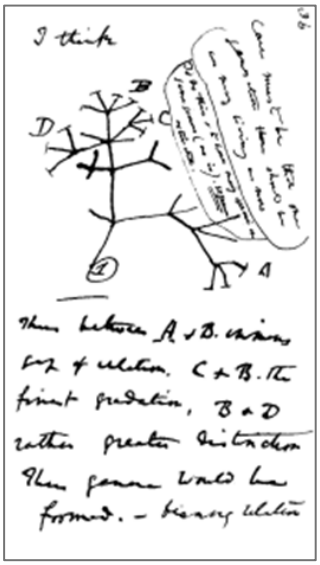
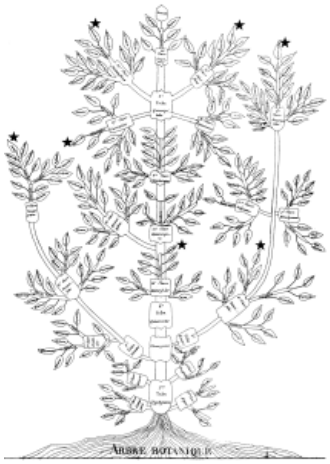
The Origins of Evolutionary Research in Jena

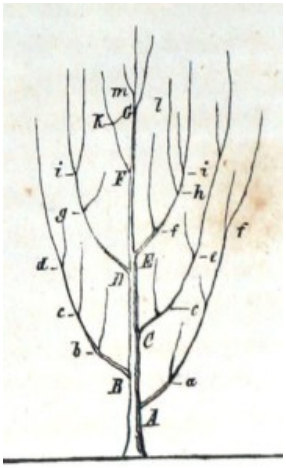
1. Darwin: The Breakthrough of the Idea of a Common Origin



By summer 1837 at the latest Charles Darwin believed in the common ancestry of different species, their gradual development by splitting and continuous modification. At this time he sketched his world-famous "Tree of life" in one of his notebooks with a few strokes, regarded as the first attempt to depict the phylogenetic development of species. However, Darwin hesitated to publish his results. Only in 1858, when he learned that Alfred R. Wallace was about to publish very similar findings, he decided to take this step first. Finally he presented his "Evolutionary Theory" on the same day as Wallace at the Linnean Society of London. However, he never used the term "evolution" for his work as the term was then dominated by the so-called preformation theory, according to which the complete organism had already been existing in the egg or sperm cell. In 1859, one year after the presentation, his major work "On the Origin of Species", which should have been even more extensive, was published. The first edition was already sold out at the day of publication. Six editions had been published by 1872. Besides Darwin and Wallace also other researchers were thinking of a development of the species out of a few forms, even from only one original form, but only Darwin´s observations of nature and his results helped advance the idea. Also the presentation of the evolutionary process as phylogenetic trees had already been thought of. Two examples are August Augier´s "Botanical Tree" of 1801 and Heinrich Georg Bronn´s hypothetical phylogenetic tree in 1958.



tree of A. Augier



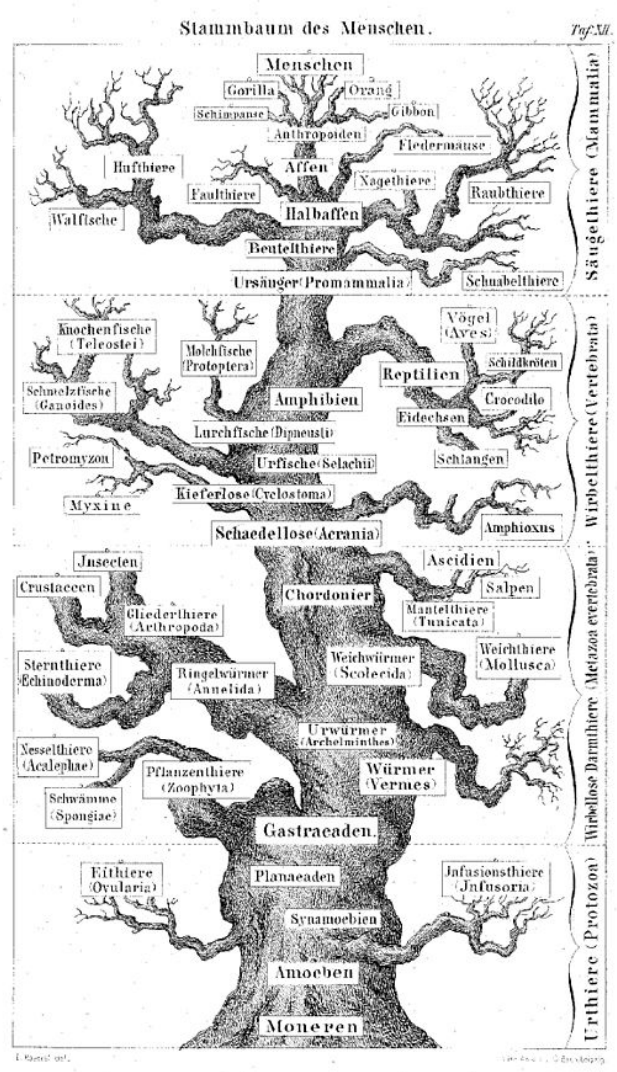
tree of H. G. Bronn

2. Jena and the Evolutionary Theory: From Schleiden and Gegenbaur to Haeckel and Schleicher

Darwin´s theory fell on fertile ground with **Matthias Jacob Schleiden**. Schleiden lived in Jena since 1839 and was director of the Botanical Garden since 1850. He became famous as co-founder of the cell theory and belonged to the first German botanists who accepted Darwin´s Evolutionary Theory. He had always been interested not only in plants but also in anthropology and gave very successful lectures about it in Jena. Even in 1862, three years after the publication of Darwin´s work, Schleiden had adapted his Evolutionary Theory for his anthropology lectures. He used it as starting point for his consideration of the cultural development of mankind as a reflection of its biological evolution. So he already took a broader view beyond biology and science.

