined the germ layer concept by giving an accurate description of the embryonal development of the chicken. Together with Eduard Joseph d'Alton the Elder, he examined skeletons of extinct and living animals in scientific collections all over Europe; the outcome was the 14-volume *Comparative Osteology* (1821–1838). They used the word “metamorphosis” as a key term when describing the manifold transformation of species. The paper deals with the question of Pander’s and d’Alton’s share in the theoretical introductions and shows that Johann Wolfgang von Goethe’s contribution was more substantial than providing the term “metamorphosis”. Thirdly new evidence is given concerning the characters of Pander and d’Alton, based on yet unpublished letters from Christian Gottfried Nees von Esenbeck and his wife to Karl Ernst von Baer.

Keywords: Christian Heinrich von Pander, Eduard Joseph d’Alton the Elder, Johann Wolfgang von Goethe, transformation of species, metamorphosis, palaeontology

Transformism in Context

As early as in the late 18th century (i.e. long before 1859, when Charles Darwin’s *Origin of Species* was published), naturalists from all over Europe supposed that the diversity and manifestations of flora and fauna were subject to changes. Among them, Jean-Baptiste Lamarck’s (1744–1829) theory seems to have been the most famous and influential until today, because it postulated not only changes, but also included conjectures on their causes (Corsi, 2001). However, theories like Lamarck’s met a formidable opposition: Prestigious scholars, first of all Peter Simon Pallas (1731–1811), endorsed the constancy of species (Pallas, 1784; Wegner, 2008). Pallas’s arguments even impressed later generations, e.g. Charles Lyell (1797–1875) (Rudwick, 2005) and Jean Louis Rodolphe Agassiz (1807–1873) (Lurie, 1988). Moreover, the proponents of transformation disagreed concerning origin, extent and determining factors of changes in nature.

Since empirical evidence (like geological and palaeontological observations) was limited — if existing at all — and, at the state of knowledge at that time, was difficult to interpret, many of those early models of transformation show notional features. These are the reason why historians of biology consider most concepts as “natural philosophy” without going into further details. Yet, the construction of an antagonism between philosophical precursors and scientific Darwinism is inadequate: Contemporaries like the famous embryologist Karl Ernst von Baer (1792–1876)

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realized the speculative and to some extent teleological nature of Darwin's theory of evolution, and recent research has confirmed these tendencies (Richards, 1992). On the other hand, the pioneers of developmental biology, palaeontology and comparative anatomy are underestimated if rated among philosophers. In their self-understanding they did scientific research when they not only described inexplicable physical findings, but also tried (or better, dared) to explain them. In fact, romanticists like Lorenz Oken (1779–1851) explicitly adhered to a theoretical approach to nature (Mischer, 1997). However, the palaeontologist Johann Jakob Kaup (1803–1873) was embarrassed by the fanciful intellectual gimmickry of his youth (Franzen, Gruber, 2004). Moreover, Karl Ernst von Baer repeatedly issued caveats regarding the unproven hypotheses of Oken (Baer, 1972 [1886], p. 289–290) and the Schellingians (Baer, 1972 [1886], p. 170–175).

International research preferably considers authors, who published their works in English when they, separately from Darwin, were concerned with the transformation of species, especially Richard Owen (1804–1892), Herbert Spencer (1820–1903) and Thomas Henry Huxley (1825–1895) (Bowler, 1988; Corsi, 2005; Rupke, 2009); Edward Hitchcock's (1793–1864) "trees of life" (1840) were discussed only recently (Archibald, 2010). The French naturalists Georges Cuvier (1769–1832) and Étienne Geoffroy Saint-Hilaire (1772–1844) have also been studied extensively (Appel, 1987; Laurent, 1987; Cardot, 1997; Rudwick, 1997; Le Guyader, 2004). The transformists from Russia, Caspar Friedrich Wolff (1734–1794), Karl Eduard von Eichwald (1795–1876), Johann Friedrich von Brandt (1802–1879), Nikolai Petrovich Wagner (1829–1907) and Nikolai Yakovlevich Danilevsky (1822–1885) have been presented as well (Vucinich, 1988; Kolchinsky 2005; 2011). Especially Karl Ernst von Baer's contributions to developmental biology have attracted attention (Lenoir, 1982, Tammiksaar, 2010) and were re-read only recently (Riha, Schmuck, 2011).

Comparative Osteology (1821–1838)

Christian Heinrich von Pander (1794–1865), a Russian naturalist of German-Baltic origin, is less famous. Born in Riga, he was adjunct of the Imperial Academy of Sciences at St. Petersburg in 1820, extraordinary member in 1823 and ordinary member from 1826 to 1827 (a summary of Pander's biography can be found in Schmuck, 2009, p. 86–99). Pander was the first to outline the germ layer concept in his doctoral thesis: Based on the preliminary work of Ignaz Doellinger (1770–1841) in Wuerzburg, Pander studied more than 2000 chicks in the first days of embryonic development (Pander, 1817; cf. Pander, 2003). However, his extensive palaeontological activities (e.g. Pander, 1856–1860) are almost forgotten (Siegfried, Gross, 1917), and nearly nobody remembers Pander as one of the first explorers of Russia's geology (Pander, 1830). On the contrary, Pander's image is becoming blurred: Pander was not indexed in the *Neue Deutsche Biographie*, the current encyclopedia of German biography, and even Pander's dissertation was recently challenged (Zwiener, 2004). Boris Raikov's detailed portrayal of Pander needs correction in many respects (Rajkov, 1951; Raikov, 1984); already the editors of the German-English translation of his monography evaluated many statements as too enthusiastic, and further corrections have been suggested in the last years (Kolchinsky, 2005; 2011).

