

Supplementary Information for

The evolution of metazoan morphological disparity

Bradley Deline, Jennifer M. Greenwood, James W. Clark, Mark N. Puttick,
Kevin J. Peterson, Philip C. J. Donoghue

Philip C. J. Donoghue

Email: phil.donoghue@bristol.ac.uk

This PDF file includes:

Supplementary text
Figs. S1 to S8
Tables S1 to S4
Captions for databases S1 to S2
References for SI reference citations

Other supplementary materials for this manuscript include the following:

Datasets S1 to S2

Supplementary Information Text

Character matrix

For our morphospace analysis, we chose to use as our data source Ax's phylogenetic system (1-3) for extant taxa, because of the extent and depth of treatment of the taxa and characters. Table S1 indicates the taxa included in the analysis and the characters are presented in Table S2. Ax systematically defined taxonomic groups based on their shared morphologic and developmental traits as well proposing the hierarchy and relatedness of the organisms presented. The phylogenetic hypothesis forwarded by Ax is one previously popularly expounded by morphological evidence, but has been found to be generally unsupported by molecular evidence more recently. This we regarded as a strength rather than a weakness of the dataset, because, whilst the dataset is cladistic in nature, the extensive revision of the phylogenetic hypothesis indicates many characters in the original books were homoplasies rather than homologies thus weakening the phylogenetic signal inherent in the dataset. Another strength of Ax's data is that it only includes those characters judged to be present in the last common ancestor (LCA) of taxa of each clade. This is certainly an underestimate of the actual characters possessed by each LCA, in short, these taxa suffer the same shortfalls as fossils for character coding as in both instances many characters are not preserved. For the most part we chose to leave Ax's data unmodified from the original form, as we trusted his judgments, however, in some cases we chose to alter characters if they were not consistent with an explicit character matrix format.

Some characters were subdivided within the bulletpoints of the text; in some cases this is because the autapomorphies were judged complex, multipart characters, in some cases this was because one or more, but not all, parts of that character complex listed as an autapomorphy were lost subsequently. Body divisions were usually coded separately (e.g. head, trunk) as in many cases a section was lost; therefore to be consistent in our coding among taxa we subdivided these sections into separate characters. These characters are marked with a [1].

Some characters were not explicitly listed in the bulletpoints, but still discussed by Ax as a groundplan feature or probable autapomorphy. In many cases, this was because the phylogenetic affinities were left unresolved by Ax, and as such, their condition as autapomorphies was uncertain. We chose to code for these features particularly in these cases as although some homologies undoubtedly went unrecognized, not coding for them likely artificially reduces the character suites of taxa without affinities. These characters are marked with a [2].

Many characters listed as autapomorphies for clades were losses of characters. In many cases the origin of the character was an autapomorphy for an earlier entity, in these cases we coded reversals as '0', and made no distinction between primary absence and secondary reduction. If the gain of the feature could not be traced within Ax's framework, they were removed. In the cases of reductions but incomplete losses of characters, taxa were coded as having both the presence of the structure, and a secondary state of reduction of that feature.

Some characters were lost in only one sex or life stage of the group; in these cases we coded these as separate characters with the loss as '1'. Where the gain of these features made up an autapomorphy of an earlier grouping, it would be coded as present in these taxa unless completely lost from the lifecycle. These characters are marked with a [3].

The judgements made by Ax were followed in the large part; the matrix was constructed within this framework. There may be subsequent losses of characters not mentioned within the text, which would not be reflected in the resultant matrix. The data is inherently cladistic in nature, not phenetic, therefore attempts to homologize similar characters were generally not made. Exceptions to this were the convergent increases/decreases in ciliation and the reduction of certain features, such as the loss of articles in the tarsi or the loss of segments, where the articles or segments lost were unknown; in these cases the manifestations were grouped phenetically (e.g. reduction to two tarsal articles, only 10 segments on the opisthosoma). These characters are marked with a [4].

In addition to this, the character matrix from Ax in its raw form, with none of the alterations described above (e.g. losses coded as '1') was constructed and the analysis was run on the data. Whilst the placement of taxa on the ordination was not identical, the general patterns were the same; in addition, the correlations were still significant. This shows that these modifications to the matrix make little or no difference to the conclusions, and are likely to be robust to any inaccuracies in the coding generated by strict adherence to the text. In order to differentiate between absent and non-applicable character states a character contingency system was implemented into the matrix. This was done based on known anatomical relationships between characters.

Finally, character states were recoded following the methods of Deline (4) and Deline and Ausich (5) in which non-preserved data was coded as missing, non-applicable data was coded as 0, absents were coded as 1, and present and multistate characters are coded as 2, 3, etc. The ordination is then based on Gower's similarity metric. This metric increases similarity when two taxa share present or absent, but applicable, characters and decrease similarity with mismatched applicable characters or when one character is applicable and the other is not. This inherently increases the morphological distance between taxa that have complex features (i.e. features that have several contingent characters) and those that lack those features. Finally, shared non-applicable characters or non-preserved characters are not included in the calculation of similarity. This metric can create triangle inequalities within multidimensional space resulting from the non-Euclidean nature of the metric, but this can be prevented by adding a small value to zero distances.

Morphospace analysis.

The character matrix for Ax's 212 operational taxa was analyzed using Nonmetric Multidimensional Scaling (NMDS). Gower distances were used to differentiate between absent and non-applicable characters. To explore how the choice of metric altered the ordination, Manhattan distances were also used. This metric was chosen because non-integer character values are not possible in a discrete character matrix, such that a step-wise distance metric more accurately estimates differences between taxa. NMDS has been previously used in morphologic studies of disparity through time because of its treatment of missing or absent data (6). However, a non-metric approach can possibly distort the distances between taxa such that the distances are non-Euclidean. If this occurs, disparity values can be skewed. To check if this is an issue with our current dataset, we repeated our analyses using Principal Coordinate Analysis (Metric Multidimensional Scaling) using Gower distances. The resulting PCO-based morphospace is extremely similar to the original morphospace (compare Fig. S1A, B, below) as shown by the correlation values between the NMDS axes and the PCO axes (Axis 1: $r=0.99544$, Axis 2: $r=0.90335$) and the similarity of the distances between taxa (Mantel statistic Pearson's $r: 0.9764$, $p=0.001$). There are some differences between the two plots, in the relative spread present within insects and the increased linear nature of the PCO plot. The differences in this case appear larger because much of the variation contained within the later PCO axes is forced into the primary two axes in the NMDS plot. However, the distances between taxa are linearly statistically indistinguishable, thus differences are not limiting on any of the interpretations or conclusions that we draw in our manuscript. Furthermore, this analysis allows us to reject the possibility that the distances in our NMDS-based analyses do not represent true distances.

Fig. S1. Analyses of the 212 operational taxa using NMDS (A) as well as PCO (B). Axes were flipped to align the two plots.

An analysis of the resulting stress for NMDS ordinations of 1-10 axes indicates that a two axis solution accurately describes the structure of the data (Fig. S2). Stress is a measure of the goodness of fit between the original data and the ordination with lower stress indicating a better fit. A large drop in stress is seen by adding a second axis, but subsequent axes only decrease stress by a miniscule amount. All statistics were conducted based on either the first two or first six axis and the inclusion of additional axes did not alter the significance of the statistical tests. We also present the proportion of the eigenvalues represented by the primary axes for the PCO analyses, which indicates that with both methodologies a two-axis solution captures a large proportion of the variation in the dataset.

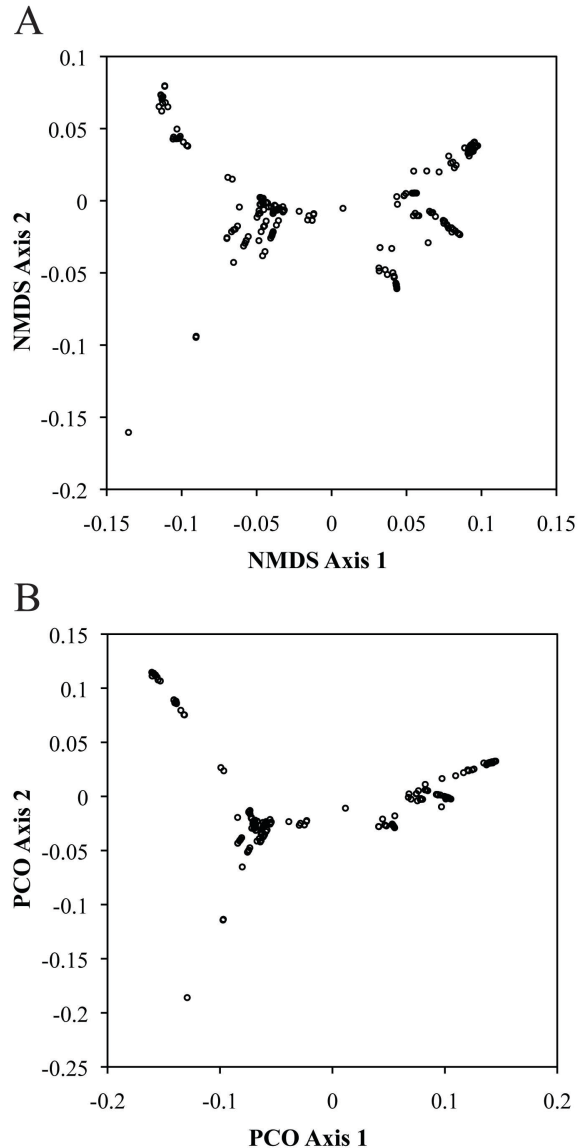
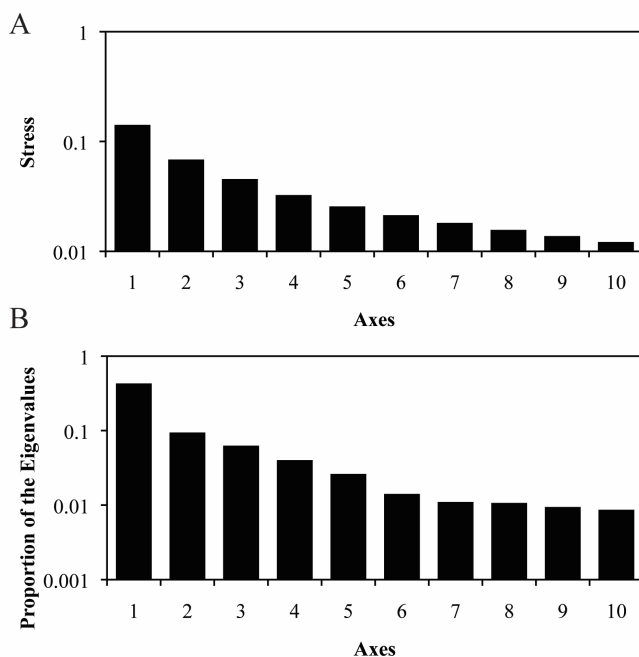


Fig. S2. Scree plots showing the stress for the NMDS analysis (A) and the proportions of the eigenvalues for the PCO analysis (B).

In order to examine the relative roles of autapomorphies compared with shared characters (synapomorphies and homoplasies) all autapomorphies were removed from the dataset. The resulting ordination strongly correlated with the original loadings ($R^2 > 0.92$ for both axes), with more variance presence on the second axis indicating that autapomorphies play a larger role in later axes but not in the primary structure of the data set (Fig. S3). The role the autapomorphies play is largely attribute to the contingency scheme increasing distance in complicated features that are often associated with subsidiary character, many of which are autapomorphies.



A

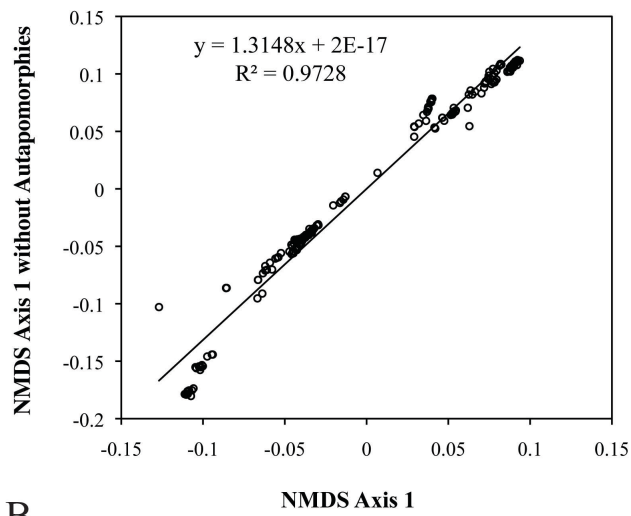


Fig. S3. A comparison of the loadings on NMDS axis 1 and 2 when analyzed with and without autapomorphic characters.

In addition, an ordination was conducted based on the characters rather than the operational taxa and characters were then separated based on the taxonomic-level in which they largely apply.

B

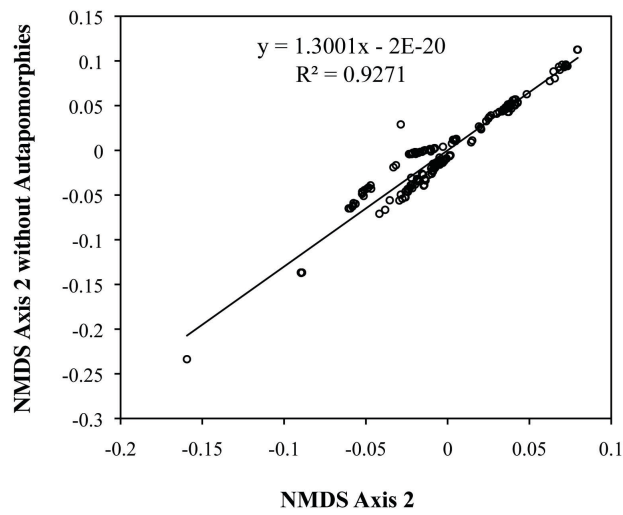


Figure S4: Phylogeny of the 212 operational extrapolated from Ax

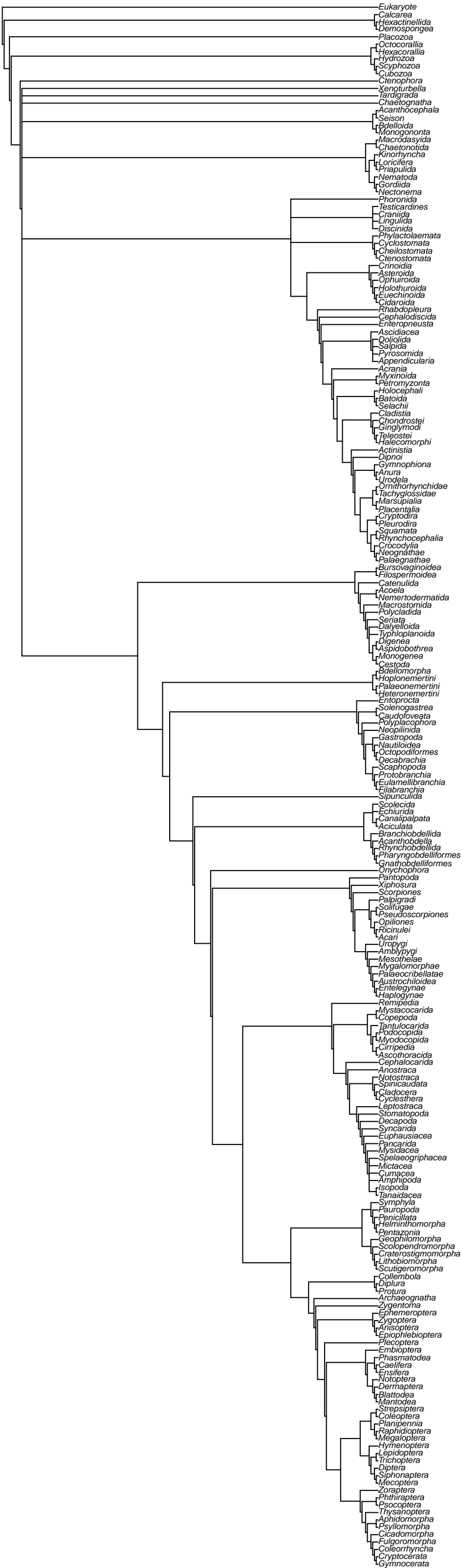
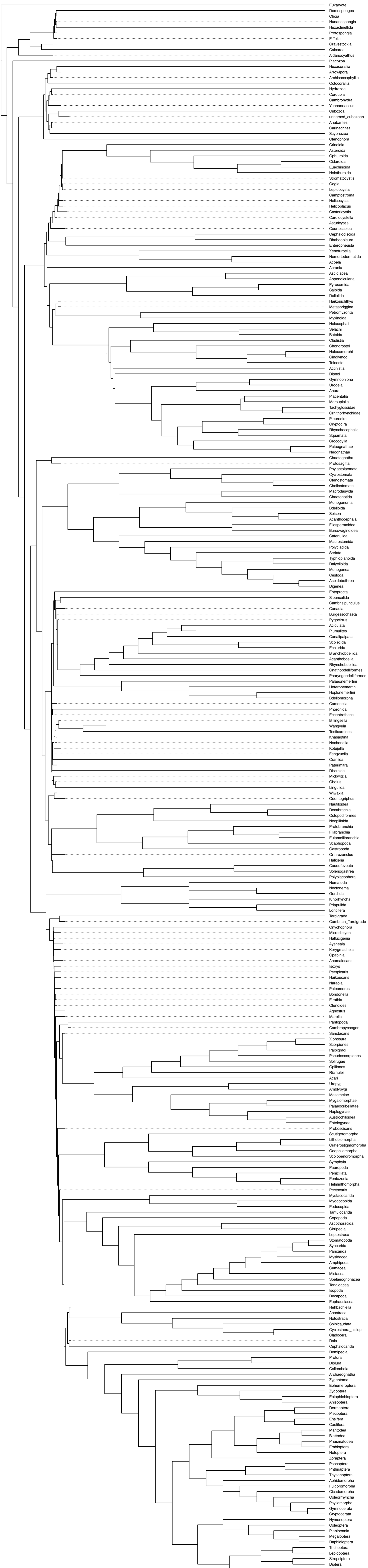


Figure S5. Consensus phylogenetic hypothesis



Ancestral and fossil state reconstruction

To analyze how the morphospace was explored through time, and what fossils contributed to morphospace, the 212 operational taxon as well as 8 fossil taxa were placed into a phylogenetic context based on a composite phylogeny taken from a number of sources (7-39) (Fig. S4). This phylogenetic hypothesis differs from that extrapolated from Ax (Supplemental Figure 5), though Ax never presents a metazoan level tree. Because there are many areas of the tree still in conflict, this tree was not fully resolved. The composite phylogeny lacked branch lengths, so to improve the accuracy of the subsequent ancestral state reconstructions that incorporate age information the branches were scaled to absolute time. Extant tips were given an age of 0, fossil tips ages were taken from the literature, and 37 internal nodes were constrained to their minima from (40). Time-scaling was conducted using the function *timePaleoPhy* in the R package *paleotree* (41). Branch lengths were thus even constrained between an internal node and tip value, and branches without one or either of these constraints shared time with other branches, with a minimum length desired branch length of 50 million years.

For the fossils, we chose Cambrian taxa, which had been previously subject to phylogenetic scrutiny and selected characters from a number of works (13, 19, 42). Fossils were coded for all characters where they applied, and were given question marks where character states were unknown. 23 new characters were also chosen which reflected differences between the fossils, or between the fossils and extant taxa. Characters were rejected where the codings would be ambiguous for the ground plan of extant taxa, where they were uninformative, or where they were in conflict with the extant characters and would require reworking of the existing matrix. The unknown character states for each fossil were inferred using stochastic character mapping (43). For each character, the conditional likelihood was estimated at each node in the tree using the function *make.simmap* in the R package *phytools* (44). The conditional likelihood forms the basis for simulations of character history along the tree, allowing estimation of both internal nodes and missing tip values. We used an empirical estimate of the Q matrix and stochastic character histories ($n=1000$) were generated using this model. A uniform prior applied to missing tip states, allowing the simulations to be informed by only the known tip states, branch lengths of the tree and the underlying model. For each analysis the most probable tip state from the posterior was used as the tip state for further analyses.

Characters were also classified as being preservable or not based on whether they have been previously recognized within the fossil record and whether they represent morphology that could potentially be fossilizable. This reduced the size of the character matrix to 912 characters.

In order to create normalize taxonomic rank we need to calculate a morphospace at the phylum level. This morphospace was calculated in two ways: (i) having more disparate groups carrying more weight, and (ii) normalizing the relative weight of phyla.

- i. Computed as per the original manuscript, we projected modelled character sets of the nodes representing the last common ancestor (crown ancestor) of each phylum onto the morphospace defined by the 212 operational taxa. In this case the original morphospace is strongly influenced by the large number of arthropods and chordates; therefore, the phylum-level morphospace is as well. This follows the argument presented above - since diversity is not uniform, we should not treat phyla uniformly.
- ii. We took the modelled character sets for phyla and ordinated them independently using NMDS (which in this case produces a morphospace that is effectively the same as PCO). In this case, we are ignoring intra-phylum disparity and treating each phylum equally.

