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## The Countenance of Nature Transformed, 1861–1869

### Müller Encounters *On the Origin of Species*

According to his annotation on the flyleaf, Müller received Heinrich Bronn's German translation of Darwin's *Origin* in 1861.<sup>1</sup> Inside the back cover is the sticker of the Hamburg bookseller Robert Kittler, whom Müller called "my bookseller,"<sup>2</sup> but it certainly came at the initiation of Schultze, who arranged an annual shipment of books, reprints, and equipment, although sometimes long delayed in transit.<sup>3</sup> The precise date of arrival is not known, but Müller had already read at least part of the *Origin* by 30 October, when he wrote his first reaction to his father and stepmother: "Darwin's book on the origin of species in the animal and plant kingdoms has given me, and still gives me, much to think about."<sup>4</sup> Given the speed with which he read later books by Darwin, and unencumbered by pioneer farming, he had probably read it all by that time. Müller was already familiar with Darwin's *Journal of Researches*, but through the *Origin* he would have recognized his common ground with this distant Englishman, most importantly in Darwin's rejection of all things supernatural. They only made contact, however, four years later.

In mid-November Müller told Schultze that he was "settling ever more into Darwin's views and finding meaning and connection for a mass of formerly unintelligible facts."<sup>5</sup> In December he told Schultze that for several weeks he had been occupied with the Crustacea, especially "with a subject [development] that seems to me of the greatest importance for a natural genealogical arrangement of that class and for its morphology."<sup>6</sup> The impetus surely came from Darwin, who had written, "descent is the hidden

bond of connection which naturalists have sought under the term of the Natural System. On this idea of the natural system being . . . genealogical in its arrangement, . . . we can understand the rules which we are compelled to follow in our classification.”<sup>7</sup>

In the winter of 1861 Müller had found the immature stages of the *Porcellana* crabs that he had been seeking when distracted by the Rhizocephala,<sup>8</sup> and in November he submitted his first manuscript on crab development. “Even among crabs there is metamorphosis, and the youngest stages are Cyclops-like, [followed by] a Zoëa-like stage . . . [and] finally a Mysis-like form, this last seeming by its three pairs of claws to point the way toward the [prawn] genus *Penaeus*.” He was beginning to find developmental stages that were traversed in common by members of different crustacean groups (figure 3.1). “The Crustacea overwhelm me with so many questions, and prawn larvae hold such promise for my hope of finding in their development the key to a definitive natural classification, that I will probably not be free of the group for years!”<sup>9</sup> And indeed he was not.