Our paper is based on the 14-volume *Comparative Osteology*. The work was the outcome of Pander's research trip throughout the European collections of natural history (1818–1819). Pander undertook that journey together with Eduard Joseph d'Alton the Elder (1772–1840),



Christian Heinrich Pander (1817)

whose acquaintance he had made during his doctoral studies, and who created the beautiful copper plates for the German version of Pander's dissertation. It was also d'Alton who supplied the 103 [!] high-class illustrations of animal skeletons that made the volumes in horizontal folio precious — and expensive. In spite of its artistic form, *Comparative Osteology* is relatively unknown (it is even missing in some Russian publications on Pander) and has not been widely spread (Raikov, 1984, p. 29–35, 44–47). Only once in the last years, the work was discussed in connection with Pander's embryological research as well as with Johann Wolfgang von Goethe's (1749–1832) term “metamorphosis” (Schmitt, 2002; 2005).

While historians of biology tend to focus exclusively on Pander and neglect his co-author d'Alton historians of literature, art and culture, only know d'Alton. There are two reasons for this strange difference in perception: Firstly, Pander's name appears

side by side of d'Alton on the flyleaf and on the title page of volume 1 to 11 only in the initial issues, which apparently circulated in only a few copies. Each volume was reprinted shortly afterwards in the same year, now only signed by d'Alton alone, while Pander is regularly missing (cf. the editors' commentary in Raikov 1984, p. 110–111). From volume 12, edited by d'Alton and his son, every indication of Pander is omitted.

The second reason is d'Alton's acquaintance with Goethe, who undoubtedly was the centre of intellectual life and the most important figure of reference in the German-speaking countries around 1800. From 1808 to 1813 d'Alton has lived in Goethe's vicinity in Tiefurt. Both men came into close and long-lasting contact. As d'Alton's letters to Goethe show, he deeply admired the elder poet (d'Alton, 1874), while Goethe appreciated d'Alton as a gifted artist and as a capable scientist. Moreover, d'Alton became part of an intellectual circle, where he met for example August Wilhelm Schlegel (1767–1845), Dorothea Schlegel (1764–1839), August Varnhagen von Ense (1785–1858) and Karl Ludwig von Knebel (1744–1834) (Schmuck, 2011). The fact that Goethe never mentioned Pander had a negative impact on the latter's posthumous reputation. Even the best chance was missed: The botanist Christian Gottfried Nees von Esenbeck (1776–1858) sent Pander's famous dissertation to Goethe, but the poet only mentioned the “acceptation” of an anonymous paper “on the incubation of the chick” (which is not the correct title) in his diary on 22 April, 1818 (WA, Section III, Vol. 5, p. 174)². From that lack of compliment we can conclude that Nees did not send the augmented German version with d'Alton's copper plates, but the plain Latin text. Pander and Nees had been friends since Pander made most of his observations on eggs in Nees' manor near Wuerzburg; we will later look at Nees being a witness of Pander's and d'Alton's personalities.

² Goethe's diaries and letters are cited according to the Weimar edition (Weimarer Ausgabe [= WA]: Goethes Werke. Hg. im Auftrage der Großherzogin Sophie von Sachsen. Weimar: Hermann Boehlau Nachfolger, 1887–1919). All translations from German primary sources (Goethe, Pander/d'Alton, Baer, Nees) by O. R.

Goethe and his contemporaries were mostly impressed by d'Alton's beautiful large-sized plates. Those illustrations in *Comparative Osteology* were based on his personal inspection of (re)constructed skeletons. They are as true-to-life as possible and partly even show the bone structure of the body from different perspectives. Concerning the introductory texts, Pander's and d'Alton's contributions are hard to separate. It seems obvious, however, that d'Alton wrote the descriptive paragraphs, which can be found in every volume. The theoretical prefaces, which deal with developmental processes in general, including transformation, are more complicated to assess. They can be found only in the first volumes (1 to 6 and 8) and in contents and style they differ remarkably from the descriptions. Since in those early volumes the investigations on chicken embryos as well as the common journey throughout the different collections might have been fresh in mind, we suppose that both scientists worked together, although to us the texts seem to reflect more Pander's interests than d'Alton's. Yet there are several reasons why d'Alton should not be excluded as an author with absolute certainty, as Raikov did (cf. also the editors' comment in Raikov, 1984, p. 111–112), which will be pointed out later.



Eduard Joseph d'Alton, chalk drawing by Johann Joseph Schmeller (1796–1841)

Leading Questions

Although *Comparative Osteology* introduced arguments from embryology, comparative anatomy and palaeontology, the concept of transformation as outlined there is often rated as natural philosophy (Schmitt, 2005; Gliboff, 2008). The reasons for this assessment can be seen in the adoption of Goethe's terminology and the richness of metaphors. A recent analysis showed that an impartial reading can provide deeper insight into transformist thinking at the beginning of the 19th century (Schmuck, 2011).

Starting with the reconstruction of *Megatherium*, this paper examines the connections between embryological research and the concept of „metamorphosis“ as presented in the introductions of the first volumes of *Comparative Osteology*, and traces both scientists' particular contributions. Furthermore, the term is supposed to have methodological implications on the interpretation of palaeontological material. This gives the opportunity to compare the ideas of Pander and d'Alton with Lamarck's and Karl Ernst von Baer's concepts, the latter having been a friend of Pander's youth who remained in close dialogue with him (Knorre, 1973; Riha, Schmuck, 2010); he was also Pander's successor at the Imperial Academy.

Secondly, we will pursue Goethe's interest in anatomy and zoological research. Regarding his own conception of metamorphosis there might be more traces of his influence in *Comparative Osteology*. For this purpose, we will use Goethe's relevant works as well as his remarks on d'Alton. Concerning Pander's and d'Alton's private lives we can — thirdly — provide some yet unknown

details: The correspondence between Christian Gottfried Nees von Esenbeck and his wife Elisabeth (1783–1857) with Karl Ernst von Baer survived within the Baer legacy in the University library in Giessen and is currently being edited for publication. We hereby collect the remarks on Pander and d’Alton, because they can contribute to an explanation of the different reception of both persons.