The two resulting morphospaces are presented in Fig. S6. Fig. S6A shows the results of method (i). Chordates and arthropods are seen as outliers and there is a strong clustering in the central area of the morphospace. Fig. S6B, was constructed with each phylum treated equally. The principal differences between the two plots are accounted for the fact that the relative positions are rotated within ordination. Otherwise, arthropods and chordates are no longer outliers, though chordates still occupy the extreme on the first axis. The central area of the morphospace is also less crowded.

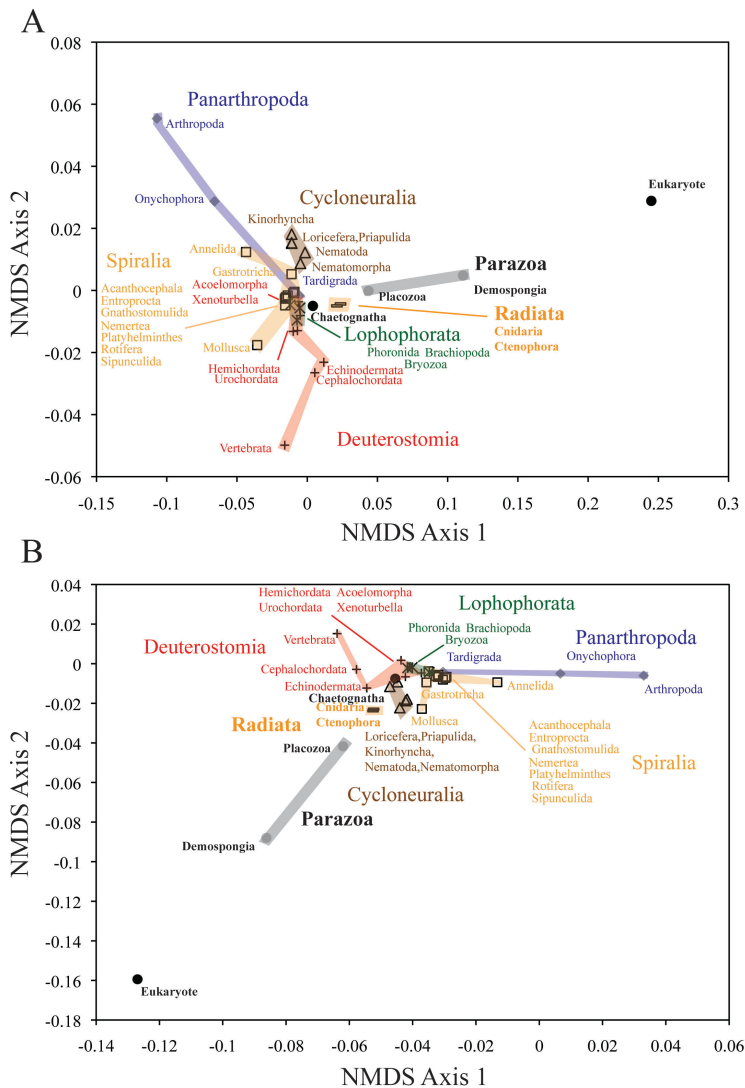


Fig. S6. Morphospace encompassing the 34 phyla. 6A. Seventeen of the phyla are represented by a single taxon in the analysis and thus their position in morphospace is identical to that in figure 1. The location of the remaining 17 phyla within morphospace is based on the projection of the modeled character states of the basal node of the phylum onto the morphospace defined by the original 202 taxa. 6B. The character states of the modeled ancestral nodes as well as the characters of the seventeen single taxon phylum were independently ordinated using NMDS. Higher order taxonomic groups are superimposed onto the morphospace

Comparisons between morphology and other datasets were done using Mantel tests (Spearman). The available data in each comparison differed and the phyla included in presented in *SI Appendix*, Table S3. Body size data is from McClain and Boyer (45). Genome Length data was accessed from the animal genome size database (46). The genome size was downloaded for each phylum and the mean c-value was calculated. Diversity was compiled by Chapman (47) and origination data is from Erwin et al. (48). The values used are presented in Supplemental Table 4. Cell types were taken from a number of sources (49-85). However, unlike Valentine et al.,’s study, all functional, histologically distinct cell types were counted from both adult and larval stages where information was available, as well as for nervous and germline cells. For smaller phyla whose members exhibit less variation, a general description of cell types possessed by that phyla sufficed. For large phyla, one or two well-studied subgroups were chosen as representatives; this is because the suite of cell types common to all members of a diverse phylum would be very low. Values and representative taxa used are presented in *SI Appendix*, tables S3 and S4.

We downloaded superfamily, family and completely predicted domain architectures data for 92 metazoan taxa and 1 choanoflagellate from the SUPERFAMILY database (v1.73) (86, 87). We treated these datasets

separately, and for each, we compiled two tables, one contained occurrence data (e.g. presence/absence) for each genome and one contained counts, e.g. how many times each domain/domain architecture appeared in each genome. The mean protein state for each phyla was calculated then each protein dataset was analyzed using NMDS in a similar manner as the morphological dataset.

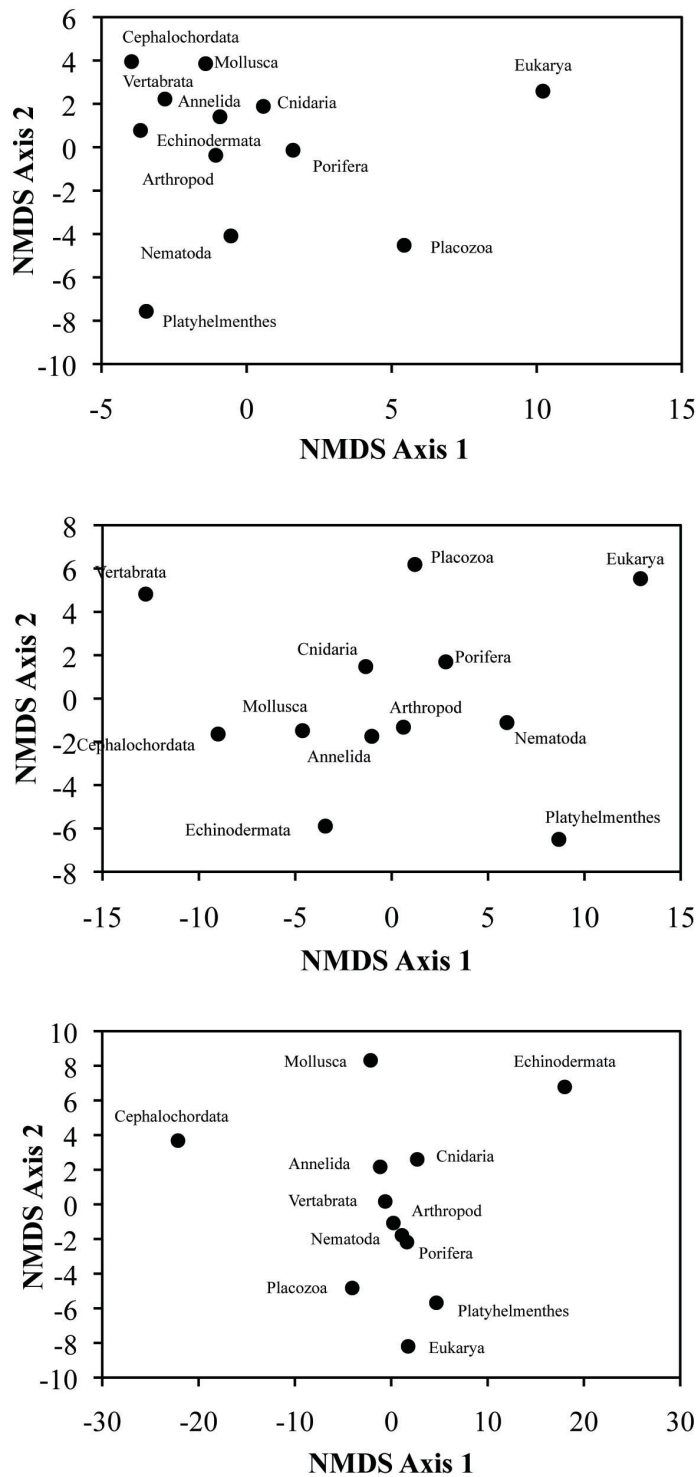


Fig. S7. NMDS ordination of protein datasets compiled for 13 phyla. A. Protein superfamily presence and absence. B. Protein superfamily abundance. C. Protein family presence and absence. D. Protein family abundance. E. Protein architecture presence and absence. F. Protein architecture abundance.

The miRNA was compiled by Peterson using methods outlined in Sperling et al. (2009). The GNR data was treated in a similar manner to that of the protein dataset.

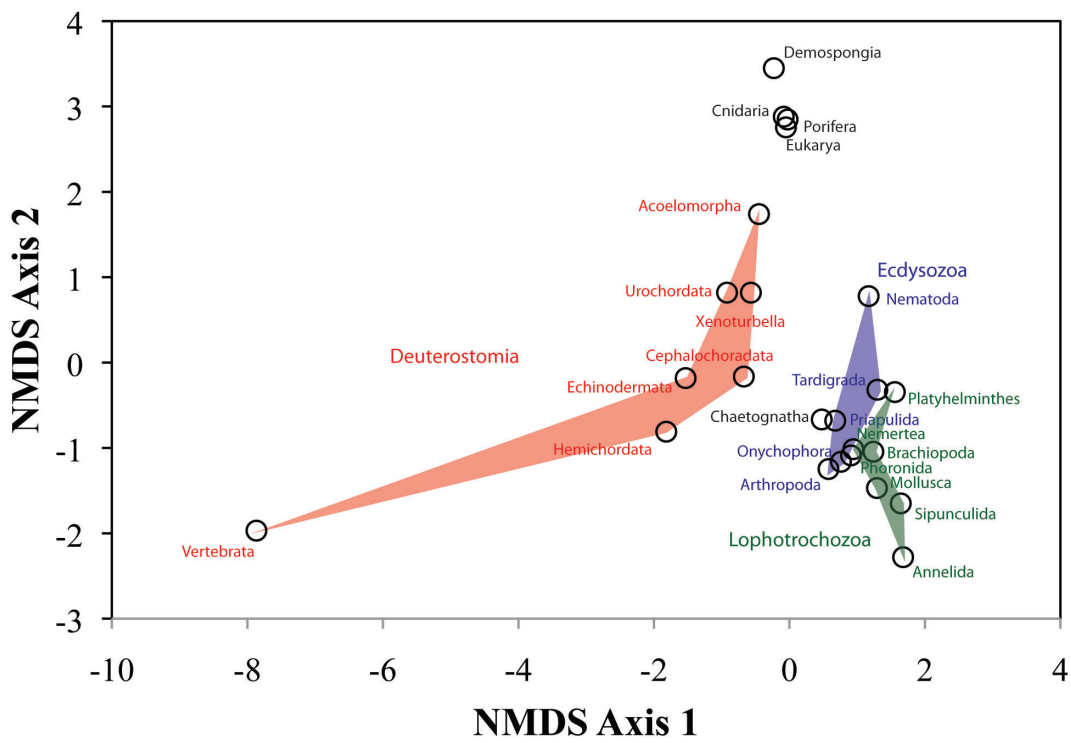


Figure S8. NMDS ordination of the miRNA suites from 24 phyla.

Analyses and statistics were conducted using R and Vegan (88, 89). The Superfamily database was queried using RMySQL (90).

Table S1: Taxa included in the morphological analysis based on Ax (1-3) and their taxonomic affiliation

Phylum	Subgroup	Ax's Terminal Taxa	Taxonomic Rank
Acanthocephala	Syndermata	Acanthocephala	Phylum
Acoelomorpha	Plathelminthomorpha	Nemertodermatida	Class
Acoelomorpha	Plathelminthomorpha	Acoela	Class
Annelida	Polychaete	Scolecida	Subclass
Annelida	Polychaete	Aciculata	Order
Annelida	Polychaete	Canalipalpata	Order
Annelida	Echiura	Echiurida	Order
Annelida	Hirudinomorpha	Branchiobdellida	Order
Annelida	Hirudinomorpha	Acanthobdella peledina	Genus
Annelida	Hirudinomorpha	Rhynchobdellida	Order
Annelida	Hirudinomorpha	Gnathobdelliformes	Order
Annelida	Hirudinomorpha	Pharyngobdelliformes	Order
Arthropoda	Chelicerata	Pantopoda	Order
Arthropoda	Chelicerata	Xiphosura	Order
Arthropoda	Chelicerata	Scorpiones	Order
Arthropoda	Chelicerata	Uropygi	Order
Arthropoda	Chelicerata	Amblypygi	Order
Arthropoda	Chelicerata	Mesothelae	Suborder
Arthropoda	Chelicerata	Mygalomorphae	Suborder
Arthropoda	Chelicerata	Palaeocribellatae	Group
Arthropoda	Chelicerata	Austrochiloidea	Superfamily
Arthropoda	Chelicerata	Haplogynae	Series
Arthropoda	Chelicerata	Entelegynae	Series
Arthropoda	Chelicerata	Palpigradi	Order
Arthropoda	Chelicerata	Pseudoscorpiones	Order
Arthropoda	Chelicerata	Solifugae	Order
Arthropoda	Chelicerata	Opiliones	Order
Arthropoda	Chelicerata	Ricinulei	Order
Arthropoda	Chelicerata	Acari	Subclass
Arthropoda	Crustacea	Remipedia	Class
Arthropoda	Crustacea	Cephalocarida	Class
Arthropoda	Crustacea	Anostraca	Order
Arthropoda	Crustacea	Spinicaudata	Suborder
Arthropoda	Crustacea	Cyclesthera hislopi	Genus
Arthropoda	Crustacea	Cladocera	Order
Arthropoda	Crustacea	Notostraca	Order
Arthropoda	Crustacea	Leptostraca	Order
Arthropoda	Crustacea	Stomatopoda	Order
Arthropoda	Crustacea	Decapoda	Order
Arthropoda	Crustacea	Syncarida	Superorder
Arthropoda	Crustacea	Euphausiacea	Order

Arthropoda	Crustacea	Pancarida	Superorder
Phylum	Subgroup	Ax's Terminal Taxa	Taxonomic Rank
Arthropoda	Crustacea	Mysidacea	Order
Arthropoda	Crustacea	Amphipoda	Order
Arthropoda	Crustacea	Cumacea	Order
Arthropoda	Crustacea	Mictacea	Order
Arthropoda	Crustacea	Spelaeogriphacea	Order
Arthropoda	Crustacea	Tanaidacea	Order
Arthropoda	Crustacea	Isopoda	Order
Arthropoda	Crustacea	Copepoda	Subclass
Arthropoda	Crustacea	Mystacocarida	Subclass
Arthropoda	Crustacea	Tantulocarida	Subclass
Arthropoda	Crustacea	Ascothoracida	Subclass
Arthropoda	Crustacea	Cirripedia	Subclass
Arthropoda	Crustacea	Myodocopida	Order
Arthropoda	Crustacea	Podocopida	Order
Arthropoda	Crustacea	Branchiura	Subclass
Arthropoda	Myriapod	Geophilomorpha	Order
Arthropoda	Myriapod	Scolopendromorpha	Order
Arthropoda	Myriapod	Craterostigmomorpha	Order
Arthropoda	Myriapod	Lithobiomorpha	Order
Arthropoda	Myriapod	Scutigermomorpha	Order
Arthropoda	Myriapod	Symphyla	Class
Arthropoda	Myriapod	Pauropoda	Class
Arthropoda	Myriapod	Penicillata	Subclass
Arthropoda	Myriapod	Pentazonia	Superorder
Arthropoda	Myriapod	Helminthomorpha	Subclass
Arthropoda	Insecta	Diplura	Order
Arthropoda	Insecta	Protura	Order
Arthropoda	Insecta	Collembola	Subclass
Arthropoda	Insecta	Archaeognatha	Order
Arthropoda	Insecta	Zygentoma	Order
Arthropoda	Insecta	Ephemeroptera	Order
Arthropoda	Insecta	Zygoptera	Suborder
Arthropoda	Insecta	Epiophlebiptera	Infraorder
Arthropoda	Insecta	Anisoptera	Infraorder
Arthropoda	Insecta	Plecoptera	Order
Arthropoda	Insecta	Embioptera	Order
Arthropoda	Insecta	Notoptera	Order
Arthropoda	Insecta	Dermaptera	Order
Arthropoda	Insecta	Mantodea	Order
Arthropoda	Insecta	Blattodea	Order
Arthropoda	Insecta	Ensifera	Suborder
Arthropoda	Insecta	Caelifera	Suborder

Arthropoda	Insecta	Phasmatodea	Order
Arthropoda	Insecta	Zoraptera	Order
Arthropoda	Insecta	Psocoptera	Order
Phylum	Subgroup	Ax's Terminal Taxa	Taxonomic Rank
Arthropoda	Insecta	Phthiraptera	Order
Arthropoda	Insecta	Thysanoptera	Order
Arthropoda	Insecta	Aphidomorpha	Order
Arthropoda	Insecta	Psyllomorpha	Suborder
Arthropoda	Insecta	Cicadomorpha	Infraorder
Arthropoda	Insecta	Fulgoromorpha	Infraorder
Arthropoda	Insecta	Coleorrhyncha	Suborder
Arthropoda	Insecta	Gymnocerata	Infraorder
Arthropoda	Insecta	Cryptocerata	Infraorder
Arthropoda	Insecta	Planipennia	Order
Arthropoda	Insecta	Megaloptera	Order
Arthropoda	Insecta	Raphidioptera	Order
Arthropoda	Insecta	Coleoptera	Order
Arthropoda	Insecta	Strepsiptera	Order
Arthropoda	Insecta	Hymenoptera	Order
Arthropoda	Insecta	Trichoptera	Order
Arthropoda	Insecta	Lepidoptera	Order
Arthropoda	Insecta	Mecoptera	Order
Arthropoda	Insecta	Siphonaptera	Order
Arthropoda	Insecta	Diptera	Order
Brachiopoda	Brachiopoda	Lingulida	Order
Brachiopoda	Brachiopoda	Discinida	Order
Brachiopoda	Brachiopoda	Craniida	Order
Brachiopoda	Brachiopoda	Testicardines	Subphylum
Bryozoa	Bryozoa	Phylactolaemata	Class
Bryozoa	Bryozoa	Cyclostomata	Order
Bryozoa	Bryozoa	Ctenostomata	Order
Bryozoa	Bryozoa	Cleilostomata	Order
Cephalochorda	Acrania	Acrania	Subphylum
Chaetognatha	Chaetognatha	Chaetognatha	Phylum
Chordata	Cyclostomata	Petromyzonta	Order
Chordata	Cyclostomata	Myxinoidea	Order
Chordata	Chondrichthyes	"Selachii"	Order
Chordata	Chondrichthyes	Batoida	Superorder
Chordata	Chondrichthyes	Holocephali	Subclass
Chordata	Actinopteri	Cladistia	Subclass
Chordata	Actinopteri	Chondrostei	Subclass
Chordata	Actinopteri	Ginglymodi	Order
Chordata	Actinopteri	Halecomorphi	Subclass
Chordata	Actinopteri	Teleostei	Infraclass

Chordata	Actinistia	Actinistia	Subclass
Chordata	Dipnoi	Dipnoi	Subclass
Chordata	Amphibia	Urodela	Order
Chordata	Amphibia	Anura	Order
Chordata	Amphibia	Gymnophiona	Order
Phylum	Subgroup	Ax's Terminal Taxa	Taxonomic Rank
Chordata	Sauropsida	Pleurodira	Suborder
Chordata	Sauropsida	Cryptodira	Suborder
Chordata	Sauropsida	Rhynchocephalia	Order
Chordata	Sauropsida	Squamata	Order
Chordata	Sauropsida	Crocodylia	Order
Chordata	Sauropsida	Palaegnathae	Superorder
Chordata	Sauropsida	Neognathae	Superorder
Chordata	Mammalia	Tachyglossidae	Family
Chordata	Mammalia	Ornithorhynchidae	Family
Chordata	Mammalia	Marsupialia	Order
Chordata	Mammalia	Placentalia	Order
Cnidaria	Cnidaria	Hexacorallia	Subclass
Cnidaria	Cnidaria	Octocorallia	Subclass
Cnidaria	Cnidaria	Hydrozoa	Class
Cnidaria	Cnidaria	Cubozoa	Class
Cnidaria	Cnidaria	Scyphozoa	Class
Ctenophora	Ctenophora	Ctenophora	Phylum
Echinodermata	Echinodermata	Crinoidea	Class
Echinodermata	Echinodermata	Asteroida	Class
Echinodermata	Echinodermata	Ophiuroidea	Class
Echinodermata	Echinodermata	Cidaroida	Order
Echinodermata	Echinodermata	Euechinoidea	Subclass
Echinodermata	Echinodermata	Holothuroidea	Class
Eukaryote	Protista	Eukaryote	Kingdom
Gastrotricha	Nemathelminthes	Macrotrichida	Order
Gastrotricha	Nemathelminthes	Chaetonotida	Order
Gnathostomulida	Gnathostomulida	Bursovaginoidea	Order
Gnathostomulida	Gnathostomulida	Filospermoidea	Order
Hemichordata	Rhabdopleura	Rhabdopleura	Order
Hemichordata	Cephalodiscida	Cephalodiscida	Order
Hemichordata	Enteropneusta	Enteropneusta	Class
Entoprocta	Entoprocta	Entoprocta	Phylum
Kinorhyncha	Nemathelminthes	Homalorhagida	Phylum
Loricifera	Nemathelminthes	Loricifera	Phylum
Mollusca	Mollusca	Solenogastrea	Subclass
Mollusca	Mollusca	Caudofoveata	Subclass
Mollusca	Mollusca	Polyplacophora	Class
Mollusca	Mollusca	Neopilinida	Family

