



## Learning from Linnaeus: towards developing the foundation for a general structure concept for morphology\*

LARS VOGT

*Systematik und Evolution der Tiere, Institut für Biologie, FU Berlin, Königin Luise Str. 1–3, D-14195 Berlin, Germany.*

*E-mail: lars.vogt@zoosyst-berlin.de*

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## Abstract

Morphology has fundamental problems regarding aperspectival objectivity of its data—morphological terminology is often based on homology assumptions, lacks standardization, and has problems with comparability, reproducibility, and transparency. This is astonishing given that with his sexual system Linnaeus had already established a high degree of aperspectival objectivity in morphology that unfortunately has been lost subsequently. In the first part of the article a brief introduction to the history of classification is given that provides an answer to the question why morphology only initially has been gripped by the general trend towards objectification that started in the seventeenth century. The conceptual shortcomings of Aristotle’s concept of essences and its link to the definition of species and taxa in natural philosophy play an important part in this development. The only solution to the problem of essences was to link it to the evolutionary concept of homology, which explains why morphological terminology today often rests on homology assumptions. By taking a closer look at Linnaeus’ sexual system, basic principles for developing a general structure concept for morphology are discussed, which would provide the conceptual basis for establishing a high degree of aperspectival objectivity for morphological data. The article concludes with discussing the role of data bases and ontologies for developing a data standard in morphology. A brief introduction to the basic principles of Resource Description Framework (RDF) ontologies is given. A morphological ontology has high potential for establishing a general morphological structure concept if it is developed on grounds of the following principles: morphological terms and concepts must be defined taxon-independently, homology-free, preferably purely anatomically, and if functionally only by clearly indicating the trait’s active participation in a specific biological process.

**Key words:** Aperspectival objectivity, Bio-ontology, Essentialism, Morphological data, Linguistic problem of morphology, RDF, Standardization

## Introduction

Morphology represents a set of methods and techniques for producing data about anatomical and organizational facts of organisms. As such, it does not represent a theory or an explanatory hypothesis. When it comes to preparing morphological descriptions, morphology is all about the textual representation, documentation, and comparison of structural diversity and patterns of structural equivalences between organisms and their traits, thereby being only *assisted* by various imaging techniques for the empirical substantiation of these descriptions. Therefore, morphological terminology and language assume a central methodological role in morphology. Only if the language and terminology used in morphological descriptions are capable of reliably transporting the relevant information in an unambiguous way and independent of individual morphologists, and only if they enable the comparison of morphological data across a broad taxonomic range, will morphology meet the high degree of comparability and communicability of data that is being increasingly demanded in the age of a growing importance of data bases in biology.

Unfortunately, morphology lacks standardization and common acceptance of morphological terms and lacks a formalized method of recording and documenting morphological descriptions (Vogt *et al. submitted*). Thus, morphology has fundamental problems with its terminology. As a consequence, morphological terminology and morphological descriptions vary from author to author, the meaning of morphological terms often changes through time, and the applicability of morphological terms is often restricted to a specific taxonomic group and cannot be easily adapted to other groups. In scientific research practice, this non-standardization of morphological terminology and the diversity in quality, organization, and style of morphological descriptions frequently lead to divergent descriptions of equivalent traits or to identically described morphological traits