The Reconstruction of *Megatherium*

Comparative Osteology starts with a strange extinct beast: The first volume is devoted to the giant ground sloth (*Megatherium*), which Pander and d’Alton had described shortly in the 6th issue of Oken’s *Isis* in 1818 (cited in: Langer, 1985, p. 94). It is illuminating that the description is combined with remarks on the development of the chick in the egg. In those few sentences the intellectual classification is already clear; obviously the first impression shaped the future model of transformism and led to a strict denial of constancy of species and creationism. Pander and d’Alton respectfully refer to Goethe’s *Metamorphosis of Plants* and argue that the same must be true in zoology: Compelling evidence from embryology and comparative anatomy supports the conclusion that the emergence of animals must be imagined as continuous succession. It is only the exterior that is subject to variation, and these variations depend on environmental conditions, be they favourable or adverse. In fact, putatively new species are only new forms.

The giant ground sloth is positioned at the beginning of *Comparative Osteology* because of its extraordinary features. It not only seems to be the most peculiar animal of the primeval world, but also the oldest (Pander, d’Alton, 1821a, Preface, s.p.). The remains were found in 1789 near Rio Luxan (Luján), west of Buenos Aires, and were transferred to Spain (Piero, 1988). In Madrid the skeleton was arranged by Juan Bautista du Bru (Bru de Ramón, 1740–1799) and in 1805 Cuvier labelled the mammal as “Great Beast”, in Greek *Megatherium*, and described its features. In this context (Cuvier, 1805, p. 434–435) Cuvier pointed to the relationship of *Megatherium* and *Megalonyx* (in English “Great Claw”), whose leg bones and claws had been found during the exploitation of salpêtre in a limestone cave in Greenbrier County, West Virginia, in 1796. That giant sloth had been endemic in North America and died out about 11.000 years ago. Initially, in 1799 the later third president of the United States, Thomas Jefferson (1743–1826), regarded it as a kind of American lion (Boyd, 1958, p. 424), but he withdrew that interpretation after having read about the Madrid *Megatherium* in *Monthly Magazine* in March 1799.

The Madrid specimen Pander and d’Alton examined in 1818 is supposed to be the oldest skeleton assembly of a fossil mammal at all (Koenigswald, Hoffmann, 2009, p. 274). The two scientists criticized du Bru’s installation, reconstructed the skeleton anew and renamed the animal by classifying it as *Bradypus* (i.e. a genus of living sloths) (Pander, d’Alton, 1821a, Preface, p. [4]). In the first sentences of their description Pander and d’Alton establish a direct connection between the bones and the mode of life and deduce a method of comprehensive reconstruction: “Comparative anatomy shows us the immediate relation of all organs to the bone system, which ties the motion of the animals, their mode of life, the way of feeding and defending to inflexible rules. Based on the skeleton of an extinct species, to which no living one equates entirely, it is our task to characterize the beast it once belonged to and to determine the position it took before in the succession of the animal world”³ (Pander, d’Alton, 1821a, p. 5).

³ „Da uns die vergleichende Anatomie die unmittelbare Beziehung aller Organe auf das Knochensystem zeigt, wodurch sowohl die Bewegung der Thiere, ihre Lebensweise, so wie die Art sich zu ernähren und zu

Characteristics of the giant ground sloth are its huge size, the dumpiness and the disproportions of its body parts (Pander, d'Alton, 1821a, p. 10). Pander and d'Alton compare it with the pale-throated sloth based on similarities in the configuration of the skull (mainly zygomatic processes and teeth), but they also use non-related mammals like bears, moles (*Talpa*) and anteaters (*Myrmecophaga*). Cuvier had already observed (1805, p. 433) that the teeth hint at the beast's nourishment, especially roots, bulbs and other subterranean plant components. The vertical thighbones, which seem to prevent climbing, running and jumping, illustrate the massiness of *Megatherium*'s body; before, Cuvier (1805, p. 427) had conceded the capability of climbing. From a present-day perspective it is amazing that Pander and d'Alton agreed with Cuvier (1805, p. 433) in denying the *Megatherium* any considerable tail and in attributing it a short trunk like that of swine or tapir. Their arguments were broad mastoid processes of the temporal bones, long spinous processes of the first vertebrae, the structure of the nasal bone and the widened aperture of maxilla (Pander, d'Alton, 1821a, p. 7–8; cf. Cuvier, 1805, p. 425). The supposed extreme shortness of the tail was deduced from the abrupt distal decrease of the sacral bone. Since the huge calcanei can only serve as support, the upper limbs were supposed to have been used “for digging and pawing, be it to search for food below ground level or to prepare a hypogeal den”⁴ (Pander, d'Alton, 1821a, p. 6). “From the mode of living of the giant ground sloth, which we believe to have recognized from the bone structure, the animal could be called a tremendous mole, which only with exertion of force was able to raise necessary sustenance underground”⁵ (Pander, d'Alton, 1821a, p. 11–12). Richard Owen (1861, p. 5) later called this lifeform “some earth-whale, as it were, or colossal mole” (cf. also Owen, 1842). Pander's and d'Alton's hypotheses show impressively, that in spite of profound anatomical knowledge reconstructions of prehistoric life were fraught with uncertainty.

Incidentally Pander and d'Alton also assumed a megafauna of mammals to be still extant in the unexplored plains in the heart of South America. As the famous story of King Kong shows similar beliefs were strong enough to survive until the 20th century.