Mollusca	Mollusca	Gastropoda	Class
Mollusca	Mollusca	Nautiloidea	Subclass
Mollusca	Mollusca	Decabrachia	Superorder
Mollusca	Mollusca	Octopodiformes	Superorder
Mollusca	Mollusca	Scaphopoda	Class
Mollusca	Mollusca	Protobranchia	Subclass
Mollusca	Mollusca	Filabanchia	Subclass
Phylum	Subgroup	Ax's Terminal Taxa	Taxonomic Rank
Mollusca	Mollusca	Eulamellibranchia	Subclass
Nematoda	Nemathelminthes	Nematoda	Phylum
Nematomorpha	Nemathelminthes	Nectonema	Genus
Nematomorpha	Nemathelminthes	Gordiida	Suborder
Nemertea	Nemertini	Palaeonemertini	Order
Nemertea	Nemertini	Heteronemertini	Order
Nemertea	Nemertini	Hoploneurtini	Order
Nemertea	Nemertini	Bdellomorpha	Order
Onychophora	Onychophora	Onychophora	Phylum
Phoronida	Phoronida	Phoronida	Phylum
Placozoa	Placozoa	Placozoa	Phylum
Platyhelminthes	Plathelminthomorpha	Catenulida	Order
Platyhelminthes	Plathelminthomorpha	Macrostomida	Order
Platyhelminthes	Plathelminthomorpha	Polycladida	Order
Platyhelminthes	Plathelminthomorpha	Seriata	Order
Platyhelminthes	Plathelminthomorpha	"Typhloplanoida"	Order
Platyhelminthes	Plathelminthomorpha	"Dalyelloida"	Family
Platyhelminthes	Plathelminthomorpha	Aspidobothrea	Subclass
Platyhelminthes	Plathelminthomorpha	Digenea	Subclass
Platyhelminthes	Plathelminthomorpha	Monogenea	Class
Platyhelminthes	Plathelminthomorpha	Cestoda	Class
Porifera	Porifera	Calcarea	Class
Porifera	Porifera	Demospongiae	Class
Porifera	Porifera	Hexactinellida	Class
Priapulida	Nemathelminthes	Priapulida	Phylum
Rotifera	Syndermata	Monogononta	Class
Rotifera	Syndermata	Bdelloida	Order
Rotifera	Syndermata	Seisonidea	Class
Sipunculidida	Sipunculidida	Sipunculida	Phylum
Tardigrada	Tardigrada	Tardigrada	Phylum
Urochordata	Tunicata	Ascidiacea	Class
Urochordata	Tunicata	Appendicularia	Class
Urochordata	Tunicata	Doliolida	Order
Urochordata	Tunicata	Pyrosomida	Order
Urochordata	Tunicata	Salpida	Order

Fossil Taxa

Anomalocaris
Aysheaia
Halkieria
Hallucigenia
Odontogriphus
Opabinia
Orthrozanclus
Wiwaxia
Courtessolea
Asturicystis
Castericystis
Helicoplacus
Helicocystis
Camptostroma
Lepidocystis
Gogia
Stromatocystis
Cardiocystella
Cambrian tardigrade
Microdictyon
Kerygmachela
Perspicaris
Naraoia
Agnostus
Olenoides
Bondonella
Elrathia
Sanctacaris
Cambropycnogon
Haikoucaris
Paleomerus
Isoxys
Marrella
Pectocaris
Dala
Rehbachella
Choia
Huanospongia
Protospongia
Gravestockia
Eifelia
Aldanocyathus
Anbarites

Arrowipora
Archisaccophyllia
Cordubia
Carinachites
unnamed cubozoa
Cambrohydra
Yunnanoascus
Haikouichthys
Metaspriggina
Protosagitta
Eccentrotheca
Camenella
Mickwitzia
Obolus
Paterimitra
Fenzuella
Kotujella
Nochoriella
Khasagtina
Billingsella
Wangyuia
Plumulites
Canadia
Cambrosipunculus
Burgessochaeta
Pygocirrus

Table S2: Character Descriptions

1. Mitosis in somatic cells (Eukaryota): 0 = absent, 1 = present.
2. Meiosis (Metazoa): 0 = absent, 1 = present.
3. Large cells (Eukaryota): 0 = absent, 1 = present.
4. Compartmentalisation (protoplast divided by membranes) (Eukaryota): 0 = absent, 1 = present.
5. Nucleus with double membrane (Eukaryota): 0 = absent, 1 = present.
6. Chromosomes arranged around histones in the nucleus (Eukaryota): 0 = absent, 1 = present.
7. Actomyosin (Eukaryota): 0 = absent, 1 = present.
8. Protein cytoskeleton (Eukaryota): 0 = absent, 1 = present.
9. Mitochondria (Eukaryota): 0 = absent, 1 = present.
10. Golgi apparatus (Eukaryota): 0 = absent, 1 = present.
11. Intracellular undulipodium with microtubules/dynein system, a 9x2+2 tubule pattern and a centriole underneath the cell membrane (Eukaryota): 0 = absent, 1 = present.
12. Diploid zygote [1] (Metazoa): absent (0), present (1). Contingent on character 2: Meiosis.
13. Ontogenesis (Metazoa): 0 = absent, 1 = present.
14. Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa): 0 = absent, 1 = present. Contingent on character 2: Meiosis.
15. Gonochoric (Metazoa): 0 = absent, 1 = present. Species which are secondarily hermaphrodites are coded as not having gonochorism.
16. Sperm mid-section has mitochondria [1] (Metazoa): 0 = absent, 1 = present. Various structure within the sperm are independently altered, and so are coded separately. Contingent on character 14: Spermatogenesis.
17. Sperm cilia [1] (Metazoa): 0 = absent, 1 = present. Contingent on character 14: Spermatogenesis.
18. Haploid male/female gametes [1] (Metazoa): 0 = absent, 1 = present. Contingent on character 2: Meiosis.
19. Oogenesis: one fertilisable egg and three abortive polar bodies from one oocyte (Metazoa): 0 = absent, 1 = present.
20. Sperm with two cilia [4] (Metazoa). 0=absent or one cilium, 1=two cilia. Contingent on character 14: Spermatogenesis.
21. Somatic differentiation (Metazoa): 0 = absent, 1 = present.
22. Impermeable cell-cell connections [1] (Metazoa): 0 = absent, 1 = present.
23. Extracellular matrix with collagen fibrils (Metazoa): 0 = absent, 1 = present.
24. Aquiferous system through the body of the sponge with canals and chambers (Porifera): 0 = absent, 1 = present.
25. Mesohyl as the interior of the sponge body (Porifera): 0 = absent, 1 = present.
26. Biphasic lifecycle with plankton larvae (coeloblastula) [1] (Porifera): 0 = absent, 1 = present. Contingent on character 13: Ontogenesis.
27. Filter feeding, sessile adult (Porifera): 0 = absent, 1 = present. Contingent on character 13: Ontogenesis.
28. Choanocytes (Porifera): 0 = absent, 1 = present. Contingent on character 21: Somatic differentiation.
29. Pinacocytes in the form of flat cells lining the body surface (Porifera): 0 = absent, 1 = present. Contingent on character 21: Somatic differentiation.
30. Existence of sclerocytes which extracellularly secrete calcareous spicules without an axial filament (Calcarea): 0 = absent, 1 = present. Contingent on character 21: Somatic differentiation.
31. Existence of sclerocytes, which intracellularly secrete a spicule made of SiO₂ around an axial filament made of scleroprotein (Silicea): 0 = absent, 1 = present. Contingent on character 21: Somatic differentiation.

32. Existence of spongioblasts which secrete the scleroprotein spongin in the mesohyl (Demospongia): 0 = absent, 1 = present. Contingent on character 21: Somatic differentiation.
33. Presence of a triaxon of siliceous spicules (Hexactinellida): 0 = absent, 1 = present. Contingent on character 31: Existence of sclerocytes, which intracellularly secrete a spicule made of SiO₂ around an axial filament made of scleroprotein (Silicea).
34. Syncytial organization through cell fusion (Hexactinellida): 0 = absent, 1 = present.
35. Glandular cells in the epithelium that produces exoenzymes for extracellular digestion (Epitheliozoa): 0 = absent, 1 = present. Ax homologises the ventral epithelium of Epitheliozoa with the endoderm of the Eumetazoa. There is then judged to be a complete loss of glandular cells in the digestive tract of acoels. Therefore there was judged to be a loss of glandular cells in this group. Contingent on character 21: Somatic differentiation (Metazoa).
36. Localised gonads [2] (Epitheliozoa): 0 = absent, 1 = present. Contingent on character 2: Meiosis (Metazoa).
37. Ciliated epidermal cells (Epitheliozoa): 0 = absent, 1 = present. This is lost in the Arthropoda. Contingent on character 21: Somatic differentiation (Metazoa).
38. Differentiation of two epithelial layers [1] (Epitheliozoa): 0 = absent, 1 = present. Contingent on character 21: Somatic differentiation (Metazoa).
39. Epithelial linking of cells by means of the development of zonulae adherentes (Epitheliozoa): 0 = absent, 1 = present. Contingent on character 21: Somatic differentiation (Metazoa).
40. Contractile fiber cells in the intermediate layer of the body (Placozoa): 0 = absent, 1 = present. Contingent on character 21: Somatic differentiation (Metazoa).
41. Cilia of the ventral cylindrical cells have two horizontal ciliary rootlets in addition to the vertical main rootlet (Placozoa): 0 = absent, 1 = present.
42. Gut cavity with endodermal lining [1] (Eumetazoa). There is a loss of the digestive tract in cestodes, but not of endoderm as a germ layer. 0 = absent, 1 = aciliated, 2 = monociliated, 3 = multiciliated. Contingent on character 21: Somatic differentiation (Metazoa): 0 = absent, 1 = present. Character contingent on 47: Endoderm [1] (Eumetazoa).
43. Epithelial muscle cells (Eumetazoa). 0 = absent, 1 = present, 2 = developed into proper myocytes. Contingent on character 21: Somatic differentiation (Metazoa).
44. Nerves at the base of the epithelia join and form a diffuse network (Eumetazoa): 0 = absent, 1 = present. Contingent on character 21: Somatic differentiation (Metazoa).
45. Monociliated sensory cells (Eumetazoa): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
46. Ectoderm completely surrounds the body (Eumetazoa): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
47. Endoderm [1] (Eumetazoa): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
48. Gap junctions between neighbouring cells (Eumetazoa): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
49. Tentacles [2] (Cnidaria): 0 = absent, 1 = present. This character was not explicitly listed as a cnidarian autapomorphy by Ax, but was judged by him to be part of the cnidarian groundplan. The tentacles are assessed to have been hollow as the plesiomorphic condition. Contingent on character 21: Somatic differentiation (Metazoa).
50. Sessile polyp (Cnidaria): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
51. Planula larvae (Cnidaria): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
52. Cnidae as products of individual cells, the cnidocytes or cnidoblasts (Cnidaria): 0 = absent, 1 = present.

53. Septa in the polyp (Anthozoa): absent (0), present (1). Contingent on character 50: Sessile polyp (Cnidaria).
54. Polyp with bilateral symmetry (Anthozoa): absent (0), present (1). Contingent on character 50: Sessile polyp (Cnidaria).
55. Ectodermal actinopharynx, which runs from a flat, oral disk and sinks deep into the coelenteron (Anthozoa): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
56. Ciliated siphonoglyphs which transport water into the coelenteron (Anthozoa): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
57. Spirocysts (Hexacorallia): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
58. Eight tentacles (Octocorallia): absent (0), present (1). Contingent on character 49: Tentacles [2] (Cnidaria).
59. Eight septa in the polyp (Octocorallia): absent (0), present (1). Contingent on character 53: Septa in the polyp (Anthozoa).
60. Endodermal ring canal [2] (Tesserazoa): 0 = absent, 1 = present. This autapomorphy was mentioned only in the event medusae were homologous between Rhopaliophora and Hydrozoa. Medusae were coded as homologous for present purposes, and therefore the coding of a ring canal was included. Contingent on character 47: Endoderm [1] (Eumetazoa).
61. Microbasic eurytele (Tesserazoa): 0 = absent, 1 = present. This is a Tesserazoa-specific nematocyst. Contingent on character 21: Somatic differentiation (Metazoa).
62. Mitochondrial DNA molecule is linear (Tesserazoa): absent (0), present (1). Contingent on character 9: Mitochondria (Eukaryota).
63. Cnidocyte has a stiff cnidocil apparatus for discharge of nematocysts (Tesserazoa): absent (0), present (1). Contingent on character 52: Cnidae as products of individual cells, the cnidocytes or cnidoblasts (Cnidaria).
64. Medusa with a velar structure (Hydrozoa): absent (0), present (1). Contingent on character 66: Medusa [1] (Rhopaliophora).
65. Tentacles of the polyp with a solid endodermal axis (Rhopaliophora): absent (0), present (1). Contingent on character 49: Tentacles [2] (Cnidaria).
66. Medusa [1] (Rhopaliophora): 0 = absent, 1 = present. This autapomorphy was mentioned with caution by Ax, as he chose to reserve judgement on whether the hydrozoan and rhopaliophoran medusae were homologous. For present purposes, where homology is not a strict requirement, this character was included and coded as present in all of Tesserazoa. Contingent on character 13: Ontogenesis (Metazoa).
67. Gastric filaments in the stomach [1] (Rhopaliophora): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
68. Rhopalia with statoliths (Rhopaliophora): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
69. The velarium as an infolding of the subumbrella on the rim of the bell (Cubozoa): absent (0), present (1). Contingent on character 66: Medusa [1] (Rhopaliophora).
70. Cube-shaped medusa (Cubozoa): absent (0), present (1). Contingent on character 66: Medusa [1] (Rhopaliophora).
71. Nerve ring (Cubozoa): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
72. Lens eyes (Cubozoa): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).

73. Polyp with four septae which divide the coelenteron into four pouches (Scyphozoa): absent (0), present (1). Contingent on character 50: Sessile polyp (Cnidaria).
74. Septa with ectodermal funnels and muscles of ectodermal origin (Scyphozoa): absent (0), present (1). Contingent on character 50: Sessile polyp (Cnidaria).
75. Medusal formations by means of strobilation and Ephyra larva [1] (Scyphozoa): absent (0), present (1). Contingent on character 66: Medusa [1] (Rhopaliophora).
76. Ephyra larva [1] (Scyphozoa): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
77. Sperm head has acrosome [1] (Acrosomata). In the original form, the Metazoa have only small acrosomal vesicles. The uniform acrosome characterising the Acrosomata is hypothesised to develop from this primary state. The acrosomal complex is defined as an uniform acrosome with subacrosomal perforatorium, and this complex is absent in Plathelminthomorpha according to Ax. Whether acrosomal vesicles are present at all is unclear, and have been putatively coded as present in the absence of an explicit description. It has also been shown that acrosomal vesicles are contained within some taxa (Jenner, 2004). The acrosomal perforatorium was also coded as absent in Plathelminthomorpha. 0 = absent, 1 = non-uniform, 2 = uniform. Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
78. Sperm have subacrosomal perforatorium [1] (Acrosomata). The Acercaria have the uniform acrosome but lack a perforatorium. Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa): absent (0), present (1). Contingent on character 77: Sperm head has acrosome [1] (Acrosomata).
79. Two tentacles with colocytes (Ctenophora). Ax notes that this character may be derived within ctenophores as they are not possessed by beroids, however was included as a character as it is suggested that beroids are a derived group within the phylum (Podar et al., 2001). Ctenophores are also not further subdivided into classes like most groups and so the disparity in this group would be artificially low anyway. Contingent on character 21: Somatic differentiation (Metazoa).
80. Biradial symmetry with sagittal and transverse planes (Ctenophora).
81. Medusa with cellular mesoglea (Ctenophora): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
82. Biradial cleavage (Ctenophora): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
83. Mosaic development (Ctenophora): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
84. Oral direction of movement (Ctenophora).
85. Gastrovascular system with an axial and a peripheral section (Ctenophora): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
86. Position of the gonads in the wall of the meridional canals (Ctenophora): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
87. Statocyst and two polar fields at the aboral pole (Ctenophora): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
88. Eight comb rows which are the primary means of locomotion (Ctenophora): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
89. Bilateral symmetry (Bilateria).
90. Mesoderm [2] (Bilateria): absent (0), present (1). Contingent on character 47: Endoderm [1] (Eumetazoa).
91. Basal lamina as a condensation of the ECM beneath the ectoderm and endoderm into a strongly contrasting layer (Bilateria): absent (0), present (1). Contingent on character 23: Extracellular matrix with collagen fibrils (Metazoa) and character 47: Endoderm [1] (Eumetazoa).

92. Body wall musculature made up of outer circular muscles [1] (Bilateria). This character originally comprised both outer circular and inner longitudinal muscles. Circular body wall musculature is lost independently however, in the Nematoida, where only longitudinal muscles are retained. Contingent on character 90: Mesoderm [2] (Bilateria).
93. Body wall musculature made up of inner longitudinal muscles [1] (Bilateria): absent (0), present (1). Contingent on character 90: Mesoderm [2] (Bilateria).
94. Central nervous system (Bilateria). Contingent on character 21: Somatic differentiation (Metazoa).
95. Protonephridial terminal cell [1][4] (Bilateria). Multiciliarity occurred multiple times, and was coded within the same character. 0 = absent, 1 = aciliated, 2 = one cilium, 3 = multiciliated. Contingent on character 98: Protonephridia of ectodermal origin [1] (Bilateria).
96. Protonephridial canal cell [1][4] (Bilateria). Multiciliarity occurred multiple times, and was coded within the same character. 0 = absent, 1 = aciliated, 2 = one cilium. Contingent on character 98: Protonephridia of ectodermal origin [1] (Bilateria).
97. Protonephridial nephropore cell [1][4] (Bilateria). Multiciliarity occurred multiple times, and was coded within the same character. 0 = absent, 1 = aciliated, 2 = one cilium. Contingent on character 98: Protonephridia of ectodermal origin [1] (Bilateria).
98. Protonephridia of ectodermal origin [1] (Bilateria): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
99. Terminal cell microvilli (Bilateria). 1=8, 2=16. Contingent on character 95: Protonephridial terminal cell [1][4] (Bilateria).
100. Lateral fins [1] (Chaetognatha): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
101. Tail fin [1] (Chaetognatha): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
102. Grasping spines and teeth with alpha chitin (Chaetognatha): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
103. Hood (preputium) with special musculature (Chaetognatha): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
104. Coelom in trunk, head and tail section (Chaetognatha): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
105. Ring of ciliary and glandular cells in the dorsal epidermis extending from the head to the trunk (Chaetognatha): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
106. Longitudinal nerves [1] (Chaetognatha): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
107. Brain-like centre of six ganglia [1] (Chaetognatha): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
108. Retrocerebral organ [1] (Chaetognatha): absent (0), present (1). Contingent on character 107: Brain-like centre of six ganglia [1] (Chaetognatha).
109. Nerve ring [1] (Chaetognatha): absent (0), present (1). Contingent on character 107: Brain-like centre of six ganglia [1] (Chaetognatha).
110. Two eyes on the dorsal side of the head, embedded in the ECM of the body wall with pigment and sensory cells (Chaetognatha): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa), and character 23: Extracellular matrix with collagen fibrils (Metazoa)
111. Corona ciliata (Chaetognatha): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).

112. Ciliary fence receptors (Chaetognatha): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
113. Multilayered or striated epidermis (Chaetognatha): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
114. Spiral quartet 4d cleavage with the formation of four micromere quartets and the development of the mesoderm from the 4d micromere (Spiralia): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
115. Thread-like sperm (Plathelminthomorpha): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
116. Direct sperm transfer with a copulatory organ (Plathelminthomorpha): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
117. Two cuticular jaws and a basal plate in the pharynx (Gnathostomulida): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
118. Cross-striated musculature (Gnathostomulida): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
119. Buccal ganglion (Gnathostomulida): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
120. Longitudinal nerves (Gnathostomulida): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
121. Unpaired ovary (Gnathostomulida): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
122. Spiral cilium receptors (Gnathostomulida): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
123. Serially repeated nephridia (Gnathostomulida): absent (0), present (1). Contingent on character 98: Protonephridia of ectodermal origin [1] (Bilateria).
124. Rostrum (Filospermoidea): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
125. Bursa (Bursovaginoidea): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
126. Sensorium with long, tactile bristles (Bursovaginoidea): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
127. Pharynx simplex [2] (Catenulida). This character according to Ax has no homology to the pharynx simplex coronatus of rhabditophorans. Contingent on character 21: Somatic differentiation (Metazoa).
128. The testes and male genital pore are located dorsally in the anterior section of the body (Catenulida): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa). Also, requires meiosis with male/female gametes (character 18).
129. Sperm cilium is transitory, sperm is nonmobile (Catenulida): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
130. Ciliary rootlets as supporting elements in the terminal cells (Catenulida): absent (0), present (1). Contingent on character 95: Protonephridial terminal cell [1][4] (Bilateria).
131. Unpaired dorsomedially positioned protonephridium with the nephropore at the posterior end of the body (Catenulida): absent (0), present (1). Contingent on character 97: Protonephridial nephropore cell [1][4] (Bilateria).
132. Frontal glandular complex (Euplathelminthes): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).