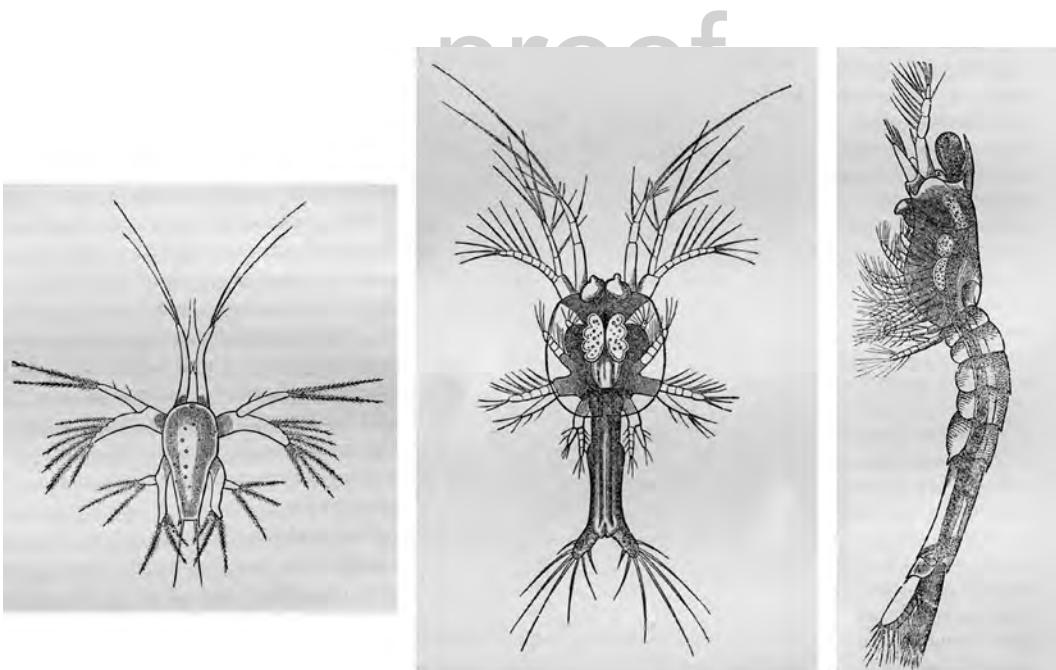


Figure 3.1. Nauplius, zoea, and mysis stages of a prawn (*Penaeus*). Nauplius about 1.4 mm long; mysis 2.5 mm. The figure is a composite of three figures in Fritz Müller, *Für Darwin* (Leipzig: W. Engelmann, 1864), 38, 39, and 41, and in *Facts and Arguments for Darwin* (London: John Murray, 1869), 58, 59, and 61. The right-hand image is counterclockwise by 90 degrees in *Für Darwin* as compared with the image here, but redrawn in the same orientation as presented here in *Facts and Arguments*.

During the summer of 1861–62 Müller pursued his hope of clarifying crustacean relationships in support of Darwin, although “using larvae fished from the sea to compare the development of animals that pass through a long series of different forms is a most time-consuming and difficult task.”<sup>10</sup> “Difficult” because it was hard to keep immature stages alive in an aquarium long enough to follow metamorphosis from beginning to end, making inference necessary for connecting juveniles with adults. In addition to accepting Darwin’s view that genealogy was the key to classification, Müller also saw natural selection as the principal motive force in organic change.

### Response to the *Origin*: *Für Darwin*

Although Müller thought about “publishing some general observations in favor of Darwin’s theory of natural selection,” he quickly decided that the theory would best be proven by applying it to “specific circumstances” to see if it brought “clarity and order to an apparent chaos.” He hoped that such an approach would benefit the theory more than by the “usual deductions, with which . . . only those [with] the same general viewpoint can be expected to agree.”<sup>11</sup> He had therefore already settled on three important components of the book that was forming in his head: evidence in favor of natural selection, development as a key to genealogy, and the use of genealogy in classification. In June 1862 Schultze told him about Louis Agassiz’s 1860 criticism of Darwinism, but Müller, though much interested, said that it did not change his “favorable opinion of Darwin.” Nevertheless, keeping an open mind, he added: “I agree with you that the matter is not yet ripe for a decision and that the first concern is to gather facts.”<sup>12</sup>

In December 1862, having heard with delight that his brother Hermann had accepted Darwin’s theories, Fritz finally laid out a plan suggested by the *Origin*, “namely to attempt to draw up a genealogy of the Crustacea” that would show “in what sequence the various living forms diverged from the ancestral form and what different stages they passed through.” For example, starting at the top of the genealogy with prawns, which he believed to be the most recently divergent group, he would attempt to determine the structure of the “common ancestor of all prawns,” and then do the same down through increasingly inclusive groups: the Macrura (lobsters, crayfish, and prawns), Decapoda (Macrura plus crabs), Podophthalmata (decapods plus other stalk-eyed crustaceans), and finally, at the bottom,

the common ancestral form of all higher Crustacea. “If Darwin’s theory is correct,” Müller had no doubt that “all Crustacea had descended from a nauplius,” because that was the form of the hatchling in Rhizocephala, barnacles, copepods, and other lower groups, and even in some of the highest Crustacea, for example a prawn, *Penaeus*, as he had himself discovered.<sup>13</sup> Fritz told Hermann that he would “in time” explain how questions of relationship such as these could be answered with the help of development; that was to be the subject of the last part of Müller’s book.<sup>14</sup> Müller’s verbal “diagram” was probably based on Darwin’s figure in the *Origin* showing descent with branching divergence from ancestors.<sup>15</sup> The two differ, however, in that Darwin’s diagram was theoretical, while Müller’s referred to real organisms.