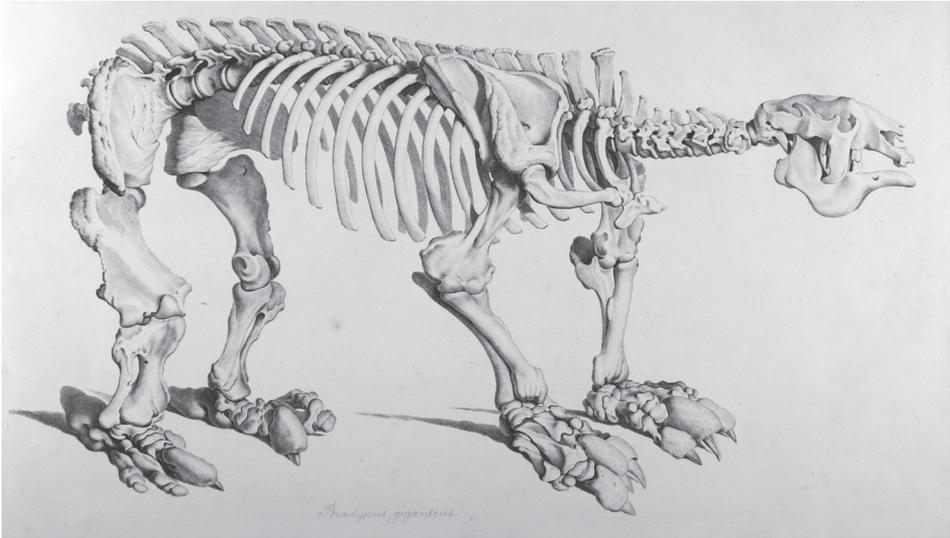
***Megatherium* as Paradigm**

In Pander's thinking metamorphosis is a universal principle of Nature which is capable of explaining embryological as well as palaeontological and evolutionary issues. His Latin dissertation of 1817 bears the term in its title, and in *Comparative Osteology* Pander tries to interrelate extinct and living species on the basis of metamorphic processes. In this respect, Pander's concept of metamorphosis is not purely speculative, but it considers empirically observable material, namely fossil finds of the Tertiary and Pleistocene megafauna. The first volume systematically compares the two-toed sloth (*Choloepus didactylus*, in Pander and d'Alton: *Bradypus didactylus*), the pale-throated sloth (*Bradypus tridactylus*) and *Megatherium*. The importance of osteology lies in the fact that in the skeleton “the organism manifests itself with all conditions of life” (Pander,

verteidigen, an feste Gesetze gebunden ist; so ist hier die Aufgabe, aus dem Scelet eines untergegangenen Geschlechts, dem keines der lebenden mehr ganz entspricht, das Thier zu characterisiren, dem es einst angehorte, und die Stelle auszumitteln, die es frueher in der Reihe der Thierwelt eingenommen hat.”

⁴ „Zum Graben und Scharren, sey es nun, um sich seine Nahrung unter der Erde zu suchen, oder unterirdisch seine Wohnung zu bereiten.“

⁵ „Nach der Lebensweise des Riesenfaulthieres, die wir aus seinem Knochenbau erkannt zu haben glauben, könnte man dieses Thier einen colossalen Maulwurf nennen, der nur mit Anstrengung seiner Kraefte die noethige Nahrung unter der Erde aufzubringen vermoechte.“



Megatherium, „Bradypus giganteus“. Table I from *Comparative Osteology*. Vol. 1 (Pander/d’Alton 1821a) (Leipzig, University Library, Sign. 01C-2005-16/1)

d’Alton, 1821a, p. 12). This was the essential prerequisite which allowed to reconstruct extinct forms by comparing them with present formations. In spite of their alleged stability, which makes them outlast long periods of time, bones are no “stereotypes of Nature” (Pander, d’Alton, 1822, p. [1]), but versatile organs. They are highly responsive to changes in demands and habits. Due to this plasticity of bone material the whole organism corresponds to changing environmental conditions, and in consequence skeletons provide significant testimony to prehistoric times.

After this programmatic hypothesis had been established and the method had proved successful, the consecutive volumes of *Comparative Osteology* continue to compare between living and fossil forms. The authors prefer representatives of exactly those living species which were traceable to fossils, especially pachyderms (Pander, d’Alton, 1821b), carnivores (Pander, d’Alton, 1822) and ruminants (Pander, d’Alton, 1823a). The second volume (on pachyderms) has the most complex structure of all, trying to combine a theoretical background of reflections on mutability with a systematic comparison of living and extinct forms. As there was a ready availability of material, elephant, rhinoceros and hippopotamus were particularly suitable for that purpose at the beginning of the 19th century. The comparative chapter is situated exactly in the middle of the investigations about the osteology of living forms.

In this context the authors voice reservations concerning earlier concepts. They reject the old model of a chain or stepladder of creatures in the same way as Karl Ernst von Baer did in his epoch-making monography *On Biogenesis of Animals (Ueber Entwicklungsgeschichte der Thiere*, 1828). The use of the terms “comparison and inference” (“Vergleichung und Folgerung”, Pander, d’Alton 1821a, Vorrede [v]) to describe the scientific method reminds of Baer’s subheading “observation and reflection” (“Beobachtung und Reflexion”). As embryologists, Pander as well as Baer are convinced of epigenesis and take the opportunity to refuse the idea of preformation (Pander, d’Alton, 1822, p. [1]).

Pander and d’Alton establish a multi-dimensional model of “an entity derivated from a common stem” (“ein, aus einem gemeinschaftlichen Stamme entsprossenes Ganze[s]”, Pander, d’Alton

1822, Preface s. p.). By means of metamorphosis they connect vanished species and living forms, which they assume to be surviving relatives. This direct derivability is the crucial conclusion: The affinity between fossil and living species is not confined to similarities but is based on descent. The relationship is so close that living forms must not only be understood as descendants of extinct ancestors, but also be classified as congeneric. Labelling living sloths as “remnants” of a vanished megafauna (Pander, d’Alton, 1821a, p. 10) is a „truly transformist“ position (Schmitt, 2005, p. 5).