133. Statocyst with one statolith and two parietal cells (Acoelomorpha): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
134. Shaft region in epidermal cilia (Acoelomorpha): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
135. Network formed by interconnecting rootlets of epidermal cilia (Acoelomorpha): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
136. Statocyst with two statoliths and many parietal cells (Nemertodermatida): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
137. Spiral duet cleavage (Acoela): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
138. Sperm cilia enclosed within the sperm body [1] (Acoela). Here the presence of two cilia was coded phenetically in the sperm cilia character. Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
139. Further differentiation of the root system of epidermal cilia by the addition of lateral rootlets (Acoela): absent (0), present (1). Contingent on character 135: Network formed by interconnecting rootlets of epidermal cilia (Acoelomorpha).
140. Pharynx simplex coronatus (Rhabditophora). This was coded as present for all rhabditophorans because, although only present in its original form in the Macrostomida, Ax hypothesised its evolution into the pharynx compositus of the Trepaxonemata by an inward folding from the mouth region. It is lost in the Cestoda, along with the pharynx compositus, which have no mouth or gut and feed by absorption through the neodermis. Contingent on character 21: Somatic differentiation (Metazoa).
141. Duo-gland adhesive organ (Rhabditophora): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
142. Lamellate rhabdites (Rhabditophora): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
143. Post oral nerve commissure (Macrostomida): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
144. Pharynx compositus (Trepaxonemata): absent (0), present (1). Contingent on character 140: Pharynx simplex coronatus (Rhabditophora).
145. Central axial rod in the cilia of the sperm (Trepaxonemata): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
146. Dorsoventral flattening (Polycladida).
147. Pharynx compositus has ruffles [2] (Polycladida): absent (0), present (1). Contingent on character 144: Pharynx compositus (Trepaxonemata).
148. Numerous intestinal diverticulae towards the front, sides, and back of the body (Polycladida): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
149. An extensive parenchyma fills the spaces between the intestinal diverticula (Polycladida): absent (0), present (1). Contingent on character 148: Numerous intestinal diverticulae towards the front, sides, and back of the body (Polycladida).
150. Follicular division of gonads (Polycladida): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
151. Ectolecithal, compound "eggs" (Neoophora): absent (0), present (1). Contingent on character 19: Oogenesis: one fertilisable egg and three abortive polar bodies from one oocyte (Metazoa).
152. Germovitellarium - heterocellular female gonad (Neoophora): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
153. Pharynx tubiformis (Seriata): absent (0), present (1). Contingent on character 144: Pharynx compositus (Trepaxonemata).

154. Testes and vitellaria are developed into follicles in rows along the body (Seriata): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
155. Pharynx bulbosus (Rhabdocoela): absent (0), present (1). Contingent on character 144: Pharynx compositus (Trepaxonemata).
156. Pharynx doliiformis (Doliopharyngiophora): absent (0), present (1). Contingent on character 144: Pharynx compositus (Trepaxonemata).
157. Inclusion of the two cilia of the sperm in the cytoplasm of the sperm cell (Neodermata): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
158. Aciliated, syncytial neodermis (Neodermata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
159. Cilia of epidermal cells have a single ciliary rootlet (Neodermata): absent (0), present (1). Contingent on character 37: Ciliated epidermal cells (Epitheliozoa).
160. Protonephridia with a two-cell weir (Neodermata): absent (0), present (1). Contingent on character 98: Protonephridia of ectodermal origin [1] (Bilateria).
161. Primary host is a member of the Mollusca (Trematoda).
162. Neodermis is extended to the larval stage (Trematoda): absent (0), present (1). Contingent on character 158: Aciliated, syncytial neodermis (Neodermata).
163. Adult with an adhesive organ on the ventral side (Aspidobothrea): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
164. Larva with a round sucker positioned at the posterior end (Aspidobothrea): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
165. Cotylocidium [1] (Aspidobothrea): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
166. Neodermis with microtubercles (Aspidobothrea): absent (0), present (1). Contingent on character 158: Aciliated, syncytial neodermis (Neodermata).
167. Cotylocidium larva with an extensive reduction of epidermal ciliation (Aspidobothrea): absent (0), present (1). Contingent on character 165: Cotylocidium [1] (Aspidobothrea).
168. Alternation of generations with three generations of different individuals [1] (Digenea). In the interest of being consistent, this character has been subdivided into the different individual life stages, as with life stages of other taxa. However, the alternation of generations was included as a distinct character as this represents a very unique mode of life. The modes of reproduction were also subdivided to reflect that the Digenea, as well as maintaining the metazoan character of sexual reproduction as a plesiomorphy, has evolved an asexual reproductive strategy at different life stages. Contingent on character 13: Ontogenesis (Metazoa).
169. Miracidium [1] (Digenea): absent (0), present (1). Contingent on character 168: Alternation of generations with three generations of different individuals [1] (Digenea).
170. Redia [1] (Digenea): absent (0), present (1). Contingent on character 168: Alternation of generations with three generations of different individuals [1] (Digenea).
171. Cercaria [1] (Digenea): absent (0), present (1). Contingent on character 168: Alternation of generations with three generations of different individuals [1] (Digenea).
172. Two-host cycle with a mollusc as the intermediate host and a vertebrate as the definitive host (Digenea): absent (0), present (1). Contingent on character 161: Primary host is a member of the Mollusca (Trematoda).
173. Asexual reproduction [1] (Digenea): absent (0), present (1). Contingent on character 2: Meiosis (Metazoa).
174. Ectodermal cells of the miracidium arranged in transverse rows (Digenea): absent (0), present (1). Contingent on character 169: Miracidium [1] (Digenea).

175. Sickle-shaped hooks at the posterior end of ciliated larva [1] (Cercomeromorpha). This character was divided into the presence of hooks and their original number of 16. Ten hooks evolved within cestodes; the number of hooks were coded independently and those with 16 hooks were not coded as having the ten in cestodes as details of their distribution on the body and homology are unknown. Contingent on character 13: Ontogenesis (Metazoa).
176. 16 hooks [1] (Cercomeromorpha): absent (0), present (1). Contingent on character 175: Sickle-shaped hooks at the posterior end of ciliated larva [1] (Cercomeromorpha).
177. Oncomiracidium [1] (Monogenea): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
178. Rhabdomerous photoreceptors in pigment cups (Monogenea): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
179. Oncomiracidium ciliated cells are in 3-cilia complexes; interspersed between is an aciliated syncytium [1] (Monogenea): absent (0), present (1). Contingent on character 177: Oncomiracidium [1] (Monogenea).
180. Ten hooks (Cestoda): absent (0), present (1). Contingent on character 175: Sickle-shaped hooks at the posterior end of ciliated larva [1] (Cercomeromorpha).
181. Lycophora [2] (Cestoda). This type of larva is judged to be the original form within cestodes, other forms of larvae evolved later. Contingent on character 13: Ontogenesis (Metazoa).
182. Ciliated syncytium in larvae (Cestoda): absent (0), present (1). Contingent on character 181: Lycophora [2] (Cestoda).
183. Free monociliated 'statolith-like' cells (Xenoturbella): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
184. Subepidermal membrane complex (Xenoturbella): absent (0), present (1). Contingent on character 91: Basal lamina as a condensation of the ECM beneath the ectoderm and endoderm into a strongly contrasting layer (Bilateria).
185. Cilia of epidermal cells with three rootlets (Xenoturbella): absent (0), present (1). Contingent on character 37: Ciliated epidermal cells (Epitheliozoa).
186. Narrow epidermal ciliated cells, each with a supporting fiber composed of bundles of filaments (Xenoturbella): absent (0), present (1). Contingent on character 37: Ciliated epidermal cells (Epitheliozoa).
187. Anus is separate from mouth (Euspiralia): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
188. Multiciliated ectodermal cells [4] (Euspiralia): absent (0), present (1). Contingent on character 46: Ectoderm completely surrounds the body (Eumetazoa).
189. Proboscis as an organ for catching prey (Nemertini): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
190. Circulatory system with cellular, endothelial lining (Nemertini): absent (0), present (1). Contingent on character 47: Endoderm [1] (Eumetazoa).
191. Rhychoel (proboscis sheath) as a hydrostatic organ (Nemertini): absent (0), present (1). Contingent on character 189: Proboscis as an organ for catching prey (Nemertini).
192. CNS is ring-shaped around the rhychoel (Nemertini): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
193. Gonads in rows (Nemertini): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
194. The proboscis pore joins with the mouth [2] (Bdellomorpha). The openings are separate in the plesiomorphic condition. Contingent on character 189: Proboscis as an organ for catching prey (Nemertini).
195. Rod-shaped rhabdoids [2] (Anopla).

196. Larvae with imaginal discs (Heteronemertini): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
197. Doubling of body wall musculature (Heteronemertini): absent (0), present (1). Contingent on character 92: Body wall musculature made up of outer circular muscles [1] (Bilateria); and character 93: Body wall musculature made up of inner longitudinal muscles [1] (Bilateria).
198. Lateral nerves in the inner muscle layer (Heteronemertini): absent (0), present (1). Contingent on character 93: Body wall musculature made up of inner longitudinal muscles [1] (Bilateria).
199. Oral opening in front of the brain (Enopla): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
200. Lateral nerves internal to the body wall musculature (Enopla): absent (0), present (1). Contingent on character 92: Body wall musculature made up of outer circular muscles [1] (Bilateria).
201. Proboscis stylet (calcium phosphate) (Hoplonemertini): absent (0), present (1). Contingent on character 189: Proboscis as an organ for catching prey (Nemertini).
202. Posterior sucker in the adult [1] (Bdellomorpha): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
203. Dorsoventral flattening [1] (Bdellomorpha).
204. Existence as commensals in the mantle cavity and between gills of marine bivalves (Bdellomorpha).
205. Trochophore larvae with prototroch (Trochozoa): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
206. Apical organ [1] (Trochozoa): absent (0), present (1). Contingent on character 205: Trochophore larvae with prototroch (Trochozoa).
207. Foot with creeping sole (Lacunifera). This character is coded as absent in Cephalopoda, with the reduction of the Trochophore and modification of the foot. Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
208. Flattened ventral surface [1] (Lacunifera). This character was marked as absent in the vermiform Aplousobranchia and vertically oriented Cephalopoda. Contingent on character 21: Somatic differentiation (Metazoa).
209. Dorsal protein-chitin cuticle (Lacunifera): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
210. Body cavity with lacunal system (Lacunifera): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
211. Cilia restricted to ventral surface [1] (Lacunifera): absent (0), present (1). Contingent on character 37: Ciliated epidermal cells (Epitheliozoa).
212. Calyx with tentacles [1] (Entoprocta): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
213. Cup-shaped calyx [1] (Entoprocta): absent (0), present (1). Contingent on character 212: Calyx with tentacles [1] (Entoprocta).
214. Stalk [1] (Entoprocta): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
215. Metamorphosis with torsion of the atrium and intestinal tract (Entoprocta): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
216. Sessility (Entoprocta).
217. Ciliated myoepithelial cells on tentacles for filter-feeding [1] (Entoprocta): absent (0), present (1). Contingent on character 212: Calyx with tentacles [1] (Entoprocta).
218. Larva with a frontal organ (Entoprocta): absent (0), present (1). Contingent on character 205: Trochophore larvae with prototroch (Trochozoa).

219. Ventral differentiation into head and foot (Mollusca): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
220. Heart and gonopericardial system (Mollusca): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
221. Radula with nine teeth and four plates per row (Cephalopoda). Teeth are lost in the Dibranchiata so this character is only coded as present in the Nautiloidea. The formation as 7 teeth and 2 plates is coded as present only for the Dibranchiata. Contingent on character 224: Jaw and radula apparatus (Mollusca).
222. Dorsal protein-chitin cuticle with calcareous spicules (Mollusca). This is coded as absent in the Conchifera with the evolution of a single calcareous shell. Contingent on character 209: Dorsal protein-chitin cuticle (Lacunifera).
223. Mantle with mantle groove (Mollusca): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
224. Jaw and radula apparatus (Mollusca): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
225. One pair of muscles for rolling into a ball (Mollusca): absent (0), present (1). Contingent on character 90: Mesoderm [2] (Bilateria).
226. Tetra neural nervous system (Mollusca): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
227. Gills [1] (Mollusca). This was subdivided into the presence of gills and their bipectinate condition which is lost in some taxa. Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
228. Bipectinate gills [1] (Mollusca): absent (0), present (1). Contingent on character 227: Gills [1] (Mollusca).
229. Osphradia (Mollusca): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
230. Ventral groove with folded foot (Aplacophora). The broad foot with creeping sole is reduced in the Aplacophora with the evolution of a folded foot and has been coded as absent. Contingent on character 21: Somatic differentiation (Metazoa).
231. Vermiform shape [1] (Aplacophora).
232. Gonopericardioducts connect the gonads with the pericardium (Aplacophora): absent (0), present (1). Contingent on character 220: Heart and gonopericardial system (Mollusca).
233. Mantle cavity as an extension of the mantle groove at the posterior (Aplacophora): absent (0), present (1). Contingent on character 223: Mantle with mantle groove (Mollusca).
234. Change of habitat from the sediment surface to within soft sediment [1] (Aplacophora).
235. Mucus channels, differentiation products of the mantle cavity, conduct gametes into the water (Aplacophora): absent (0), present (1). Contingent on character 233: Mantle cavity as an extension of the mantle groove at the posterior (Aplacophora).
236. Papilla cells with a presumed excretory function (Aplacophora): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
237. Opening of the gonoducts into voluminous spawn ducts formed from the invagination of mucus channels of the mantle cavity into the body (Solenogastres): absent (0), present (1). Contingent on character 235: Mucus channels, differentiation products of the mantle cavity, conduct gametes into the water (Aplacophora).
238. Oral shield (Caudofoveata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).

239. Free haemoglobin in serum (Caudofoveata): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
240. Fusion of the pleurovisceral and pedal nerves at the posterior of the body, forming a longitudinal stem on both sides (Caudofoveata): absent (0), present (1). Contingent on character 226: Tetraneural nervous system (Mollusca).
241. Calcareous shell (Eumollusca): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
242. Dorsoventral muscle bundles used as foot retractors (Eumollusca). 0 = absent, 1 = 16 separate pairs, 2 = fusion to 8 pairs, 3 = one pair. Contingent on character 21: Somatic differentiation (Metazoa).
243. Metanephridia from pericardioducts (Eumollusca). Contingent on character 220: Heart and gonopericardial system (Mollusca).
244. Tegmentum with aesthetes (Polyplacophora): absent (0), present (1). Contingent on character 241: Calcareous shell (Eumollusca).
245. Eight dorsal plates (Polyplacophora): absent (0), present (1). Contingent on character 241: Calcareous shell (Eumollusca).
246. Articulamentum (Polyplacophora): absent (0), present (1). Contingent on character 245: Eight dorsal plates (Polyplacophora).
247. Single dorsal shell (Conchifera): absent (0), present (1). Contingent on character 241: Calcareous shell (Eumollusca).
248. Hypostracum developed to a nacreous layer [2] (Conchifera): absent (0), present (1). Contingent on character 241: Calcareous shell (Eumollusca).
249. Anterior jaw in the oral cavity (Conchifera): absent (0), present (1). Contingent on character 224: Jaw and radula apparatus (Mollusca).
250. Crystalline style, storage organ for enzymes in the midgut (Conchifera): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
251. Subrectal commissure between the lateral cords of the nervous system (Conchifera): absent (0), present (1). Contingent on character 226: Tetraneural nervous system (Mollusca).
252. Renopericardioducts [5] (Neopilinida). Renopericardioducts are lost in the Neopilinida according to Ax. They are present in the Polyplacophora, so are assumed to be a eumolluscan autapomorphy co-evolving with the kidneys. For this reason, they are also coded as present in the Ganglioneuralia. Contingent on character 243: Metanephridia from pericardioducts (Eumollusca).
253. Two pairs of atria (Neopilinida): absent (0), present (1). Contingent on character 220: Heart and gonopericardial system (Mollusca).
254. Several pairs of gills [1] (Neopilinida): absent (0), present (1). Contingent on character 227: Gills [1] (Mollusca).
255. Monopectinate gills (Neopilinida): absent (0), present (1). Contingent on character 227: Gills [1] (Mollusca).
256. Several pairs of gonads [1] (Neopilinida): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
257. Several pairs of kidneys [1] (Neopilinida): absent (0), present (1). Contingent on character 243: Metanephridia from pericardioducts (Eumollusca).
258. Ganglioneural nervous system (Ganglioneura): absent (0), present (1). Contingent on character 226: Tetraneural nervous system (Mollusca).
259. Restriction of the mantle groove at the posterior and concomitant development of a cavity (Rhacopoda): absent (0), present (1). Contingent on character 223: Mantle with mantle groove (Mollusca).

260. Development of a free extrusible head through limitation of the mantle, with the shell on the covering of the visceral mass (Rhacopoda): absent (0), present (1). Contingent on character 241: Calcareous shell (Eumollusca).
261. Evolution of a special muscle system for the rapid extension of foot and tentacles (Rhacopoda): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
262. Operculum (Gastropoda): absent (0), present (1). Contingent on character 241: Calcareous shell (Eumollusca).
263. Torsion of the visceral mass and shell above the foot with a twisting of the pleurovisceral nerves (Gastropoda): absent (0), present (1). Contingent on character 241: Calcareous shell (Eumollusca).
264. Mantle groove displaced to the anterior [2] (Gastropoda): absent (0), present (1). Contingent on character 223: Mantle with mantle groove (Mollusca).
265. Reduction of the right gonad (Gastropoda): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
266. Perioral tentacles become arms for catching prey (Cephalopoda). The arms were coded as present for all cephalopods; the numbers of arms were coded separately for the three groups; four, ten, or 80-90. Those with more than four arms were not coded as having the four in Octopodiformes; this was seen as a separate state without prior knowledge of the transition between the different manifestations. Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
267. Evolution of a primary two-lobed funnel from the foot for rapid movement using a "jet propulsion" technique (Cephalopoda): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
268. Connection between the gonocoelom and the pericardium through the gonopericardioduct (Cephalopoda): absent (0), present (1). Contingent on character 220: Heart and gonopericardial system (Mollusca).
269. Large, beak-like jaws (Cephalopoda): absent (0), present (1). Contingent on character 249: Anterior jaw in the oral cavity (Conchifera).
270. Hydrostatic skeleton (Cephalopoda): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
271. Yolky eggs with discoidal cleavage (Cephalopoda): absent (0), present (1). Contingent on character 19: Oogenesis: one fertilisable egg and three abortive polar bodies from one oocyte (Metazoa).
272. Change to floaters in open water with a vertical orientation of the shell (Cephalopoda): absent (0), present (1). Contingent on character 241: Calcareous shell (Eumollusca).
273. Carnivorous mode of feeding with the capability of catching large objects of prey (Cephalopoda): absent (0), present (1). Contingent on character 269: Large, beak-like jaws (Cephalopoda).
274. Concentration of the nervous system due to fusion of the ganglia to a brain-like center (Cephalopoda): absent (0), present (1). Contingent on character 258: Ganglioneural nervous system (Ganglioneura).
275. Differentiation of a storage organ for spermatophores from the distal part of the male gonoduct [1] (Cephalopoda): absent (0), present (1). Contingent on character 276: Spermatophores [1] (Cephalopoda).
276. Spermatophores [1] (Cephalopoda): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
277. One pair of eversed pin-hole camera eyes (Cephalopoda): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
278. Hood as a fusion product of the sheaths of the dorsal arms (Nautiloidea): absent (0), present (1). Contingent on character 266: Perioral tentacles become arms for catching prey (Cephalopoda).
279. 80-90 arms for catching prey (Nautiloidea): absent (0), present (1). Contingent on character 266: Perioral tentacles become arms for catching prey (Cephalopoda).