During 1863, as revealed by the details of crustacean anatomy and development that filled his letters to Schultze, Müller was “gathering facts” for the book that would be his major work in favor of Darwin. The first part of the manuscript went in September of that year to Schultze, who responded warmly with suggested alterations, and in January 1864 Müller told him that his “extremely and undeservedly favorable opinion of my attempt to bring some new facts for Darwin into the field has boosted my courage” to finish the “half-sent work.”<sup>16</sup> On 5 February 1864 Müller dispatched the remainder of the manuscript, with last revisions and additions, and also gave Schultze a list of recipients of free copies, if the publisher were to offer them.

The list included Carl Gegenbauer (1826–1903), comparative anatomist, Jena, and Carl Claus (1835–99), authority on crustaceans, Marburg, both Darwinists; Franz von Leydig (1821–1908), microscopist, Tübingen; Adolph Eduard Grube (1812–80), zoologist, Breslau; Rudolf Leuckart (1822–98), zoologist, Gießen; Eduard Oscar Schmidt (1823–86), specialist in sponges and a friend from Greifswald, then in Graz; Henri Milne-Edwards (1800–1885), preeminent authority on crustaceans, Paris; “and above all Darwin. Also [Charles] Spence Bate, whom I must not forget.”<sup>17</sup> Bate (1818–89) was an English dentist and naturalist interested in the development and morphology of Crustacea. Müller’s list included prominent crustaceologists, friends, and others with whom he had been corresponding and who had helped him in their specialties, and of course the man in whose support the book was written. Müller later asked that copies of the book be sent to his father and to Alexander Agassiz at Harvard University, with whom he was already in a friendly argument about the validity of Darwinism. He had told Agas-

siz about the impending book and was “curious what he will say about it.”<sup>18</sup> The letters to Schultze also reveal Müller’s debt to his old friend for comments on his manuscripts and help in sending them on for publication. Unfortunately, none of Schultze’s letters has been found.

*Für Darwin* appeared around the middle of 1864, and Müller received his copy in November, when he thanked Schultze for guiding the manuscript through publication.<sup>19</sup> On the title page is the quotation from Otto F. Müller that Fritz had used in his dissertation twenty years before, avowing that everything was his own work and was based on repeated observations. The aptness of that epigraph is confirmed by the wealth of original observations in the book, as well as in Müller’s previous publications and in his letters, especially to Schultze, in the early 1860s.

The book now out, Schultze suggested a sequel, and Müller wrote optimistically that “there is certainly no lack of material to follow up with a second volume during my next vacation. Only one thing is lacking: time!”<sup>20</sup> In 1865 he reiterated his desire to aid in the recognition of Darwin’s theory “with a wealth of further original observations.”<sup>21</sup> He told Schultze that he had suggested to Haeckel a new journal to promote Darwinism. “There is a whole swarm of embryonic articles buzzing around in my head,” he wrote, but if Haeckel couldn’t do it, Müller might prepare that second volume of *Für Darwin* as a stimulus. Candidly, he hoped that it “would turn out somewhat less impossible to read than the first, with its special carcinological content.”<sup>22</sup>

The book was reviewed favorably in 1865 by the German zoologist Carl E. Adolf Gerstaecker (1828–95), at that time curator of the Zoological Museum of Humboldt University.<sup>23</sup> “Among the ever increasing number of young scientists who support the Darwinian theory of the origin of species by natural selection,” wrote Gerstaecker, “Fritz Müller clearly occupies one of the most distinguished places by his brilliant as well as weighty treatise ‘*Für Darwin*.’” Unlike most of Darwin’s followers, “the author has done research to confirm the correctness of those views directly through a series of observations of the class Crustacea, or at least to provide them with weighty support.” Gerstaecker then summarized Müller’s principal points. Another review, favorable but unsigned, in Geneva early in 1865 was translated in the *Annals and Magazine of Natural History* later that year. Neither of those reviews was by a specialist in Crustacea, but the one in the *Annals and Magazine* gave a clear-eyed summary and brought Müller’s book to the attention of English readers.<sup>24</sup> Bate devoted nine pages to a review in the first