Richard Owen observed that postulation of direct lineage; remarkably enough, he interpreted it as an example of transformist as well as of philosophical thinking: “But, imbued with the principles of the transcendental and transmutative hypotheses, then prevalent in the schools of Germany, they regard the great Megatherium and Megalonyx as being not merely predecessors but progenitors [!] of those still lingering remnants of the tardigrade race, into which such ancestral giants are supposed to have dwindled down by gradual degeneration and alteration of characters” (Owen, 1861, p. 5).

Claim to Universality

At that time, the term “metamorphosis” was pivotal not only for Goethe or Pander and d’Alton. In his *Biogenesis of Animals* (1828) Baer applied it to embryonic development in general with special reference to the development of particular organs. The “metamorphic array of the individual” (“Metamorphosereihe des Individuums”, Baer, 1828, p. XIX) here means a regulated succession of differentiations (“Sonderungen”), when — starting with an amorphous base substance — organs are formed via intermediate stages as layers, laminae and ducts. To Baer this metamorphosis seemed a such “compelling truth” („schlagende Wahrheit“, Baer, 1828, p. XX) that he expected the common acceptance of that model in near future. Similar to Pander and d’Alton Baer distinguished the “individual metamorphosis” (the embryonic development of a single animal) from a “thinkable metamorphosis of the whole animal kingdom” (Baer, 1828, p. 202), that means, between ontogeny and phylogeny. Baer discussed the correlation of those two different metamorphoses when criticizing the recapitulation theory (Riha, Schmuck, 2011, p. 19–24). Baer called the assumed descent communities only “thinkable” because he considered what was later to be called “evolution” an hypothesis, based on powerful arguments, but yet unproven (Baer, 1876).

Pander and d’Alton also gave thought to causes and triggers of metamorphoses. In contrast to previous research, they regarded metamorphosis as a reactive process. It is no internal desire or urge (as Johann Friedrich Blumenbach, 1752–1840, suggested) and no materializing idea (as Baer sometimes supposed). Instead, changing living conditions effect structural changes, deviations, loss or gigantic formations of organs. Not “life” as an abstract force (as in vitalism) but the specific mode of life permitted or constrained by the environmental conditions exerts direct influence on the manifestations of life (Pander, d’Alton, 1823a, Introduction, s.p.). That leads to the “conclusion, that Nature always proves itself most active in its development where it is stimulated most, and this is the reason why monstrous formations result from every unidirectional tendency, as we see in elephants”⁶ (Pander, d’Alton, 1821b, p. 18). Two years later the assessment was analogous: “No less inexplicable [sc. than the loss of tusks in certain species] would be the egregious teeth of the skeleton [of the Siberian mammoth Mikhail] Adams [1780–1838] discovered [in 1806]. When measured by their bending, they amount to nine

⁶ „Folgerung, dass die Natur in ihrer Entwicklung sich stets da am thaetigsten erweist, wo sie am meisten angeregt wird, und diesem zufolge aus jeder einseitigen Richtung derselben monstroese Bildungen entstehen, wie wir an Elephanten sehen.“

feet, and because of their spiral torsion they exclude any use: But we see those parts also in other forms and circumstances"⁷ (Pander, d'Alton, 1823b, p. 9).

It would need a separate study to investigate thoroughly the ideas Pander and Lamarck have in common and the points in which they differ. Research literature sometimes claimed Lamarck's influence on Pander without being very specific. As to that, Baer already stated: "Under the older naturalists there might be only a few who have not read Lamarck's *Philosophie zoologique*" (Baer, 2006 [1864], p. 38). Yet in the discussion about transformation Lamarck was "only one voice among many" (Corsi, 2005, p. 68), and a general notice as such is no evidence for a specific reception or adoption. Pander and d'Alton, for example, explicitly oppose Lamarck's opinion that species could not die out and at most some animals might have been killed off by Man (Pander, d'Alton, 1822, p. [3]).

In *Comparative Osteology* Pander and d'Alton replace Lamarck's straight and parallel lines of development, each one beginning with its own isolated origin, with a model of transformation and ramification with common roots, extinction and growing differentiation, in short: with a tree of life. They do neither accept the necessarily long periods of time (then pure speculation) nor the missing transitional forms („Mittelglieder“, Pander, d'Alton, 1823a, Introduction, s.p.) as valid objections against their model of metamorphosis, assuming that missing links would be found in the course of time.

Cuvier had rejected the concept of transformation of species by pointing to the consistency of contemporary animals and animals from Egyptian graves — then the oldest known in past history. Pander and d'Alton did not accept that argument, but unlike Darwin nearly 40 years later, they did not make recourse to vast aeons: In their model the absence of changes had its reason in the constancy of environmental and living conditions (Pander, d'Alton, 1822, p. [1]).

Pander and d'Alton also raised the question if the basic principle of metamorphosis included the phylogeny of humankind, connecting it with pondering on the existence of prehistoric humans. Cuvier had considered the lack of evidence of fossil humans an irrefutable objection. Pander and d'Alton disagreed with this apodictic statement and referred to the discovery of fossil human bones in Koestritz (Thuringia), which had been verified by Oken and Carl Asmund Rudolphi (1771–1832) (Pander, d'Alton, 1822, p. [2]). Thus, the human species was included into not only ontogenetic but also phylogenetic processes of metamorphosis.