280. Two pairs of atria [1] (Nautiloidea): absent (0), present (1). Contingent on character 220: Heart and gonopericardial system (Mollusca).
281. Two pairs of gills [1] (Nautiloidea): absent (0), present (1). Contingent on character 227: Gills [1] (Mollusca).
282. Spermatophore store in females [1] (Nautiloidea): absent (0), present (1). Contingent on character 276: Spermatophores [1] (Cephalopoda).
283. Copulation organ in males [1] (Nautiloidea): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
284. Two pairs of kidneys [1] (Nautiloidea): absent (0), present (1). Contingent on character 243: Metanephridia from pericardioducts (Eumollusca).
285. Fins (Dibranchiata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
286. Closure of the funnel to a tube (Dibranchiata): absent (0), present (1). Contingent on character 267: Evolution of a primary two-lobed funnel from the foot for rapid movement using a "jet propulsion" technique (Cephalopoda).
287. Branchial hearts (Dibranchiata): absent (0), present (1). Contingent on character 220: Heart and gonopericardial system (Mollusca).
288. Radula with seven teeth and two plates per row (Dibranchiata): absent (0), present (1). Contingent on character 224: Jaw and radula apparatus (Mollusca).
289. Incorporation of the shell within the body (Dibranchiata): absent (0), present (1). Contingent on character 241: Calcareous shell (Eumollusca).
290. Development of the rostrum at the shell's apex (Dibranchiata): absent (0), present (1). Contingent on character 241: Calcareous shell (Eumollusca).
291. Close connection between the mantle and funnel through cartilage (Dibranchiata): absent (0), present (1). Contingent on character 267: Evolution of a primary two-lobed funnel from the foot for rapid movement using a "jet propulsion" technique (Cephalopoda).
292. Poison gland in the foregut (Dibranchiata): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
293. Ink-sac (Dibranchiata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
294. Fusion of the pedal and visceral ganglia (Dibranchiata): absent (0), present (1). Contingent on character 258: Ganglioneural nervous system (Ganglioneura).
295. Stellate ganglia in mantle nerves (Dibranchiata): absent (0), present (1). Contingent on character 258: Ganglioneural nervous system (Ganglioneura).
296. Transformation of one arm pair into hectocotyli used for the transfer of spermatophores (Dibranchiata): absent (0), present (1). Contingent on character 276: Spermatophores [1] (Cephalopoda).
297. Pinhole camera eyes with lens (Dibranchiata): absent (0), present (1). Contingent on character 277: One pair of eversed pin-hole camera eyes (Cephalopoda).
298. Chromatophores (Dibranchiata): absent (0), present (1). Contingent on character 21: Somatic differentiation.
299. Evolution of suckers of the arms (Dibranchiata): absent (0), present (1). Contingent on character 266: Perioral tentacles become arms for catching prey (Cephalopoda).
300. Ten pairs of arms (Decabrachia): absent (0), present (1). Contingent on character 266: Perioral tentacles become arms for catching prey (Cephalopoda).
301. Stalked suckers with horny rim [1] (Decabrachia): absent (0), present (1). Contingent on character 299: Evolution of suckers of the arms (Dibranchiata).

302. Four pairs of arms (Octopodiformes): absent (0), present (1). Contingent on character 266: Perioral tentacles become arms for catching prey (Cephalopoda).
303. Arms joined by a web of skin (Octopodiformes): absent (0), present (1). Contingent on character 266: Perioral tentacles become arms for catching prey (Cephalopoda).
304. Statocyst with two chambers (Octopodiformes): absent (0), present (1). Contingent on character 21: Somatic differentiation.
305. Rostrally extended digging and anchoring foot (Ancyropoda): absent (0), present (1). Contingent on character 21: Somatic differentiation.
306. Lateral extension of the mantle edges and the shell (Ancyropoda): absent (0), present (1). Contingent on character 241: Calcareous shell (Eumollusca).
307. Concentration of the nervous system with the cerebral and pleural ganglia lying in close proximity to one another (Ancyropoda): absent (0), present (1). Contingent on character 258: Ganglioneural nervous system (Ganglioneura).
308. Proboscis and captacula in the oral cavity (Scaphopoda): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
309. Cylindrical tube-shaped shell open at both ends (Scaphopoda): absent (0), present (1). Contingent on character 241: Calcareous shell (Eumollusca).
310. Water is drawn posteriorly into the mantle cavity (Scaphopoda): absent (0), present (1). Contingent on character 223: Mantle with mantle groove (Mollusca).
311. Two shell valves with adductor muscles (Bivalvia): absent (0), present (1). Contingent on character 241: Calcareous shell (Eumollusca).
312. Fusion of the gill axis to the roof of the mantle cavity (Bivalvia): absent (0), present (1). Contingent on character 223: Mantle with mantle groove (Mollusca).
313. Diagonal orientation of the gills in the mantle (Protobranchia): absent (0), present (1). Contingent on character 223: Mantle with mantle groove (Mollusca).
314. Adoral sensory organ (Protobranchia): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
315. Byssus glands (Metabanchia): absent (0), present (1). Contingent on character 21: Somatic differentiation.
316. Transformation of the ctenidia to filibranch gills for filtering organic material out of the water (Metabanchia). This is coded as absent in eulamellibranchs with their derived gill structure. Contingent on character 227: Gills [1] (Mollusca).
317. Byssus glands extended to the adult stage (Filibranchia): absent (0), present (1). Contingent on character 315: Byssus glands (Metabanchia).
318. Abdominal sensory organ (Filibranchia): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
319. Evolution of eulamellibranch gills as solid lamellar gills (Eulamellibranchia): absent (0), present (1). Contingent on character 227: Gills [1] (Mollusca).
320. Cuticle with collagen fibers (Pulvinifera): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
321. Coelom as hydrostatic organ, with peritoneum and myoepithelium (Pulvinifera): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
322. Retractable introvert [1] (Sipunculida): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
323. Trunk [1] (Sipunculida): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
324. Ciliated urns (Sipunculida): absent (0), present (1). Contingent on character 321: Coelom as hydrostatic organ, with peritoneum and myoepithelium (Pulvinifera).

325. Intestinal canal with ascending branch (Sipunculida): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
326. Unpaired 'nuchal organ' (Sipunculida): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
327. Prostomium/acron [1] (Articulata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
328. Segmentation (metamerism) [1] (Articulata). This character originally included serial repetition of many organs in the body, however, subsequently the number of organs in different systems are reduced differentially, and decoupled from individual metameres, therefore these characters were subdivided. Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
329. Trunk [1] (Articulata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
330. Pygidium/telson [1] (Articulata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
331. Lateral canals in a closed circulatory system [1] (Articulata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
332. Coelomic sacs serially repeated [1] (Articulata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
333. Mesenteries [1] (Articulata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
334. Dissepiments (Articulata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
335. Teloblastic growth (Articulata): absent (0), present (1). Contingent on character 13: Ontogenesis.
336. Longitudinal muscles in separate bands [1] (Articulata). This character is coded as absent in Echiurida where the muscles are described as peripheral and uniform. Contingent on character 93: Body wall musculature made up of inner longitudinal muscles [1] (Bilateria).
337. Ganglia repeated, forming a ladder like-ventral nervous system [1] (Articulata): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
338. Nephridia confined to individual segments [1] (Articulata). Serially repeated nephridia are repeatedly reduced within the Articulata, often to one pair or none. Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
339. Capillary chaetae with beta-chitin (Annelida): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
340. Ciliated folds in foregut [2] (Annelida). This character may belong in the articulatan stem-group according to Ax, however, as there is no evidence mentioned for this feature in arthropods it was coded as an autapomorphy for the clade. Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
341. Parapodia [1] (Polychaeta): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
342. Chaetae in rows [1] (Polychaeta). These chaetae appear on the parapodia of polychaetes. Those taxa with rows of chaetae on the parapodia were coded as having no chaetal bundles. Contingent on character 339: Capillary chaetae with beta-chitin (Annelida).
343. A pair of pygidial cirri (Polychaeta): absent (0), present (1). Contingent on character 330: Pygidium/telson [1] (Articulata).
344. Paired nuchal organ (Polychaeta): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
345. 2+ pairs of pygidial cirri (Scolecida): absent (0), present (1). Contingent on character 343: A pair of pygidial cirri (Polychaeta).

346. Sensory palps on the prostomium (Palpata): absent (0), present (1). Contingent on character 327: Prostomium/acron [1] (Articulata).
347. Antennae on the prostomium (Aciculata): absent (0), present (1). Contingent on character 327: Prostomium/acron [1] (Articulata).
348. Parapodia with aciculae [1] (Aciculata): absent (0), present (1). Contingent on character 341: Parapodia [1] (Polychaeta).
349. Lobe-shaped, locomotory parapodia [1] (Aciculata): absent (0), present (1). Contingent on character 341: Parapodia [1] (Polychaeta).
350. Compounded chaetae (Aciculata). The chaetae are assumed to still be in a row arrangement. Contingent on character 342: Chaetae in rows [1] (Polychaeta).
351. Parapodial cirri (Aciculata): absent (0), present (1). Contingent on character 341: Parapodia [1] (Polychaeta).
352. Grooved palps (Canalipalpata): absent (0), present (1). Contingent on character 346: Sensory palps on the prostomium (Palpata).
353. Hooked chaetae with restricted distribution on trunk (Echiurida): absent (0), present (1). Contingent on character 339: Capillary chaetae with beta-chitin (Annelida).
354. Large prostomium as an organ of microphagous feeding (Echiurida): absent (0), present (1). Contingent on character 327: Prostomium/acron [1] (Articulata).
355. Two anal sacs as excretory organs with numerous ciliated funnels (Echiurida): absent (0), present (1). Contingent on character 187: Anus is separate from mouth (Euspiralia).
356. Clitellum (Clitellata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
357. Relocation of the brain to the trunk (Clitellata): absent (0), present (1). Contingent on character 329: Trunk [1] (Articulata).
358. Acrosome tube (Clitellata): absent (0), present (1). Contingent on character 77: Sperm head has uniform acrosome [1] (Acrosomata). This character is ok – but put non-applicable for organisms with non-uniform acrosome.
359. Male before female gonads on successive segments [1] (Clitellata): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
360. Existence of a posterior sucker (Hirudinomorpha): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
361. Secondary annulation of the segments (Hirudinomorpha): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
362. Epizoa on fresh-water animals (Hirudinomorpha).
363. Tubular muscle cells (Hirudinomorpha): absent (0), present (1). Contingent on character 93: Body wall musculature made up of inner longitudinal muscles [1] (Bilateria).
364. Ganglia with neuron packets (Hirudinomorpha): absent (0), present (1). Contingent on character 337: Ganglia repeated, forming a ladder like-ventral nervous system [1] (Articulata).
365. Acrosome is corkscrew-like (Hirudinomorpha): absent (0), present (1). Contingent on character 77: Sperm head has uniform acrosome [1] (Acrosomata). As for 358.
366. Male genital pores are fused (Hirudinomorpha): absent (0), present (1). Contingent on character 359: Male before female gonads on successive segments [1] (Clitellata).
367. Displacement of the anus to the anterior, dorsally before the sucker (Hirudinomorpha): absent (0), present (1). Contingent on character 360: Existence of a posterior sucker (Hirudinomorpha).
368. Head formed from four segments [1] (Branchiobdellida): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
369. Trunk divided by a furrow into two rings [2] (Branchiobdellida): absent (0), present (1). Contingent on character 329: Trunk [1] (Articulata).

370. A constant 15 segments with a sucking disc [1] (Branchiobdellida): absent (0), present (1). Contingent on character 360: Existence of a posterior sucker (Hirudinomorpha).
371. Cuticular jaws in the pharynx (Branchiobdellida): absent (0), present (1). Contingent on character 320: Cuticle with collagen fibers (Pulvinifera).
372. Penis and unpaired spermatheca [2] (Branchiobdellida): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa). Also on meiosis with a male.
373. Two pairs of nephridia (Branchiobdellida): absent (0), present (1). Contingent on character 338: Nephridia serially repeated [1] (Articulata).
374. Posterior sucker with at least four segments [1] (Hirudinea): absent (0), present (1). Contingent on character 360: Existence of a posterior sucker (Hirudinomorpha).
375. Stronger annulation [1] (Hirudinea): absent (0), present (1). Contingent on character 361: Secondary annulation of the segments (Hirudinomorpha).
376. Strongly developed parenchymatous connective tissue (Hirudinea): absent (0), present (1). Contingent on character 21: Somatic differentiation.
377. Constriction of the connective tissue (Hirudinea): absent (0), present (1). Contingent on character 376: Strongly developed parenchymatous connective tissue (Hirudinea).
378. Double-layer of oblique muscles (Hirudinea): absent (0), present (1). Contingent on character 90: Mesoderm [2] (Bilateria).
379. Further two neuron packets (Hirudinea): absent (0), present (1). Contingent on character 364: Ganglia with neuron packets (Hirudinomorpha).
380. Nervous system with at least 31 pairs of ganglia (Hirudinea): absent (0), present (1). Contingent on character 364: Ganglia with neuron packets (Hirudinomorpha).
381. Spermatophores (Hirudinea): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
382. Unpaired female genital openings (Hirudinea): absent (0), present (1). Contingent on character 359: Male before female gonads on successive segments [1] (Clitellata).
383. 29 segments in the trunk [1] (Acanthobdella). The original segmentation, although assessed for Hirudinea (but not realised in any group) is not assessed for the Annelida as a whole; particularly the existence of a peristomium in the group was not documented. Therefore, the different forms of the trunk were coded separately, except for the case of the posterior sucker which evolved within the entity and whose original condition was assessed. Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
384. Chaetae have an anchor function (Acanthobdella): absent (0), present (1). Contingent on character 339: Capillary chaetae with beta-chitin (Annelida).
385. Posterior sucker with further three segments [1] (Autobdella). This is an addition of segments from the four in the Hirudinea and realised in Acanthobdella to a total of seven segments. Autobdella were also coded as having the first four segments. Contingent on character 374: Posterior sucker with at least four segments [1] (Hirudinea).
386. Anterior sucker (Autobdella): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
387. Prostomium plus segments 1-33 [1] (Autobdella): absent (0), present (1). Contingent on character 327: Prostomium/acron [1] (Articulata).
388. Coelom as a canal system (Autobdella): absent (0), present (1). Contingent on character 321: Coelom as hydrostatic organ, with peritoneum and myoepithelium (Pulvinifera).
389. Nervous system with a further three pairs of ganglia (Autobdella). This is an addition of ganglia from the 31 in the Hirudinea and realised in Acanthobdella to a total of 34. Autobdella were also coded as having the 31 ganglia. Contingent on character 380: Nervous system with at least 31 pairs of ganglia (Hirudinea).

390. Serial testes follicles (Autobdella): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
391. Proboscis (Rhynchobdellida): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
392. Secondary circulatory system (Arhynchobdellida): absent (0), present (1). Contingent on character 388: Coelom as a canal system (Autobdella).
393. Three cuticular jaws in the pharynx (Gnathobdelliformes): absent (0), present (1). Contingent on character 320: Cuticle with collagen fibers (Pulvinifera).
394. Penis (Gnathobdelliformes): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa) and meiosis with male.
395. Spirally twisted pharynx (Pharyngobdelliformes): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
396. Uniramous appendages [1] (Tardigrada): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
397. Appendages with claws [1] (Tardigrada): absent (0), present (1). Contingent on character 396: Uniramous appendages [1] (Tardigrada).
398. Combination of the pharynx with a stylet apparatus (Tardigrada): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
399. Isolated stem and appendage muscles [2] (Tardigrada): absent (0), present (1). Contingent on character 90: Mesoderm [2] (Bilateria).
400. Unpaired gonads dorsal of the gut (Tardigrada): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
401. Antennae on segment one [1] (Arthropoda): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
402. Paired walking appendages on repeated segments (Arthropoda): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
403. Acron and three segments form the head [1] (Arthropoda): absent (0), present (1). Contingent on character 327: Prostomium/acron [1] (Articulata).
404. Heart with ostia (Arthropoda). 0 = absent, 1 = present, 2 = reduced to a tubular heart. Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
405. Alpha-chitin cuticle [1] (Arthropoda): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
406. Body cavity with pericardial septum (Arthropoda): absent (0), present (1). Contingent on character 404: Heart with ostia (Arthropoda).
407. Superficial radial cleavage (Arthropoda): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
408. Ecdysis [1] (Arthropoda): absent (0), present (1). Contingent on character 405: Alpha-chitin cuticle [1] (Arthropoda).
409. Nephridia with sacculi (Arthropoda): absent (0), present (1). Contingent on character 98: Protonephridia of ectodermal origin [1] (Bilateria).
410. Oncopodia (Onychophora): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
411. Claw-like jaws (Onychophora): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
412. Air-breathing organs, unbranched tracheae that spring from a short atrium, not homologous to tracheae of Euarthropoda. Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).

413. Oral papillae [1] (Onychophora). This character refers to the slime gland openings. Contingent on character 414: Slime glands [1] (Onychophora).
414. Slime glands [1] (Onychophora): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
415. Salivary glands (Onychophora): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
416. Tracheae [1] (Onychophora): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
417. Lensed eyes [1] (Onychophora): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
418. Labrum [1] (Euarthropoda): absent (0), present (1). Contingent on character 327: Prostomium/acron [1] (Articulata).
419. Arthropodium (Euarthropoda): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
420. Fourth segment forms head [1] (Euarthropoda): absent (0), present (1). Contingent on character 403: Acron and three segments form the head [1] (Arthropoda).
421. Skeleton formed from solid, flexible plates (Euarthropoda): absent (0), present (1). Contingent on character 405: Alpha-chitin cuticle [1] (Arthropoda).
422. Ventral germ band (Euarthropoda): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
423. Separate cross-striated muscle cords (Euarthropoda). This follows a disintegration of the muscle cords of the Articulata. Contingent on character 90: Mesoderm [2] (Bilateria).
424. Brain has deutocerebrum [1] (Euarthropoda): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
425. Brain has tritocerebrum [1] (Euarthropoda): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
426. Brain has protocerebrum [5] (Euarthropoda): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
427. Median ocelli [1] (Euarthropoda). The median eyes are lost or altered multiple times. This character was subdivided into this character to reflect the presence of the ocelli in any form and its plesiomorphic condition of four median eyes only realised in Pantopoda. Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
428. Four median eyes [1] (Euarthropoda). This refers to the state in which they are found in the groundplan as separate entities. They are modified into the naupilus eye in most Crustacea. Contingent on character 427: Median ocelli [1] (Euarthropoda).
429. Compound eyes uniting characters 430-432: [1] (Euarthropoda): absent (0), present (1): absent (0), present (1): absent (0), present (1). Contingent on characters 430-432.
430. Ommatidia with corneal lens [1] (Euarthropoda): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
431. Retinula cells [1] (Euarthropoda): absent (0), present (1). Contingent on character 21: Somatic differentiation.
432. Sensory cells with stereocila (Euarthropoda): absent (0), present (1). Contingent on character 21: Somatic differentiation.
433. Six pairs of nephridia (Euarthropoda). This character is lost multiple times. This character was subdivided into the occurrence of the nephridia on different arthropod segments; these are segments four and six (Chelicerata) and two and five (Crustacea). The Tracheata in the groundplan have nephridia on segments four and five, but a loss on segment four occurs in the insects, where it becomes the labial glands. A loss also occurs in the Dignatha - this is coded as the segment five

- nephridia, as the maxilla on which it sits is lost. Contingent on character 338: Nephridia serially repeated [1] (Articulata).
434. Chelicerae are made of three parts with a distal pincer portion [1] (Chelicerata): absent (0), present (1). Contingent on character 435: Prosoma segment two has chelicerae [1] (Chelicerata).
435. Prosoma segment two has chelicerae [1] (Chelicerata): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
436. Caudal spine [1] (Chelicerata): absent (0), present (1). Contingent on character 330: Pygidium/telson [1] (Articulata).
437. Mesosoma with appendages and a metasoma without appendages (Chelicerata). There is a loss of the subdivision of the opisthosoma in the Labellata. Contingent on character 439: Opisthosoma [1] (Chelicerata).
438. Prosoma made of acron and seven segments [1] (Chelicerata): absent (0), present (1). Contingent on character 327: Prostomium/acron [1] (Articulata).
439. Opisthosoma [1] (Chelicerata): absent (0), present (1). Contingent on character 329: Trunk [1] (Articulata).
440. Opisthosoma of 12 trunk segments [1] (Chelicerata). This character was subdivided into the presence of an opisthosoma, which was coded for all chelicerates with any number of segments, and the number of segments which were coded separately. In the absence of information on which segments were lost for different taxa, they were coded independently, therefore taxa with 12 segments were not coded as having 10 or 11. Contingent on character 439: Opisthosoma [1] (Chelicerata).
441. Five book gills (Chelicerata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
442. Genital opercula on mesosoma segment two (Chelicerata): absent (0), present (1). Contingent on character 439: Opisthosoma [1] (Chelicerata).
443. Eyes inverted and in rows [2] (Chelicerata): absent (0), present (1). Contingent on character 427: Median ocelli [1] (Euarthropoda).
444. Thin walking legs [1] (Pantopoda): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
445. First leg pair become parapalps (Pantopoda): absent (0), present (1). Contingent on character 444: Thin walking legs [1] (Pantopoda).
446. Proboscis (Pantopoda): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
447. Prosoma is formed of two sections (Pantopoda): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
448. Opisthosoma reduced in size (Pantopoda): absent (0), present (1). Contingent on character 439: Opisthosoma [1] (Chelicerata).
449. Tube-like narrowing of body [1] (Pantopoda): absent (0), present (1). Contingent on characters 439: Opisthosoma [1] (Chelicerata); 447: Prosoma is formed of two sections (Pantopoda).
450. Ovigera (Pantopoda): absent (0), present (1). Contingent on character 444: Thin walking legs [1] (Pantopoda).
451. Branched gonads (Pantopoda): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
452. Genital pores on walking legs (1-4 pairs) (Pantopoda): absent (0), present (1). Contingent on character 444: Thin walking legs [1] (Pantopoda).
453. Buccal nerve ring with proto- and tritocerebrum anteriorly (Euchelicerata): absent (0), present (1). Contingent on characters 425: Brain has tritocerebrum [1] (Euarthropoda) and 426: Brain has protocerebrum [5] (Euarthropoda).