Also **Carl Gegenbaur**, professor for anatomy and director of zoology who is today known as one of the fathers of Evolutionary Morphology and one of the most significant vertebrate morphologists of the 19th century, was in Jena at this time, where also his standard work "Main features of comparative anatomy" was produced, in which he identified structural similarities of different animals as evidence for their evolutionary development. The Evolutionary Morphology aimed at

showing that different extremities descent from a single form, like for instance the development of the scull as a mere modification of the spine. **Ernst Haeckel** came to Jena in 1861 through his friend Carl Gegenbaur. In Germany the origins of Evolutionary Theory and research are closely related to Ernst Haeckel. Ernst Haeckel (born 1834 in Potsdam) first studied medicine and received his qualification as a doctor in 1858. Already from an early age he had been more interested in the natural sciences, at first in botany and from the 1850s on also in zoology. In 1860 Ernst Haeckel read Darwin´s book about the origin of species in its 1st German translation and adopted the theory. He dedicated a large part of his scientific research to its dissemination and further development. It became the starting point of his worldview. In preparation of his lecture he noted the following about Darwin´s Theory: "No miracles, no creation, no Creator". Starting in the winter term 1862/63, Haeckel offered lectures, which became attractive to many international students. On the basis of the so-called "Biogenetic Constitution", according to which the phylogeny (ancestral development) recurs in the ontogenesis (individual development) he hoped to reconstruct the evolutionary development with the help of embryological investigation.Not only many scientists like Schleiden and Haeckel came to Jena, but also researchers of other disciplines like the linguist **August Schleicher**. A friendship developed between Haeckel and Schleicher, and Haeckel urged his friend to read Darwin´s book „The origin of species". Schleicher recognized major parallels between the "life of languages" and "life itself". He presented these parallels in an open letter to Haeckel in 1863 with the title: "The Darwinian Theory and Linguistics". Schleiden thought of a close connection between a phylogeny of languages and of mankind. With the help of reconstructing linguistic phylogeny he saw the possibility of following up on migration movements and human expansion as well as on cultural development. Schleicher concluded from the fact that languages are subject to the same development processes as animals and plants, that linguistics should also be conducted with the same scientific methods. It was important to find the protolanguage from which the various modern languages were derived. Schleicher visualized their family relationships and phylogeny with the help of phylogenetic trees and became the founder of the phylogenetic tree theory and pioneer of Indo-European studies in comparative



linguistics. As Haeckel inspired Schleicher to new ideas with the reading of Darwin, also Schleicher´s phylogenetic trees inspired Haeckel to present his thoughts and findings in the form of phylogenetic trees. 1866, three years after Schleicher´s letter, Haeckel´s "General Morphology" was published with illustrations of those phylogenetic trees, which have been the model for many phylogenetic figures. This popularity of the presentation in form of trees is also due to Haeckel´s artistic talent. In 1874 the probably most famous of Haeckel´s trees appeared: A strong oak tree with the human being on top as the crown of creation. Haeckel became increasingly extreme with regard to his opinion. His statements about lower and higher human races, racial hygiene and worthless life where he argued also economically, resulted in the fact that Haeckel was increasingly used politically and ideologically. Besides this critical view of Haeckel himself, his earnings remain undisputed. He founded not only the Zoological Institute in Jena for the actual scientific research, but also the so-called "Phyletische Museum", which also covers the Evolutionary Theory in all its aspects. Haeckel´s former house, the "Villa Medusa", is now a museum and also hosts the Institute for History and Sciences, Medicine and Technology of the Friedrich-Schiller University Jena. In the premises one can find significant archives and collections, among them the most important collection of evolutionary research in Europe. By the mid-1890s Haeckel finished his actual bioscientific work. New scientific insights and disciplines, like genetics, were disregarded by him.

Ernst Haeckel's study room (Villa Medusa)

Phyletisches Museum

3. Evolutionary Theory Today: The Max Planck Institute for the Science of Human History

Nowadays genetics cannot be ignored any longer in biology and especially in biomolecular research. At the Max Planck Institute for the Science of Human History with the Department of Archaeogenetics concentrating on seeking knowledge about human history from the Stone Age to the present with the help of DNA sequencing, the focus is also on genetics. Scientists of the institute keep using methods from evolutionary biology for the research of language history in order to answer e.g. questions about the distribution and diversification of languages. Once again the research of linguistic, cultural and genetic history is combined at the Max Planck Institute for the Science of Human History in Jena – quite as when Haeckel and Schleicher inspired each other and exchanged their views about ideas and methods exceeding the individual disciplines.