Goethe's Esteem

It was no less a figure than Johann Wolfgang von Goethe, who in 1789 introduced the term "metamorphosis" into natural history (Kuhn, 1988; Breidbach, 2005). In fact, Pander and d'Alton knew his *Metamorphosis of Plants*. As we have shown, they claimed to have applied the deliberations concerning botany to zoology. However, Goethe had shown the way into that field before, including comparative methodology and the interpretation of bones. In his *First Draft of a General Introduction to Comparative Anatomy, Beginning with Osteology (Erster Entwurf einer allgemeinen Einleitung in die vergleichende Anatomie, ausgehend von der Osteologie*, HA⁸,

⁷ „Nicht weniger unerklärlich mussten uns auch die ungeheuren Zähne an dem von Adams entdeckten Gerippe seyn, die, nach ihrer Krümmung gemessen, eine Länge von neun Fuss betragen, und durch ihre spiralförmige Windung jeden Gebrauch ausschliessen: sahen wir diese Theile nicht auch in anderen Gestalten und Verhältnissen.“

⁸ Goethe's works are cited according to the paperback version of the Hamburg edition (Johann Wolfgang von Goethe: Werke. Hamburger Ausgabe [= HA]. München: Beck, 1982).

vol. 13, p. 169–183) he had already taken the step to zoology and discussed metamorphoses of the spine in the direction of skull and tail. The idea of a faunal prototype in analogy to the famous primordial plant („Urpflanze“, HA, vol. 13, p. 63 and 164) has always been present. The *First Draft* was prepared at the suggestion of Alexander and Wilhelm von Humboldt in 1795–1796. Then it was neglected for some time, until Goethe revised the text for printing in 1816. The first edition was published in 1820 (cf. HA, vol. 13, p. 591–592), simultaneously with the first volumes of Pander’s and d’Alton’s *Comparative Osteology*. Moreover, while Pander and d’Alton were preparing their opus magnum, Goethe’s original description of the intermediate bone of the upper jaw in humans („Zwischenknochen der obern Kinnlade“, *Os intermaxillare*) came out in 1820 (HA, vol. 13, p. 184–196). The text had been finished presumably in 1784, in 1786 at the latest (HA, vol. 13, p. 593). In addition to metamorphosis of formation, Goethe’s main concern was to show the permanence of nature behind superficial varieties.

As several testimonies show, Goethe appreciated Pander’s co-author d’Alton as an important stimulator and consultant in questions of natural history (Eckermann, 1998, p. 588–589), but it also should be taken into account that in turn d’Alton might have profited from that intellectual exchange. It can not be excluded that he adopted trains of thought, which were discussed as early as in 1808 when he first entered Goethe’s circle (HA, vol. 14, p. 481). Goethe himself took the *Comparative Osteology* as a proof of his own hypotheses, when he wrote to d’Alton on December 28, 1820: “With reason I count the new information you give us and let us expect about constancy and versatility of organic formation as new moments of creation, which, animating the animate world all the more, enhancingly bear a higher development”⁹ (cit. in Gaedertz, 1900, p. 144).

D’Alton sent the serial *Comparative Osteology* to Goethe, who attributed it exclusively to him. In a letter to Carl Gustav Carus (1789–1869) from January 13, 1822, Goethe rates the volume [!] on sloths and pachyderms (Pander, d’Alton, 1821a; 1821b) among d’Alton’s “splendid works” („treffliche Arbeiten“, WA, Section IV, vol. 35, p. 234): It is possible that in Goethe’s copies only d’Alton’s name appeared or maybe his chief interest lay in d’Alton’s artistic plates, while the introductions could not provide much new inspiration. In the essay *Fossil Bull* (1822, HA, vol. 13, p. 196–203) Goethe made use of “d’Alton’s pages lying before us” (op. cit., 200). In his detailed analysis of the controversy between Geoffroy Saint-Hilaire and Cuvier in 1830 (*Principes de philosophie zoologique*, HA, vol. 13, p. 219–250) Goethe repeatedly emphasized that he took his arguments (in favour of Geoffroy’s one-type concept) from the „contemplation“ (op. cit., p. 241) of the „excellent plates“ (ibid, p. 238) or “images” (ibid, p. 243) in “d’Alton’s great work” (ibid, p. 238, 241). For Goethe the academic debate on the relations between cephalopods and vertebrates was an occasion to repeat his own thoughts based on the unity of Nature and to refuse Cuvier’s theory of four different prototypes. So for decades Goethe’s concept of metamorphosis and the positions of *Comparative Osteology* can be correlated. This is an important reason for us not to underestimate d’Alton’s share in the theoretical introductions.

D’Alton’s personal comments on rodents are another example of the intensive exchange of ideas: “D’Alton talked on the gnawers and the formations and modifications of their skeletons, and Goethe was never tired to hear more and more facts” (April 16, 1825, cit. in Eckermann, 1998, p. 589). In that conversation Goethe obviously pursued his intensive concern in the interpretation of rodent skeletons. Immediately after having received the volumes (Pander, d’Alton, 1823b; 1824). Goethe dictated a treatise on *The Skeletons of Rodents, Illustrated and Compared*

⁹ „Mit Recht betrachte ich daher die neueren Aufschlüsse, die Sie uns ueber Constanz und Versatilitaet organischer Bildung schenken und erwarten lassen, als neue Schoepfungs-Momente, die das Lebendige erst recht belebend, eine hoehere Bildung steigernd hervorbringen.“

by d'Alton (HA, vol. 13, p. 212–219), followed by an appreciative letter to d'Alton (August 20, 1824). Goethe again discovered the „community of all organisation“ („Gemeinschaft aller Organisation“, op. cit., p. 218) and used the osseous evidence to characterise the different animals. Only a few weeks prior, Goethe had finished his own essay on *Comparative Osteology* [!] (HA, vol. 13, p. 206–212), which — in analogy to the volume on sloths — programmatically highlighted the skeleton as “basic condition of all living higher-ranking shape” („Grundbedingung aller lebendigen hoehern Gestalt“, op. cit., p. 211) and therefore as an important source of knowledge. D'Alton is praised because he, by his *Comparative Osteology*, had satisfied all “friends of Nature” “over and above all our wishes” (op. cit., p. 211).