454. Two median eyes (Euchelicerata): absent (0), present (1). Contingent on character 427: Median ocelli.
455. Chelae on prosoma locomotory appendages (Xiphosura): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
456. Spoon-shaped setae on last prosoma leg pair (Xiphosura): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
457. Mesosoma fused to form a box-shaped body (Xiphosura): absent (0), present (1). Contingent on character 437: Mesosoma with appendages and a metasoma without appendages (Chelicerata).
458. Metasoma fused (Xiphosura): absent (0), present (1). Contingent on character 437: Mesosoma with appendages and a metasoma without appendages (Chelicerata).
459. United excretory pore pair for nephridia (Xiphosura): absent (0), present (1). Contingent on character 409: Nephridia with sacculi (Arthropoda).
460. First leg pair become pedipalps (Arachnida): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
461. Chilaria fused to form a metasternum (Arachnida): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
462. Terrestrialisation (Arachnida).
463. Precerebral sucking pump from the pharynx [1] (Arachnida): absent (0), present (1). Contingent on character 187: Anus is separate from mouth (Euspiralia).
464. Extraintestinal feeding [1] (Arachnida): absent (0), present (1). Contingent on character 463: Precerebral sucking pump from the pharynx [1] (Arachnida).
465. Increased ganglion ring with union of further pairs of ganglia into the buccal nerve ring (Arachnida): absent (0), present (1). Contingent on character 453: Buccal nerve ring with proto- and tritocerebrum anteriorly (Euchelicerata).
466. Plate-shaped appendages on opisthosoma fuse to form lung plates [1] (Arachnida). This character was subdivided into the presence of booklungs, and their original number. The Lipoctena were coded as having these lungplates, but two pairs of booklungs. The taxa with four booklungs (Scorpiones) were not coded as having the two booklungs realised in the Lipoctena, as they are on different segments. Contingent on character 439: Opisthosoma.
467. Four pairs of booklungs on segment 3-6 [1] (Arachnida): absent (0), present (1). Contingent on character 466: Plate-shaped appendages on opisthosoma fuse to form lung plates [1] (Arachnida).
468. Indirect sperm transfer - spermatophores are deposited before females takes them up internally [1] (Arachnida). This character was subdivided - spermatophores exist in the groups with direct spermatophore transfer. Contingent on character 469: Spermatophores [1] (Arachnida).
469. Spermatophores [1] (Arachnida): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
470. Unpaired genital opening from fusion (Arachnida).
471. Division of compound eyes into lateral pairs of eyes with ommatidia and retinula cells under cornea [1] (Arachnida). This character was subdivided into the presence of lateral eyes, which was coded for all arachnids with these eyes in any number, and the number of lateral eyes. The number of eyes were coded separately as five, three or two pairs. In the absence of information on which eyes were lost and their position, they were coded independently, i.e. those taxa with five pairs were not coded as having two or three. Contingent on character 430: Ommatidia with corneal lens (Euarthropoda) and 431: Retinula cells (Euarthropoda).
472. Five pairs of lateral eyes [1] (Arachnida): absent (0), present (1). Contingent on character 471: Division of compound eyes into lateral pairs of eyes with ommatidia and retinula cells under cornea [1] (Arachnida).

473. Trichobothrium (Arachnida): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
474. Slit sense organs (Arachnida): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
475. Nephridia of segment four [1][4] (Arachnida). The nephridia are lost multiple times in the chelicerates - this character reflects a convergent loss of nephridia on the first leg. Contingent on character 338: Nephridia serially repeated [1] (Articulata).
476. Nephridia of segment six [1][4] (Arachnida). The nephridia are lost multiple times in the chelicerates - this character reflects a convergent loss of nephridia on the third leg. Contingent on character 338: Nephridia serially repeated [1] (Articulata).
477. Malpighian tubules (Arachnida): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
478. Chelate pedipalps used as feeler organs (Scorpiones): absent (0), present (1). Contingent on character 460: First leg pair become pedipalps (Arachnida).
479. Poison gland on caudal spine (Scorpiones): absent (0), present (1). Contingent on character 436: Caudal spine [1] (Chelicerata).
480. Genital operculum from anterior of segment two [1] (Scorpiones): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
481. Pectines (mechanoreceptors) from posterior of segment two [1] (Scorpiones): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
482. Caudal spine is modified into a flagellar structure (Lipoptena): absent (0), present (1). Contingent on character 436: Caudal spine [1] (Chelicerata).
483. Two pairs of booklungs (Lipoptena): absent (0), present (1). Contingent on character 466: Plate-shaped appendages on opisthosoma fuse to form lung plates [1] (Arachnida).
484. Coiled, immobile sperm (Lipoptena): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
485. Uniform retinal cells with microvillar fringes in lateral eyes (Lipoptena): absent (0), present (1). Contingent on character 471: Division of compound eyes into lateral pairs of eyes with ommatidia and retinula cells under cornea [1] (Arachnida).
486. Slit sense organs form lyriform organs (Lipoptena): absent (0), present (1). Contingent on character 474: Slit sense organs (Arachnida).
487. Subchelate chelicerae have two articles with jackknifing function (Megoperkulata): absent (0), present (1). Contingent on character 435: Prosoma segment two has chelicerae [1] (Chelicerata).
488. Sperm cilia in a 9x2+3 arrangement (Megoperkulata): absent (0), present (1). Contingent on character 17: Sperm cilia (Metazoa).
489. Camerostom (Uropygi): absent (0), present (1). Contingent on character 460: First leg pair become pedipalps (Arachnida).
490. Third prosoma appendage lengthened and subdivided into tactile organs (Uropygi): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
491. Powerful pedipalps with chelae (Uropygi): absent (0), present (1). Contingent on character 460: First leg pair become pedipalps (Arachnida).
492. Anal acid glands on opisthosoma segment 12 (Uropygi): absent (0), present (1). Contingent on character 439: Opisthosoma [1] (Chelicerata).
493. Sternites fused to form sternum on prosoma [2] (Labellata): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
494. First prosoma has a sternite [2] (Labellata): absent (0), present (1). Contingent on character 493: Sternites fused to form sternum on prosoma [2] (Labellata).

495. Petiole from segment one of the opisthosoma (Labellata): absent (0), present (1). Contingent on character 439: Opisthosoma [1] (Chelicerata).
496. Post-cerebral sucking stomach (Labellata): absent (0), present (1). Contingent on character 463: Precerebral sucking pump from the pharynx [1] (Arachnida).
497. All opisthosoma neuromeres are in the suboesophageal ganglion (Labellata): absent (0), present (1). Contingent on character 439: Opisthosoma [1] (Chelicerata).
498. Sperm nucleus with post-centriole lengthening (Labellata): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
499. Pedipalps form legs with spines (Amblypygi): absent (0), present (1). Contingent on character 460: First leg pair become pedipalps (Arachnida).
500. Strongly segmented tactile organs on prosoma (Amblypygi): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
501. Chelicerae with poison glands in basal segments (Araneae): absent (0), present (1). Contingent on character 435: Prosoma segment two has chelicerae [1] (Chelicerata).
502. Four pairs of spinnerets (Araneae). This pair is lost in the Mygalomorphae. Three pairs of spinnerets are coded as present for this group and all groups with a fourth pair. Contingent on character 513: Three pairs of spinnerets (Mygalomorphae).
503. Silk glands (Araneae): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
504. Pedipalp for sperm transfer made of three parts (Araneae): absent (0), present (1). Contingent on character 460: First leg pair become pedipalps (Arachnida).
505. Three pairs of lateral eyes [2] (Araneae): absent (0), present (1). Contingent on character 471: Division of compound eyes into lateral pairs of eyes with ommatidia and retinula cells under cornea [1] (Arachnida).
506. Median eyes in a row with lateral eyes [2] (Araneae): absent (0), present (1). Contingent on character 505: Three pairs of lateral eyes [2] (Araneae).
507. Plagiognathy of chelicerae (Mesothelae): absent (0), present (1). Contingent on character 435: Prosoma segment two has chelicerae [1] (Chelicerata).
508. Tibia with spurs on leg pairs one, two, and three (Mesothelae): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
509. Concavity on the coxae of the fourth leg pair (Mesothelae): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
510. Reduction of middle spinnerets in the adult [3] (Mesothelae): absent (0), present (1). Contingent on character 513: Three pairs of spinnerets (Mygalomorphae).
511. Spinnerets migrate to the posterior of the opisthosoma (Opisthothelae): absent (0), present (1). Contingent on character 513: Three pairs of spinnerets (Mygalomorphae).
512. Sac-shaped opisthosoma (Opisthothelae): absent (0), present (1). Contingent on character 439: Opisthosoma [1] (Chelicerata).
513. Three pairs of spinnerets (Mygalomorphae): absent (0), present (1). Contingent on character 439: Opisthosoma [1] (Chelicerata).
514. Middle spinnerets form the cribellum (Araneomorphae): absent (0), present (1). Contingent on character 513: Three pairs of spinnerets (Mygalomorphae).
515. Calamistrum from the setae (Araneomorphae): absent (0), present (1). Contingent on character 503: Silk glands (Araneae).
516. Notch on the surface of the chelicerae to accommodate the tips of the long claws (Palaeocribellatae): absent (0), present (1). Contingent on character 435: Prosoma segment two has chelicerae [1] (Chelicerata).

517. Midgut diverticulae extend into the chelicerae (Palaeocribellatae): absent (0), present (1). Contingent on character 435: Prosoma segment two has chelicerae [1] (Chelicerata).
518. Poison gland extends into the prosoma (Neocribellatae): absent (0), present (1): absent (0), present (1). Contingent on character 501: Chelicerae with poison glands in basal segments (Araneae).
519. U-shaped passageway of the nephridia (Neocribellatae): absent (0), present (1). Contingent on character 409: Nephridia with sacculi (Arthropoda).
520. The anterior edge of the prosoma forms a triangular projection being a short cap-like area over the base of the chelicerae (Austrochiloidea): absent (0), present (1). Contingent on character 435: Prosoma segment two has chelicerae [1] (Chelicerata).
521. Three pairs of heart ostia (Araneoclada): absent (0), present (1). Contingent on character 404: Heart with ostia (Arthropoda).
522. Extended arrangement of the intestine in the opisthosoma (Araneoclada): absent (0), present (1). Contingent on character 439: Opisthosoma [1] (Chelicerata).
523. Tracheae (Araneoclada): absent (0), present (1). Contingent on character 466: Plate-shaped appendages on opisthosoma fuse to form lung plates [1] (Arachnida).
524. Basal fusion of the chelicerae (Haplogynae): absent (0), present (1). Contingent on character 435: Prosoma segment two has chelicerae [1] (Chelicerata).
525. Chelicerae with a lamina along the claw groove in place of teeth (Haplogynae): absent (0), present (1). Contingent on character 435: Prosoma segment two has chelicerae [1] (Chelicerata).
526. Secondarily simple palp organ (Haplogynae): absent (0), present (1). Contingent on character 504: Pedipalp for sperm transfer made of three parts (Araneae).
527. Synspermia (Haplogynae): absent (0), present (1). Contingent on character 14: Spermatogenesis.
528. Entelegynous genitalia with epigynum (Entelegynae): absent (0), present (1). Contingent on character 504: Pedipalp for sperm transfer made of three parts (Araneae).
529. Tactile leg on the prosoma (Palpigradi): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
530. Prosoma divided into an anterior with four segments and further two free segments [2] (Palpigradi): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
531. Opisthosoma has 11 segments (Palpigradi): absent (0), present (1). Contingent on character 439: Opisthosoma [1] (Chelicerata).
532. Subterminal position of the mouth (Palpigradi): absent (0), present (1). Contingent on character 187: Anus is separate from mouth (Euspiralia).
533. Tracheae with a pair of spiracles on opisthosoma segment three (Holotracheata): absent (0), present (1). Contingent on character 466: Plate-shaped appendages on opisthosoma fuse to form lung plates [1] (Arachnida).
534. Two pairs of lateral eyes (Holotracheata): absent (0), present (1). Contingent on character 471: Division of compound eyes into lateral pairs of eyes with ommatidia and retinula cells under cornea [1] (Arachnida).
535. Chelate chelicerae with two articles, including a mobile ventral finger (Haplocnemata): absent (0), present (1). Contingent on character 435: Prosoma segment two has chelicerae [1] (Chelicerata).
536. Spiracles on segment three and four (Haplocnemata): absent (0), present (1). Contingent on character 533: Tracheae with a pair of spiracles on opisthosoma segment three (Holotracheata).
537. Chelate pedipalp with terminal poison gland on the mobile ventral finger (Pseudoscorpiones): absent (0), present (1). Contingent on character 460: First leg pair become pedipalps (Arachnida).
538. Pretarsus of walking leg with arolium (Pseudoscorpiones): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).

539. Serrulae [1] (Pseudoscorpiones): absent (0), present (1). Contingent on character 435: Prosoma segment two has chelicerae [1] (Chelicerata).
540. Embryonic envelope [1] (Pseudoscorpiones): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
541. Brooding [1] (Pseudoscorpiones): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
542. Larval pump organ [1] (Pseudoscorpiones): absent (0), present (1). Contingent on character 187: Anus is separate from mouth (Euspiralia).
543. Chelicerae with silk glands opening on a galea [1] (Pseudoscorpiones): absent (0), present (1). Contingent on character 435: Prosoma segment two has chelicerae [1] (Chelicerata).
544. Pedipalp with a clasper organ (Solifugae): absent (0), present (1). Contingent on character 460: First leg pair become pedipalps (Arachnida).
545. Mobile prosoma (Solifugae): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
546. Rostrum with the mouth at the tip under the chelicerae (Solifugae): absent (0), present (1). Contingent on character 187: Anus is separate from mouth (Euspiralia).
547. Trachea with longitudinal stems and more spiracles (Solifugae): absent (0), present (1). Contingent on character 533: Trachaea with one pair of spiracles on opisthosoma segment three (Holotracheata).
548. Spermatophores are directly transferred by chelicerae (Solifugae): absent (0), present (1). Contingent on character 469: Spermatophores [1] (Arachnida).
549. Malleolus (chemoreceptor) (Solifugae): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
550. Prosoma and opisthosoma are broadly fused (Opiliones): absent (0), present (1). Contingent on character 439: Opisthosoma [1] (Chelicerata).
551. Opisthosoma has ten segments [4] (Opiliones). This is seen convergently in the Xiphosura. Contingent on character 439: Opisthosoma [1] (Chelicerata).
552. Repugnatorial glands in the prosoma (Opiliones): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
553. Penis [1] (Opiliones): absent (0), present (1). Contingent on character 46: Ectoderm completely surrounds the body (Eumetazoa).
554. Ovipositor [1] (Opiliones): absent (0), present (1). Contingent on character 46: Ectoderm completely surrounds the body (Eumetazoa).
555. Genital openings move rostralwards (Opiliones): absent (0), present (1). Contingent on character 470: Unpaired genital opening from fusion (Arachnida).
556. Median eyes on eye tubercle (Opiliones): absent (0), present (1). Contingent on character 427: Median ocelli (Euarthropoda).
557. Larvae with six legs (Acarinomorpha): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
558. Three nymph stages (Acarinomorpha): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
559. Two-part chelate chelicerae with a mobile finger (Ricinulei): absent (0), present (1). Contingent on character 435: Prosoma segment two has chelicerae [1] (Chelicerata).
560. Cucullus on the prosoma covering the chelicerae (Ricinulei): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
561. Second leg pair forms a tactile organ (Ricinulei): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
562. Chelate pedipalp with tarsus as a mobile finger against a fixed tibia (Ricinulei): absent (0), present (1). Contingent on character 460: First leg pair become pedipalps (Arachnida).

563. Opisthosoma with four large elements in the middle and other segments hidden (Ricinulei): absent (0), present (1). Contingent on character 439: Opisthosoma [1] (Chelicerata).
564. Spiracles on the posterior of the prosoma which open into the atrium with tracheal capillaries (Ricinulei): absent (0), present (1). Contingent on character 533: Trachaea with one pair of spiracles on opisthosoma segment three (Holotracheata).
565. Copulatory organ on third leg pair (Ricinulei): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
566. Gnathosoma [1] (Acari): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
567. Idiosoma [1] (Acari): absent (0), present (1). Contingent on character 438: Prosoma made of acron and seven segments [1] (Chelicerata).
568. Broad fusion of opisthosoma and prosoma (Acari): absent (0), present (1). Contingent on character 439: Opisthosoma [1] (Chelicerata).
569. Second antennae have endo- and exopodites [1] (Mandibulata): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
570. Second antennae [1] (Mandibulata). This character is subdivided as the exopodites are lost independently of the antenna. Contingent on character 419: Arthropodium (Euarthropoda).
571. Second maxilla [1] (Mandibulata). This coding assumes the condition of dignathy evolved from maxilla once only. Contingent on character 419: Arthropodium (Euarthropoda).
572. First maxilla (Mandibulata): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
573. Mandibles on the third head segment [1] (Mandibulata). Palps are lost independently in the maxillae and mandibles so presence of palps are coded separately. Contingent on character 419: Arthropodium (Euarthropoda).
574. Mandibles with palps [1] (Mandibulata): absent (0), present (1). Contingent on character 573: Mandibles on the third head segment [1] (Mandibulata).
575. First maxilla with palps [1] (Mandibulata): absent (0), present (1). Contingent on character 572: First maxilla (Mandibulata).
576. Second maxilla with palps [1] (Mandibulata): absent (0), present (1). Contingent on character 571: Second maxilla [1] (Mandibulata).
577. Fifth segment on head [2] (Mandibulata): absent (0), present (1). Contingent on character 403: Acron and three segments form the head [1] (Arthropoda).
578. Molt gland (Mandibulata): absent (0), present (1). Contingent on character 408: Ecdysis [1] (Arthropoda).
579. Four-part crystalline cone with four cone cells [1] (Mandibulata). This character is coded as present in Amphiesmenoptera; the three-part cone is present in larvae, so it is assumed that a four-part cone is still present in the adult. In the Thecostraca, where the adult has no eyes, it is coded as absent. Contingent on character 581: Crystalline cone in ommatidia [1] (Mandibulata).
580. Constant eight retinula cells forming the rhabdome [1] (Mandibulata): absent (0), present (1). Contingent on character 431: Retinula cells [1] (Euarthropoda).
581. Crystalline cone in ommatidia [1] (Mandibulata). The crystalline cone undergoes reductions in different lineages. This character was divided into the presence of a crystalline cone, and the number of cone cells, grouped phenetically, based on how many cone cells were in the eye; four is the original condition, it is two or three in other taxa. This coding was chosen to reflect the difference in cone structure in the larval and adult forms of Amphiesmenoptera and Thecostraca. Contingent on character 430: Ommatidia with corneal lens [1] (Euarthropoda).
582. Corneal lens secreted by two corneageous cells [1] (Mandibulata): absent (0), present (1). Contingent on character 430: Ommatidia with corneal lens [1] (Euarthropoda).

583. Naupilus eye forms from median eye ocelli (Mandibulata): absent (0), present (1). Contingent on character 427: Median ocelli [1] (Euarthropoda).
584. Naupilus eye has four ocelli (Mandibulata): absent (0), present (1). Contingent on character 583: Naupilus eye forms from median eye ocelli (Mandibulata).
585. Naupilus larva (Crustacea): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
586. Nephridia on segment two [1] (Crustacea): absent (0), present (1). Contingent on character 338: Nephridia serially repeated [1] (Articulata). Serially repeated nephridia are repeatedly reduced within the Articulata, often to one pair or none.
587. Nephridia on segment five [1] (Crustacea): absent (0), present (1). Contingent on character 338: Nephridia serially repeated [1] (Articulata). Serially repeated nephridia are repeatedly reduced within the Articulata, often to one pair or none.
588. Preantennal processes on the first antennae (Remipedia): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
589. Second antenna is short, with an endopodite of three articles and an exopodite of one article (Remipedia): absent (0), present (1). Contingent on character 569: Second antennae have endo- and exopodites [1] (Mandibulata).
590. Uniramous maxillipeds on the cephalothorax [1] (Remipedia): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
591. Cephalothorax forms as the first trunk segment fuses to the head [1] (Remipedia): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
592. Mandibles are asymmetric (Remipedia): absent (0), present (1). Contingent on character 573: Mandibles on the third head segment [1] (Mandibulata).
593. Uniramous first and second maxillae as grasping organs (Remipedia): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
594. Maxillary glands (Remipedia): absent (0), present (1). Contingent on character 593: Uniramous first and second maxillae as grasping organs (Remipedia).
595. Thorax [1] (Eucrustacea): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
596. Abdomen [1] (Eucrustacea): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
597. Turgor appendages with epipodites for feeding (Thoracopoda): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
598. Palps on the mandibles are absent in the adult [3] (Cephalocarida): absent (0), present (1). Contingent on character 574: Mandibles with palps [1] (Mandibulata).
599. Phyllopodia with loss of articles in podites form turgor appendages (Phyllopodomorpha): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
600. Filtration from open water (Phyllopodomorpha): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
601. Compound eyes on stalks (Phyllopodomorpha): absent (0), present (1). Contingent on character 429: Compound eyes uniting characters 430-432: [1] (Euarthropoda).
602. The first antennae are small and thread-like (Anostraca): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
603. The second male antenna is a copula (Anostraca): absent (0), present (1). Contingent on character 570: Second antennae [1] (Mandibulata).
604. The second maxilla is greatly reduced (Anostraca): absent (0), present (1). Contingent on character 571: Second maxilla [1] (Mandibulata).