From 1824 onwards Goethe reviewed all volumes of *Comparative Osteology in Morphologische Hefte* and followed those studies with great interest. A letter to Carus from January 7, 1826, sheds light on the essence of Goethe's concern. While talking about a beginning sunrise of science, Goethe confesses: “Then inside a similar emotion rises, when I watch d'Alton's work, who depicts the things grown namely after their consummation and decay, and at the same time he artistically visualizes the innermost and outermost, temper and transition and makes up life from death”¹⁰ (WA, section IV, vol. 40, p. 228–229). It was exactly that approach that seems to have fascinated Goethe for decades.

Self interest and beauty of the soul

Having heard about d'Alton's reputation with Goethe, it is time for contrasting other sources. As signified above, we will use the correspondence between Christian Gottfried and Elisabeth Nees and Karl Ernst von Baer. In these 50 letters¹¹, written in the years 1816 to 1828, Pander is mentioned 17 times, d'Alton 12 times. Both had met during Baer's short study visit in Wuerzburg (1815–1816) and together with several other persons, e. g. Pander's and Baer's academic teacher Ignaz Doellinger, they belonged to Nees' circle of friends. Most entries are only greetings, notes of arrival or acknowledgements of receipt. Some describe or recall joint activities like excursions into the proximity, visits to the theatre and, of course, Pander's doctorate dinner („Doktorschmaus“, C.G. Nees to Baer, June 30, 1817). Pander's elaborate and costly investigations are a recurrent topic, since they were (mainly) carried out in Sickershausen. If there were any doubts



Christian Gottfried Daniel Nees von Esenbeck (c. 1830), Lithograph by C. Beyer

¹⁰ „Rege wird sodann in mir ein gleiches Gefuehl, wenn ich d'Alton's Arbeit beobachte, der das Gewordene und zwar nach dessen Vollendung und Untergang darstellt und zugleich das Innerste und Aeußerste, Gemuet und Uebergang, kuenstlerisch vermittelt vor Augen bringt und aus dem Tode das Leben dichtet.“

¹¹ All of them are part of the Baer legacy, Universitaetsbibliothek Giessen, Volume 16. An edition is being prepared for 2012 within the project ‘German-Russian Scientific Relations in the 19th century’ at the Saxon Academy of Sciences and Humanities at Leipzig.

concerning Pander's skills and his commitment to research, they could be resolved by Nees' statements. Accordingly, Nees writes to Baer on December 28, 1816: "Pander has not yet finished with breeding, as I thought, and he will start again at shrovetide." Nees was also consulted concerning the quality of the copper plates for the German version of Pander's dissertation: "Of Mr. Pander's plates I have now seen two samples. He sent to me a copy of one of them. The engraving is very delicate and pursues the expression of the egg texture ["strebt nach dem Ausdruck des Eyartigen"]. I cannot express more compliments on it" (Nees to Baer, March 9, 1817). Pander's cooperation with d'Alton is described as very harmonious; the younger man obviously was impressed by the artist and eager to improve himself: "It is a credit to Pander, that d'Alton affects his development very favourably. There must be an inner cause, where it takes place like this."¹² (Nees to Baer, April 18, 1817). Pander must have been a very amiable person: "I think that I already wrote to you how I acknowledge his [sc. Pander's] progress and that I have learnt to love his character" (Nees to Baer, June 30, 1817).

In 1818 Nees took up a professorship in Bonn, where he had an extramarital affair. His wife lived outside in the village of Poppelsdorf. In those burdensome times, Elisabeth Nees often remembered the happy years in Franconia: "I met Panther [!] last spring when he passed from Frankfurt — the most cheerful hours that I spent here. The courtesy of his appearance awoke a whole world of most enjoyable memories. How rich were those times, rich in pleasure and tears! [...] With few people I was so dearly and delightfully pleased as with Panther [!]; may a merciful fate hold a protecting hand over him! Recently, he wrote to my husband from Dorpat, where he does not seem to be very happy" (E. Nees to Baer, January 23, 1820). And many years later: "Few people left to me such an unclouded impression of true beauty of the soul as he [Pander] did. I would think it to be a void in my life not to have known him" (E. Nees to Baer, November 17, 1827).

Already in 1820 Pander had returned to Russia. After the expedition to Bucharra (1820–1821) he suffered from a chronic disease. Nees and his wife followed that sickness with great compassion: "Pander is said to be suffering from cold fever for two years and to have hope to become an ordinary Academician [sc. in St. Petersburg]. I cannot be glad about the latter. I wish he was in the South and was seated a little warmer without fever" (Nees to Baer, January 27, 1825). "Pander should move to Bonn; the climate would heal him" (Nees to Baer, February 18, 1828). "Pander's continued malady affects me deeply. I do not believe that he will live long" (E. Nees to Baer, November 17, 1827).

The first volume of *Comparative Osteology* is mentioned as a common work of Pander and d'Alton: "I hear pleasant things about our Pander. I wish he was not as silent, but fired [!] at us from St. Petersburg sometimes. The first booklet of his and Dalton's [!] comparative osteology is finished and is met with deserved applause. It contains the most beautiful portrayal of the giant ground sloth, together with the skeletons of pail-throated and two-toed sloths. If you correspond with Pander, remind him of me and that he might also give a paper to the Academy of Scientists [sc. Leopoldina]" (Nees to Baer, December 17, 1820). However, soon the *Osteology* turns into "D'Alton's work", which advances "rapidly and enjoyably" (Nees to Baer, April 10, 1822).