605. Thoracic segments are incorporated into the reproductive apparatus (Anostraca): absent (0), present (1). Contingent on character 595: Thorax [1] (Eucrustacea).
606. Naupilus eye has three ocelli (Anostraca). This was coded as convergent in Anostraca and Maxillopoda. Contingent on character 583: Naupilus eye forms from median eye ocelli (Mandibulata).
607. Carapace as a bivalved shell (Ostraca): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
608. ~30 thoracopods (Phyllopoda): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
609. Sessile compound eyes (Phyllopoda): absent (0), present (1). Contingent on character 429: Compound eyes uniting characters 430-432: [1] (Euarthropoda).
610. Strongly developed biramous second antennae with locomotory function (Onychura): absent (0), present (1). Contingent on character 570: Second antennae [1] (Mandibulata).
611. Short legless abdomen folded downward ventrally (Onychura): absent (0), present (1). Contingent on character 596: Abdomen [1] (Eucrustacea).
612. First thoracopod of the male with hooks for copulation (Onychura): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
613. Dorsal telson with a pair of long setae (Onychura): absent (0), present (1). Contingent on character 330: Pygidium/telson [1] (Articulata).
614. Branches of the furca differentiated into backward-directed claws (Onychura): absent (0), present (1). Contingent on character 596: Abdomen [1] (Eucrustacea).
615. Carapace with growth rings (Onychura): absent (0), present (1). Contingent on character 607: Carapace as a bivalved shell (Ostraca).
616. Deposition of the eggs in a dorsal shell space between the carapace and the back of the thorax (Onychura): absent (0), present (1). Contingent on character 607: Carapace as a bivalved shell (Ostraca).
617. Attachment of the eggs (embryos) in the female onto the dorsal structures of the exopodite (Onychura): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
618. Compound eye position (Onychura). 0 = absent/plesiomorphic, 1 = moved toward middle of the head, 2 = medially placed in very close proximity, 3 = medially fused to one entity. Contingent on character 429: Compound eyes uniting characters 430-432: [1] (Euarthropoda).
619. The additional transformation of a second pair of thoracopods to a copulatory structure (Spinicaudata): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
620. Life cycle with heterogony (Cladoceromorpha): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
621. Ephippium (Cladoceromorpha): absent (0), present (1). Contingent on character 616: Deposition of the eggs in a dorsal shell space between the carapace and the back of the thorax (Onychura).
622. 15/16 thoracopods (Cyclestheria): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
623. Males and females bear on their posterior thoracic segments cuticular lamellae with backward-pointing setae (Cyclestheria): absent (0), present (1). Contingent on character 595: Thorax [1] (Eucrustacea).
624. Six thoracopods in the ground pattern (Cladocera): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
625. Free head as a bivalved shell; the carapace only encloses the trunk (Cladocera): absent (0), present (1): absent (0), present (1). Contingent on character 607: Carapace as a bivalved shell (Ostraca).

626. Opening of the female genital pore in the brood chamber (Cladocera): absent (0), present (1). Contingent on character 616: Deposition of the eggs in a dorsal shell space between the carapace and the back of the thorax (Onychura).
627. Compound eye with a pore to the exterior (Cladocera). 0 = absent or open, 1 = closed. Contingent on character 429: Compound eyes uniting characters 430-432: [1] (Euarthropoda).
628. First antennae are short, thin rods on the ventral side of the head (Notostraca): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
629. Polypody (Notostraca): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
630. First thoracopod with three long multiarticulate endites (Notostraca): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
631. Furcal branches of body length (Notostraca): absent (0), present (1). Contingent on character 596: Abdomen [1] (Eucrustacea).
632. Shield-like carapace (Notostraca): absent (0), present (1). Contingent on character 607: Carapace as a bivalved shell (Ostraca).
633. Mode of life on muddy bottom substrates (Notostraca).
634. Nutrient uptake from the bottom (Notostraca).
635. Eleventh thoracopod in the female with a circular egg capsule (Notostraca): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
636. Pleopods on all pleomeres [1] (Malacostraca). Some pleopods are absent in the Pancarida. Because the segment distribution is recorded, the pleopods characters were coded as present on segments 3-5 (the situation realised in Pancarida) and pleopods on all pleomeres. Those taxa with all pleopods were also coded as having 3-5. Contingent on character 675: Pleopods on pleon segments 3-5 (Pancarida).
637. Thorax one with eight appendages [1] (Malacostraca): absent (0), present (1). Contingent on character 638: Thorax one and pleon [1] (Malacostraca).
638. Thorax one and pleon [1] (Malacostraca): absent (0), present (1). Contingent on character 595: Thorax [1] (Eucrustacea).
639. 15 trunk segments, abdomen is segment 15 only (Malacostraca): absent (0), present (1). Contingent on character 596: Abdomen [1] (Eucrustacea).
640. Rostrum, a mobile plate anterior of the carapace (Malacostraca): absent (0), present (1). Contingent on character 607: Carapace as a bivalved shell (Ostraca).
641. Ectoblast ring (Malacostraca): absent (0), present (1). Contingent on character 46: Ectoderm completely surrounds the body (Eumetazoa).
642. Stomach with cardiac and pyloric chambers (Malacostraca): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
643. Constant position of the genital openings (Malacostraca): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
644. First antennae with short, scale-like appendages (Leptostraca): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
645. Second maxilla with a long palp to clean the carapace and filter-legs (Leptostraca): absent (0), present (1). Contingent on character 571: Second maxilla [1] (Mandibulata).
646. Brood care (Leptostraca): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
647. The scaphocerite, the exopodite of antenna two, is a large flattened scale for swimming (Eumalacostraca): absent (0), present (1). Contingent on character 569: Second antennae have endo- and exopodites [1] (Mandibulata).

648. Transformation of the phyllopodia into stenopodia (Eumalacostraca): absent (0), present (1). Contingent on character 637: Thorax one with eight appendages [1] (Malacostraca).
649. Tail fan of uropods and telson (Eumalacostraca): absent (0), present (1). Contingent on character 330: Pygidium/telson [1] (Articulata).
650. First antennae are triramous (Stomatopoda): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
651. Thoracopods 1-5 become raptorial legs (Stomatopoda): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
652. Flat carapace plate (Stomatopoda): absent (0), present (1). Contingent on character 607: Carapace as a bivalved shell (Ostraca).
653. Gills on the pleopods (Stomatopoda): absent (0), present (1). Contingent on character 636: Pleopods on all pleomeres [1] (Malacostraca).
654. Petasma is a copulatory organ (Stomatopoda): absent (0), present (1). Contingent on character 638: Thorax one and pleon [1] (Malacostraca).
655. Mandibles of the larva with a row of setae between the processus incisivus and processus molaris (Caridoida): absent (0), present (1). Contingent on character 573: Mandibles on the third head segment [1] (Mandibulata).
656. Anterior head with first antenna and rostrum firmly fused to the rest of the head (Caridoida): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
657. Pleon and tail fan as escape device with complex musculature (Caridoida): absent (0), present (1). Contingent on character 638: Thorax one and pleon [1] (Malacostraca).
658. Statocyst in first antenna (Caridoida): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
659. Thoracopods one and two are transformed into maxillipeds used in food uptake (Decapoda): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
660. Thoracopods with four gills and an extra epipodite for gill cleaning (Decapoda): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
661. Fusion of cephalon and thorax one (Decapoda): absent (0), present (1). Contingent on 638: Thorax one and pleon [1] (Malacostraca).
662. Scaphognathite from the exopodite of the second maxilla forms a water pump (Decapoda): absent (0), present (1). Contingent on character 571: Second maxilla [1] (Mandibulata).
663. Two-part crystalline cone with two accessory cone cells (Xenommacarida): absent (0), present (1). Contingent on character 581: Crystalline cone in ommatidia [1] (Mandibulata).
664. Distal extension of the retinula cells and corresponding displacement of the cell nuclei (Xenommacarida): absent (0), present (1). Contingent on character 431: Retinula cells [1] (Euarthropoda).
665. Fresh-water dwellers (Syncarida).
666. Gills with a branch directly into the gill cavity (NN_Euphausiacea_Pancarida_Peracarida): absent (0), present (1). Contingent on character 595: Thorax [1] (Eucrustacea).
667. Distal displacement of the accessory cone cell nuclei (NN_Euphausiacea_Pancarida_Peracarida): absent (0), present (1). Contingent on character 663: Two-part crystalline cone with two accessory cone cells (Xenommacarida).
668. Subapical appendages on the telson (Euphausiacea): absent (0), present (1). Contingent on character 330: Pygidium/telson [1] (Articulata).
669. Fusion of cephalon and thorax (Euphausiacea): absent (0), present (1). Contingent on character 638: Thorax one and pleon [1] (Malacostraca).

670. *Lacinia mobilis* on both mandibles of the adult (Neocarida): absent (0), present (1). Contingent on character 573: Mandibles on the third head segment [1] (Mandibulata).
671. Transformation of the first thoracopod to a maxilliped (Neocarida): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
672. The epipodite of the maxilliped generates a ventilating current of water by oscillations in the respiratory cavity (Neocarida): absent (0), present (1). Contingent on character 671: Transformation of the first thoracopod to a maxilliped (Neocarida).
673. Cephalothorax formed from the fusion of the head and first thoracic segment (Neocarida): absent (0), present (1). Contingent on character 638: Thorax one and pleon [1] (Malacostraca).
674. Absence of thoracopods seven and eight on hatching [3] (Pancarida): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
675. Pleopods on pleon segments 3-5 (Pancarida): absent (0), present (1). Contingent on character 638: Thorax one and pleon [1] (Malacostraca).
676. Short carapace (Pancarida): absent (0), present (1). Contingent on character 607: Carapace as a bivalved shell (Ostraca).
677. Dorsal brood-pouch in the female (Pancarida): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
678. Cell pattern formation on the embryonic germ band (Peracarida): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
679. Marsupium of oostegites present on all thoracopods (Peracarida). Some oostegites are absent in the Amphipoda. Because the segment distribution is recorded, the oostegite characters were divided into present on segments 3-6 (the situation realised in Amphipoda) and oostegites on all thoracopods. Those taxa with oostegites on all thoracopods were also coded as having 3-6. Contingent on character 686: Oostegites on thoracopods 3-6 (Amphipoda).
680. A clear protruding tooth at the posterior edge of the labrum (Mysidacea): absent (0), present (1). Contingent on character 418: Labrum [1] (Euarthropoda).
681. Special formation of the crystalline cone (Mysidacea): absent (0), present (1). Contingent on character 663: Two-part crystalline cone with two accessory cone cells (Xenommacarida).
682. Plasmatic offshoots of the accessory cone cells surround the proximal part of the cone (Mysidacea): absent (0), present (1). Contingent on character 663: Two-part crystalline cone with two accessory cone cells (Xenommacarida).
683. Thoracopods 1-8 have fully developed exopodites (Amphipoda). This character was originally a loss of exopodites in Amphipoda. It is coded as absent in remipeds with no thorax and groups with fewer than eight thoracopods. Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
684. Thoracopods two and three are subchelate (Amphipoda): absent (0), present (1): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
685. Gills on thoracopods 3-8 shift inward (Amphipoda): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
686. Oostegites on thoracopods 3-6 (Amphipoda): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
687. Manca stage leave the marsupium (Mancoidea): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
688. Pleopods 1-5 are reduced in the female [3] (Cumacea): absent (0), present (1). Contingent on character 638: Thorax one and pleon [1] (Malacostraca).
689. Two large epipodites from the first thoracopod pair with gills are found in the gill cavity (Cumacea): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).

690. Thoracopods two and three are also transformed into maxillipeds (Cumacea): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
691. Paired lobes of the carapace combine to form a pseudorostrum to the anterior (Cumacea): absent (0), present (1). Contingent on character 607: Carapace as a bivalved shell (Ostraca).
692. Posterior edge of carapace is fused with the body wall (Cumacea): absent (0), present (1). Contingent on character 607: Carapace as a bivalved shell (Ostraca).
693. Strong reduction of the pleopods (Mictacea): absent (0), present (1). Contingent on character 638: Thorax one and pleon [1] (Malacostraca).
694. Short carapace covers only the first thoracic segment (Mictacea): absent (0), present (1). Contingent on character 607: Carapace as a bivalved shell (Ostraca).
695. Exopodites with one article on thoracopods 5-7, differentiated into gills (Spelaeogriphacea): absent (0), present (1). Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
696. The second thoracopod is transformed into a large chela (Tanaidacea Contingent on character 597: Turgor appendages with epipodites for feeding (Thoracopoda).
697. Pistil-shaped uropods (Tanaidacea): absent (0), present (1). Contingent on character 649: Tail fan of uropods and telson (Eumalacostraca).
698. Cephalothorax of head and two thoracic segments (Tanaidacea): absent (0), present (1). Contingent on character 673: Cephalothorax formed from the fusion of the head and first thoracic segment (Neocarida).
699. Carapace fused dorsally with head and first two thoracic segments (Tanaidacea): absent (0), present (1). Contingent on character 607: Carapace as a bivalved shell (Ostraca).
700. Exopodites of the second antennae are vestigial (Isopoda): absent (0), present (1). Contingent on character 569: Second antennae have endo- and exopodites [1] (Mandibulata).
701. Dorsoventrally flattened body with oval outline (Isopoda): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
702. Heart in pleon (Isopoda): absent (0), present (1). Contingent on character 638: Thorax one and pleon [1] (Malacostraca).
703. Separate molting of anterior and posterior body (Isopoda): absent (0), present (1). Contingent on character 408: Ecdysis [1] (Arthropoda).
704. Thoracomere seven with a copulatory organ [1] (Maxillopoda): absent (0), present (1). Contingent on character 595: Thorax [1] (Eucrustacea).
705. Appendages on thoracomere 1-6 [1] (Maxillopoda): absent (0), present (1). Contingent on character 595: Thorax [1] (Eucrustacea).
706. Thorax of seven segments [1] (Maxillopoda). The thorax appendages are altered within the Maxillopoda; the copulatory organ is lost and the thorax appendages are reduced independently, therefore they were subdivided. Tracing homology between appendage pairs was not possible, so Ostracoda are coded as having two pairs, Mystacocarida as having five, and others as having six. Contingent on character 595: Thorax [1] (Eucrustacea).
707. Abdomen of constant three segments without appendages [1] (Maxillopoda): absent (0), present (1): absent (0), present (1). Contingent on character 596: Abdomen [1] (Eucrustacea).
708. Antenna one in the male is a grasping organ (Copepoda): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
709. Thoracopod one becomes a maxilliped [1] (Copepoda): absent (0), present (1). Contingent on character 705: Appendages on thoracomere 1-6 [1] (Maxillopoda).
710. Special joint in thorax for mobility [2] (Copepoda): absent (0), present (1). Contingent on character 706: Thorax of seven segments [1] (Maxillopoda).

711. Cephalothorax [1] (Copepoda): absent (0), present (1). Contingent on character 706: Thorax of seven segments [1] (Maxillopoda).
712. Intercoxal plate (Copepoda): absent (0), present (1). Contingent on character 705: Appendages on thoracomere 1-6 [1] (Maxillopoda).
713. Copepodite stages in lifecycle [2] (Copepoda): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
714. Spermatophores (Copepoda): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
715. Seminal receptacle for sperm storage (Copepoda): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
716. Formation of egg-sacs through gland secretions of the oviducts (Copepoda): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
717. First maxilla, second maxilla and first thoracopod are scraping and scratching structures for food uptake (Mystacocarida): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda), 571: Second maxilla and 572: First maxilla.
718. Second antennae and mandibles are branched appendages with endo- and exopodites for locomotion. They are carried over from nauplius to the adult (Mystacocarida). Contingent on character 573: Mandibles on the third head segment [1] (Mandibulata).
719. Thoracic appendages 2-5 only developed as small undivided plates (Mystacocarida): absent (0), present (1): Contingent on character 706: Thorax of seven segments (Maxillopoda).
720. Five thorax appendages (Mystacocarida): absent (0), present (1). Contingent on character 706: Thorax of seven segments (Maxillopoda).
721. Lateral furrows in the posterior head section and on all trunk segments (Mystacocarida): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
722. Long, tongue-shaped labrum reaching to the posterior end of the head (Mystacocarida): absent (0), present (1). Contingent on character 418: Labrum [1] (Euarthropoda).
723. Location of the genital pores in the female and male in the fourth thoracomere (Mystacocarida): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
724. Four separate ocelli on the head (Mystacocarida): absent (0), present (1). Contingent on character 427: Median ocelli [1] (Euarthropoda).
725. Location of the female genital pores on the first thoracic segment (Progonomorpha): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
726. Reduction of all head appendages except for antenna one in the sexually reproducing female [3] (Tantulocarida): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda) and 401: Antennae on segment one (Arthropoda).
727. Larva with an adhesive disc to adhere to the host and a stylet to bore into the hosts skin (Tantulocarida): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
728. Variable number of abdominal segments in larvae (Tantulocarida): absent (0), present (1). Contingent on character 596: Abdomen [1] (Eucrustacea).
729. Male with one abdominal segment between the thorax and telson [3] (Tantulocarida): absent (0), present (1). Contingent on character 596: Abdomen [1] (Eucrustacea).
730. Female with a further shortened trunk [3] (Tantulocarida): absent (0), present (1). Contingent on character 595: Thorax [1] (Eucrustacea).
731. In the male and female with bisexual reproduction the cephalothorax consists of head and two thoracomeres (Tantulocarida): absent (0), present (1). Contingent on character 706: Thorax of seven segments [1] (Maxillopoda).

732. Larval parasitism (Tantulocarida): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
733. Evolution of a second form of the female with parthenogenetic reproduction (Tantulocarida): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
734. Bivalved carapace with adductor muscle (Thecostracomorpha): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
735. First antennae are terminal with pincer-like grasping organs for attaching to the host (Ascothoracida): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
736. Mouthparts transformed into piercing setae (Ascothoracida): absent (0), present (1). Contingent on characters 571: Second maxilla [1] (Mandibulata), and 572: First maxilla (Mandibulata).
737. In the cypris, the first antenna is differentiated into an attachment organ with cement glands (Cirripedia): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
738. Thoracopods 1-6 as multiarticulate cirri [1] (Cirripedia): absent (0), present (1). Contingent on character 705: Appendages on thoracomere 1-6 [1] (Maxillopoda).
739. Peduncle [1] (Cirripedia): absent (0), present (1). Contingent on character 403: Acron and three segments form the head [1] (Arthropoda).
740. In the cypris, thorax segments six and seven are fused (Cirripedia): absent (0), present (1). Contingent on character 746: Cypris larva [1] (Cirripedia).
741. Abdomen lost in the course of metamorphosis [3] (Cirripedia): absent (0), present (1). Contingent on character 596: Abdomen [1] (Eucrustacea).
742. Capitulum [1] (Cirripedia): absent (0), present (1). Contingent on character 595: Thorax [1] (Eucrustacea).
743. Carapace in the cypris larva is undivided [1] (Cirripedia): absent (0), present (1). Contingent on character 746: Cypris larva [1] (Cirripedia).
744. Carapace is ventrally fused in the adult with a slit in the posterior (Cirripedia): absent (0), present (1). Contingent on character 734: Bivalved carapace with adductor muscle (Thecostracomorpha).
745. Calcareous plates in chitin cuticle (Cirripedia): absent (0), present (1). Contingent on character 405: Alpha-chitin cuticle [1] (Arthropoda).
746. Cypris larva [1] (Cirripedia). An Ascothoracid stage larva is proposed to be homologous with the cypris within the Ascothoracida; therefore this character was coded as present in the Ascothoracida. Contingent on character 13: Ontogenesis (Metazoa).
747. Cypris without nutrient uptake [1] (Cirripedia): absent (0), present (1). Contingent on character 746: Cypris larva [1] (Cirripedia).
748. Frontal horns with opening glands of unknown function and caudal spine in naupilus (Cirripedia): absent (0), present (1). Contingent on character 585: Naupilus larva (Crustacea).
749. Thoracopod seven as a long, mobile penis [1] (Cirripedia): absent (0), present (1). Contingent on character 706: Thorax of seven segments [1] (Maxillopoda).
750. Two thoracopods (Ostracoda): absent (0), present (1). Contingent on character 706: Thorax of seven segments (Maxillopoda). Changed from 705: Appendages on thoracomere 1-6 [1] (Maxillopoda).
751. Extreme shortening of the trunk (Ostracoda). The division of thorax and abdomen are still marked as present as they are implied by the endoskeleton. Contingent on character 595: Thorax [1] (Eucrustacea).
752. Nauplius larva with carapace as well as uniramous second antennae and mandibles (Ostracoda): absent (0), present (1). Contingent on character 585: Naupilus larva (Crustacea) and character 734: Bivalved carapace with adductor muscle (Thecostracomorpha).