While in these letters Pander is described in a very flattering manner, the impression of d'Alton is contradictory: Of course, there are positive features, but in sum he must have been somehow unreliable and obviously his character was difficult to read. We do not know the background, but there are allusions to conflicts: "While apologizing for the hurried writing of these lines, I have only to report that d'Alton arrived yesterday and that all our hearts beat with remorse to have suspected him so badly" (Baer to Nees, Juli 24, 1816). And the answer runs as follows: "I am glad to hear that D'Alton [!] has arrived. You always like to learn that you have made a hasty judgment on others, and nothing is as delightful as to be urged to recant in such a way" (Nees to Baer, Juli 25, 1816).

¹² „Was Pandern Ehre macht, ist, dass D'Alton sehr gunstig auf seine Entwicklung wirkt. Da muss innerer Grund seyn, wo es so ablaeuft.“

In spite of initial problems Elisabeth Nees stayed in touch with d'Alton and gave a detailed sketch of his character from the time of Pander's and d'Alton's common journey through Europe: "D'Alton writes to me from London that he is just leaving for Scotland. Pander seemed to doubt if he should go there or to Paris, to his sister. He chose the former. [Georg August] Goldfus[s] [1782–1848] and my husband try to win D'Alton for the Academy [sc. Bonn University]; he rejects totally and decisively. His wife is heartbroken because of his long absence. By the way, he is incredibly hardworking and presumably will accomplish something significant in natural history, to which he has addicted himself at the moment. — Do not believe that I overestimate d'Alton. I only like to revoke where I feel to have done wrong. Between d'Alton and me there was the strongest repulsion for a long time; his readiness to withdraw an injustice he had done to me imposes the same liability to me. This is the way in which we interrelate. He very often writes to me long letters, humorous, witty, sentimental, as if describing or reflecting. I answer scarcely. His letters can never be answered. A.W. Schlegel sometimes reminds me of him, but D'Alton's tone is easier, more trifling; regrettably both of them are on the wrong way of telling anecdotes for convivial entertainment — an extinction of all vividly evolving conversation" (E. Nees to Baer, February 24, 1819).

Obviously the friends had been afraid that d'Alton might exercise bad influence on Pander during the long journey, but fortunately they had been wrong: "I believe that Panther [!] returned very pure-minded, although I completely shared your concern about him" (E. Nees to Baer, January 23, 1820). Instead, it seems to be d'Alton who had changed: "I suppose you know that D'Alton is professor here; I won't answer if to his and the public's satisfaction. He lives with his family very quietly and in seclusion; but the middle-class simplicity of this way of life does not seem to please him, and indeed he is not the same D'Alton he had been in Wuerzburg and Sickershausen" (E. Nees to Baer, January 23, 1820).

Some years later, d'Alton's proneness to difficulties is mentioned again: "I delivered your letters to D'Alton [!]. I am happy that you look after this matter, which could have embarrassed D'Alton very much. But that is just between you and me" (Nees to Baer, January 27, 1825). As in the early letters, a certain lack of reliability seems to be a constant feature of d'Alton's character: "Nobody will be able to praise d'Alton's punctuality in financial matters. You should know his principles in this regard from Franconia. In the same way he utilizes people for his own goals, he disposes of their purses"¹³ (E. Nees to Baer, November 17, 1827).

Seen from this point of view, the disappearance of Pander's name in *Comparative Osteology* would fit these problematic traits of d'Alton's character. The publisher resided in Bonn where d'Alton worked from 1823, so it was easy for him to exert influence. As creator of the artistic plates which regularly were subject to laudatory reviews, he presumably considered himself the "true" author and surely the more important one. When Pander received his specimen copy from the first prints with his name on the title page, he had no occasion to be suspicious. D'Alton could be quite sure that Pander, living in far-away Russia, would not realize any manipulations. Moreover, since Pander was not interested in matters of glory at all (Stieda, 1887), d'Alton could also be sure that he would not mind.

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¹³ „Von d'Altons Puenktlichkeit in Geldangelegenheiten wird Niemand viel zu ruehmen wissen. Seine Grundsaeze hierueber sollten Ihnen noch von Franken her bekannt seyn. Wie er die Menschen zu seinen Zwecken gebraucht, so schaltet er auch ueber ihre Boersen.“

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О костях и зверях: идеи изменяемости видов Христиана Генриха (Христиана Ивановича) Пандера

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Русско-немецко-балтийский натуралист Христиан Генрих (Христиан Иванович) Пандер занимался проблемой развития в эмбриологии, сравнительной анатомии и палеонтологии. В 1817 г. он представил концепцию зародышевых листков, исходя из точного детального описания эмбрионального развития цыплёнка. Вместе с Иоганном Вильгельмом Эдуардом д'Альтоном он изучал скелеты вымерших и сохранивших современных животных по всей Европе. Результатом этого путешествия стал труд «Сравнительная остеология» (1821–1838, 14 выпусков, 103 таблицы). Для описания изменяемости видов Пандер и д'Альтон пользовались ключевым словом «метаморфоз». В данной статье рассматривается вопрос о личном вкладе Пандера и д'Альтона, соответственно, в написание текста. Показано, что влияние Гёте было более значительным, чем только воздействие его концепции метаморфоза. В статье использованы до сих пор не опубликованные письма супругов Христиана Готфрида и Элизабет Неес-фон-Эзенбек к Карлу Эрнсту (Карлу Максимовичу) фон Бэру, по-новому характеризующие Пандера и д'Альтона.

Ключевые слова: Христиан Генрих фон Пандер, Иоганн Вильгельм Эдуард д'Альтон, Иоганн Вольфганг фон Гёте, изменяемость видов, метаморфоз, палеонтология