753. Hinge margin (Ostracoda): absent (0), present (1). Contingent on character 734: Bivalved carapace with adductor muscle (Thecostracomorpha).
754. Furca in the form of broad lamellae with strong spines (Myodocopida): absent (0), present (1). Contingent on character 596: Abdomen [1] (Eucrustacea).
755. Anterior edge of the carapace with rostral incisor for the protrusion of the antennae (Myodocopida): absent (0), present (1). Contingent on character 734: Bivalved carapace with adductor muscle (Thecostracomorpha).
756. The exopodite of antenna two has a maximum of two articles (Podocopida): absent (0), present (1). Contingent on character 569: Second antennae have endo- and exopodites [1] (Mandibulata).
757. Maxilla one with large branchial plates (Podocopida): absent (0), present (1). Contingent on character 572: First maxilla (Mandibulata).
758. Terrestrialisation (Tracheata).
759. Trachaea with spiracles [1] (Tracheata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
760. Spiracles in every segment [1] (Tracheata): absent (0), present (1). Contingent on character 759: Trachaea with spiracles [1] (Tracheata).
761. Spermatophores (Tracheata): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
762. Temporal organ with fine pores in cuticle (Tracheata): absent (0), present (1). Contingent on character 405: Alpha-chitin cuticle [1] (Arthropoda).
763. Malpighian tubules from a pair of outgrowths of the proctodaeum at the midgut-hindgut boundary (Tracheata): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
764. Compound eyes become loosely arranged ocelli [1] (Myriapoda): absent (0), present (1). Contingent on characters 430-432.
765. Multilayered retinula consisting of a large number of cells [1] (Myriapoda): absent (0), present (1). Contingent on character 431: Retinula cells [1] (Euarthropoda).
766. Hatching spine on the second maxillae of the embryo to rip open the egg membrane (Chilopoda): absent (0), present (1). Contingent on character 571: Second maxilla [1] (Mandibulata).
767. Raptorial feeding (Chilopoda): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
768. Maxillipeds with poison glands (Chilopoda): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
769. Sperm with striated cylinder and mantle (Chilopoda): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
770. Repugnatorial glands (Geophilomorpha): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
771. Heterotery (Heteroterga). 0 = absent, 1 = present, 2 = extreme heterotery. Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
772. Spiracles in alternating segments (Heteroterga): absent (0), present (1). Contingent on character 759: Trachea with spiracles [1] (Tracheata).
773. Tergite of maxilliped segment fuses with that of the first walking leg segment (Scolopendromorpha): absent (0), present (1). Contingent on character 768: Maxillipeds with poison glands.
774. Musculature on the spiracle pouches (Scolopendromorpha): absent (0), present (1). Contingent on character 759: Trachea with spiracles [1] (Tracheata).
775. 15 pairs of locomotory appendages (Triakontapoda): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).

776. Six long tergites 4,6,8,9,11,13 are each divided into two plates by transverse joint membranes (Craterostigmomorpha): absent (0), present (1). Contingent on character 771: Heterotergy (Heteroterga).
777. Trunk segment 16 is a strongly sclerotized ring without any demarcation between tergite, pleurite and sternite (Craterostigmomorpha): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
778. Anogenital capsule (Craterostigmomorpha): absent (0), present (1). Contingent on character 405: Alpha-chitin cuticle [1] (Arthropoda).
779. On the corresponding segments 4,6,8,9,11,13 lateral pleural glands of unknown function occur (Craterostigmomorpha): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
780. One ocelli on each side of the head (Craterostigmomorpha): absent (0), present (1). Contingent on character 764: Compound eyes become loosely arranged ocelli [1] (Myriapoda).
781. Pinnate setae on the first maxillae (Gonopodophora): absent (0), present (1). Contingent on character 572: First maxilla (Mandibulata).
782. Deposition of single eggs in sediment one by one (Gonopodophora): absent (0), present (1). Contingent on character 783: Gonopod pincers used in egg deposition (Gonopodophora).
783. Gonopod pincers used in egg deposition (Gonopodophora): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
784. Unpaired testes (Lithobiomorpha): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa), and meiosis with male.
785. Basal articles of the female gonopods have prominent, terminal, rounded spines (Lithobiomorpha): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
786. Long, annulated antennae (Scutigeromorpha): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
787. Long appendages with two-part tarsi consisting of about 40 annuli (Scutigeromorpha): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
788. Maxillipeds with separate coxae (Scutigeromorpha): absent (0), present (1). Contingent on character 768: Maxillipeds with poison glands.
789. Seven large tergites in heterotergic plates (Scutigeromorpha): absent (0), present (1). Contingent on character 771: Heterotergy (Heteroterga).
790. Fused spiracles [1] (Scutigeromorpha): absent (0), present (1). Contingent on character 759: Trachea with spiracles [1] (Tracheata).
791. Tracheal lungs [1] (Scutigeromorpha): absent (0), present (1). Contingent on character 759: Trachea with spiracles [1] (Tracheata).
792. Two-part gonopods in the female (Scutigeromorpha): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
793. Pseudocompound eyes from lateral eyes with a new vitreous body (Scutigeromorpha): absent (0), present (1). Contingent on character 764: Compound eyes become loosely arranged ocelli [1] (Myriapoda).
794. Maxillary organ (Scutigeromorpha): absent (0), present (1). Contingent on character 572: First maxilla (Mandibulata).
795. Position of the genital opening in the anterior body (Progoneata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
796. Trichobothria with a bulbous extension of the sensory hair near the root (Progoneata): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
797. Labium - fusion of the second maxilla, with distal sensory cones (Symphylla): absent (0), present (1). Contingent on character 571: Second maxilla [1] (Mandibulata).

798. Increase in the number of tergites (Symphyla): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
799. Spinnerets, paired spin glands (Symphyla): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
800. One pair of spiracles in head only (Symphyla): absent (0), present (1). Contingent on character 759: Trachea with spiracles [1] (Tracheata).
801. Uptake of sperm into buccal pouches in the female's oral cavity and external fertilisation (Symphyla): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
802. Unpaired genital openings (Symphyla): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
803. Dignathy (Dignatha): absent (0), present (1). Contingent on character 573: Mandibles on the third head segment [1] (Mandibulata).
804. Position of the spiracles close to coxae of appendages (Dignatha): absent (0), present (1). Contingent on character 759: Trachea with spiracles [1] (Tracheata).
805. Tracheal pouches (Dignatha): absent (0), present (1). Contingent on character 759: Trachea with spiracles [1] (Tracheata).
806. Penes (Dignatha): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
807. First antennae have six articles with forked branches and antennal filaments (Pauropoda): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
808. Trunk segmentation: 12 segments with telson and 11 appendage pairs (Pauropoda). This arrangement is regarded as independent of other trunk segment/appendage arrangements. Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
809. One pair of trachea and one pair of spiracles on the base of the first leg pair (Pauropoda): absent (0), present (1). Contingent on character 759: Trachea with spiracles [1] (Tracheata).
810. Unpaired genital pores in the female (Pauropoda): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
811. Antennae have four sensory cones on the last of eight articles (Diplopoda): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
812. Gnathochilarium (Diplopoda): absent (0), present (1). Contingent on character 572: First maxilla (Mandibulata).
813. Diplosegments after the first four segments (Diplopoda). With this comes the doubling of all the anatomical features per segment. Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
814. Lateral eyes reduced to a few isolated ocelli (Penicillata): absent (0), present (1). Contingent on character 764: Compound eyes become loosely arranged ocelli [1] (Myriapoda).
815. Segmental tufts and rows of serrated setae (Penicillata): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
816. Storage of calcium salts in cuticle (Chilognatha): absent (0), present (1). Contingent on character 405: Alpha-chitin cuticle [1] (Arthropoda).
817. One pair of repugnatorial glands with poisonous secretions per diplosomite (Chilognatha): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
818. Direct sperm transfer using modified appendages (Chilognatha): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
819. Repugnatorial glands with unpaired median dorsal pores (Pentazonia): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).

820. Telopods for direct sperm transfer formed from the last appendage pair (Pentazonia): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
821. Gonopods are formed from the legs of the seventh trunk segment (Helminthomorpha): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
822. Labium from fused second maxillae, medially with glossae and paraglossae, laterally with multiarticulate labial palps (Insecta): absent (0), present (1). Contingent on character 571: Second maxilla [1] (Mandibulata).
823. Abdominal segment ten without appendages (Insecta). This is coded as absent for some Eumetabola where the penis forms from the ventral side of this segment; however, it is coded as present when it moves back onto the ninth segment in Mecoptera. Contingent on character 825: Abdomen [1] (Insecta).
824. Cerci [2] (Insecta): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
825. Abdomen [1] (Insecta). The abdomen segment number is altered within the lineage. Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
826. Thorax of three segments [1] (Insecta): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
827. 11 abdominal segments plus telson [1] (Insecta): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).
828. Coxal organs [2] (Insecta). Lost in Pterygota. They are also coded for all subtaxa of the Progoneata but as absent in the Geophilomorpha. Contingent on character 419: Arthropodium (Euarthropoda).
829. Spiracles on segments 1-8, two pairs on the meso- and metathorax [2] (Insecta): absent (0), present (1). Contingent on character 759: Trachea with spiracles [1] (Tracheata).
830. Axoneme of the sperm with "9+9+2" pattern (Insecta): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
831. Differentiation of the ovary into a germarium and a vitellarium (Insecta): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
832. Ommatidia of the compound eyes with two primary pigment cells (Insecta): absent (0), present (1). Contingent on character 429: Compound eyes uniting characters 430-432: [1] (Euarthropoda).
833. Entognathy (Entognatha): absent (0), present (1). Contingent on characters 571. Second maxilla [1] (Mandibulata), 572. First maxilla (Mandibulata), 573. Mandibles on the third head segment [1] (Mandibulata).
834. Fusion of abdominal segments 10 and 11 during embryogenesis (Diplura): absent (0), present (1). Contingent on characters 827: 11 abdominal segments plus telson [1] (Insecta).
835. Spiracles on abdominal segments 1-7 and thorax [4] (Diplura). This is also seen in males of Diptera. These independent losses were coded convergently because of the homology of the spiracles retained. Diptera are also coded as having the spiracle distribution in the insect groundplan, which are realised in the female. Contingent on characters 825: Abdomen [1] (Insecta) and on character 759: Trachea with spiracles [1] (Tracheata).
836. In both sexes, gonopores between abdominal segments eight and nine (Diplura): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).
837. Antennae have four articles (Ellipura): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
838. Fusion of the tibia and tarsus in the meso- and meta thorax appendages (Ellipura): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
839. Pretarsus with an unpaired claw (Ellipura): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).

840. Reduction of the tracheal system with restricted distribution of spiracles on the thorax (Ellipura): absent (0), present (1). Contingent on character 759: Trachaea with spiracles [1] (Tracheata).
841. Reduction of the number of ommatidia in the compound eye to a maximum of eight (Ellipura): absent (0), present (1). Contingent on character 429: Compound eyes uniting characters 430-432: [1] (Euarthropoda).
842. On hatching, eight abdominal segments (Protura): absent (0), present (1). Contingent on character 825: Abdomen.
843. Genital apparatus sunk in a deep body pocket (Protura): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
844. Evolution of the prothorax appendages into new sensory organs (Protura): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
845. Jumping apparatus of retinaculum and furcula (Collembola): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
846. Fusion of the tibia and tarsus on the prothorax (Collembola): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
847. Ventral tube (Collembola): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
848. Shortening of the abdomen to six segments (Collembola): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).
849. Concentration of the trunk ganglia to three ganglion pairs in the thorax (Collembola): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
850. One pair of spiracles in the throat with few trachaea (Collembola): absent (0), present (1). Contingent on character 759: Trachaea with spiracles [1] (Tracheata).
851. Antennae have a scapus with musculature, pedicellus and anellus [1] (Ectognatha): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
852. Johnstons organ on the pedicellus [1] (Ectognatha): absent (0), present (1). Contingent on character 851: Antennae have a scapus with musculature, pedicellus and anellus [1] (Ectognatha).
853. Subdivided tarsus (Ectognatha): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
854. Terminal filament (Ectognatha): absent (0), present (1). Contingent on characters 827: 11 abdominal segments plus telson [1] (Insecta).
855. Formation of an amniotic cavity in embryogenesis (Ectognatha): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
856. Ovipositor from gonophyses (Ectognatha). 1 = present, 2 = modified, with palps, 3 = further modified to form new structure from palps. Contingent on character 825: Abdomen [1] (Insecta).
857. Three median ocelli (Ectognatha): absent (0), present (1). Contingent on character 427: Median ocelli.
858. Hypertrophic maxillary palps (Archaeognatha): absent (0), present (1). Contingent on either characters 577: Second maxilla with palps [1] (Mandibulata), and character 576: First maxilla with palps (Mandibulata).
859. Absence of the spiracles on the first abdominal segment (Archaeognatha): absent (0), present (1). Contingent on character 759: Trachaea with spiracles [1] (Tracheata).
860. Enlarged compound eyes, medially contiguous (Archaeognatha): absent (0), present (1). Contingent on character 429: Compound eyes uniting characters 430-432: [1] (Euarthropoda).
861. Mandibles with two condyles (Dicondylia): absent (0), present (1). Contingent on character 573: Mandibles on the third head segment [1] (Mandibulata).

862. Tarsus probably of five articles (Dicondylia). This character is present in many entities - whilst they may have been reduced convergently, these independent losses were coded as a single character. Contingent on character 853: Subdivided tarsus (Ectognatha).
863. Pore of the amniotic cavity at least partly closed (Dicondylia): absent (0), present (1). Contingent on characters 855. Formation of an amniotic cavity in embryogenesis (Ectognatha).
864. Abdominal tracheae with longitudinal and transverse connections (Dicondylia): absent (0), present (1). Contingent on characters 825: Abdomen [1] (Insecta) and on character 759: Trachea with spiracles [1] (Tracheata).
865. Gonangulum - a sclerite on the ovipositor (Dicondylia): absent (0), present (1). Contingent on character 856: Ovipositor from gonophyses (Ectognatha).
866. Labial palp with a clearly broadened final article (Zygentoma): absent (0), present (1). Contingent on character 822: Labium from fused second maxillae, medially with glossae and paraglossae, laterally with multiarticulate labial palps (Insecta).
867. Paired sperm (Zygentoma): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
868. Forewings [1] (Pterygota): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
869. Hindwings [1] (Pterygota): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
870. Pleura of the wing-bearing segment elevated and strongly sclerotized (Pterygota): absent (0), present (1). Contingent on character 405: Alpha-chitin cuticle [1] (Arthropoda).
871. In the wing-bearing segments there is a thoracic endoskeleton for strengthening purposes and muscle attachment (Pterygota): absent (0), present (1). Contingent on characters 868: Forewings [1] (Pterygota) and/or 869: Hindwings [1] (Pterygota).
872. Short bristle-like flagellum of the annulated antennae in the imago (Palaeoptera): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
873. Fusion of galea and lacinia in the maxillae of the larva (Palaeoptera): absent (0), present (1). Contingent on characters 571: Second maxilla [1] (Mandibulata) and 572: First maxilla (Mandibulata).
874. Aquatic larva with a closed tracheal system (Palaeoptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
875. Small hindwings (Ephemeroptera): absent (0), present (1). Contingent on character 869: Hindwings [1] (Pterygota).
876. Subimago (Ephemeroptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
877. No food uptake in the imago [3] (Ephemeroptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
878. Tracheal gills (Ephemeroptera): absent (0), present (1). Contingent on character 759: Trachea with spiracles [1] (Tracheata).
879. Male with paired penes (Ephemeroptera): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
880. Aerostatic organ (Ephemeroptera): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
881. Larva with a labial grasping mask (Odonata): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
882. Wing propulsion apparatus with an "indirect-direct" flight mechanism (Odonata): absent (0), present (1). Contingent on characters 868: Contingent on characters 868: Forewings [1] (Pterygota) and/or 869: Hindwings [1] (Pterygota).

883. Capture of flying prey with a "capturing basket" (Odonata): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
884. Larvae with a rectal gill (Odonata): absent (0), present (1). Contingent on character 759: Trachaea with spiracles.
885. Secondary copulatory apparatus on the sternites of abdominal segments two and three (Odonata): absent (0), present (1). Contingent on character 825: Abdomen. Changed from 419: Arthropodium (Euarthropoda).
886. Pterothorax with an extreme oblique position (Zygoptera): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
887. Broad barrel-shaped head with compound eyes set far apart (Zygoptera): absent (0), present (1). Contingent on character 403: Acron and three segments form head [1] Arthropoda and character 429: Compound eyes uniting features 430-432 [1] (Euarthropoda).
888. Larva with three caudal lamellae (tracheal gills) as projections of the anal valves of the eleventh abdominal segment (Zygoptera): absent (0), present (1). Contingent on character 759: Trachaea with spiracles [1] (Tracheata) and 827: 11 segments plus telson.
889. Further development of the rectal gills to complex hindgut gills (Epiprocta): absent (0), present (1). Contingent on character 884: Larvae with a rectal gill (Odonata).
890. Abdominal claspers in the male of three elements for anchoring onto the head of the female (Epiprocta): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).
891. Eyes enlarged and close to one another (Epiprocta): absent (0), present (1). Contingent on character 429: Compound eyes uniting features 430-432 [1] (Euarthropoda).
892. Pedicellus of the antenna is flat and egg-shaped (Epiophlebioptera): absent (0), present (1). Contingent on character 851: Antennae have a scapus with musculature, pedicellus and anellus [1] (Ectognatha).
893. Larva with stridulating organs on abdominal segments (Epiophlebioptera): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).
894. Expansion of cubito anal field of the hindwing (Anisoptera): absent (0), present (1). Contingent on character 869: Hindwings [1] (Pterygota).
895. Dorsal longitudinal muscles of the flight apparatus are reduced [4] (Anisoptera): absent (0), present (1). Contingent on characters 868: Forewings [1] (Pterygota) and/or 869: Hindwings [1] (Pterygota).
896. Larva with transverse muscles in the anterior abdominal segments (Anisoptera): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).
897. Four-part penis on the secondary copulatory apparatus (Anisoptera): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa), and meiosis with a male.
898. Division of the free wing surface into the fields remigium, vannus and neala by two flexile folds-jugal and anal folds (Neoptera): absent (0), present (1). Contingent on characters 868: Forewings [1] (Pterygota) and/or 869: Hindwings [1] (Pterygota).
899. Roof-like arrangement of the folded wings over the abdomen through a pleural muscle inserted on the third pterale (axillare) of the wing joint (Neoptera): absent (0), present (1). Contingent on characters 868: Forewings [1] (Pterygota) and/or 869: Hindwings [1] (Pterygota).
900. Tarsi with three articles [4] (Plecoptera). This character is present in many entities - whilst they may have been reduced convergently we combined these independent losses into a single character. Contingent on character 853: Subdivided tarsus (Ectognatha).
901. The larva has in its thorax and abdomen segment-jumping muscle cords (Plecoptera): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).
902. Aquatic larva with tracheal gills (Plecoptera): absent (0), present (1). Contingent on character 759: Trachaea with spiracles [1] (Tracheata).

903. Gonads joined at the anterior (Plecoptera): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
904. Lateral wall of the prothorax is a uniform plate (NN_All_other_Neoptera): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
905. One male genital pore (NN_All_other_Neoptera): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa), and meiosis with a male.
906. Uniform testes (NN_All_other_Neoptera): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa), and meiosis with a male..
907. Grape-like accessory genital glands in the male (Paurometabola): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa) , and meiosis with a male..
908. Femur of the metathorax appendages enlarged (Embioptera): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
909. Cerci with a maximum of two articles (Embioptera). This character is present in many entities - whilst the number of articles may have been reduced convergently, these independent losses were combined into a single character. Contingent on character 824: Cerci [2] (Insecta).
910. Female without wings, male with wings [3][4] (Embioptera). This female-specific loss of wings occurred within Strepsiptera as well. Contingent on characters 868: Forewings [1] (Pterygota) and/or 869: Hindwings [1] (Pterygota).
911. Vannus of the hindwing reduced in the male (Embioptera): absent (0), present (1). Contingent on character 869: Hindwings [1] (Pterygota).
912. Larvae with prognathous head (Embioptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
913. Production of webs (Embioptera): absent (0), present (1). Contingent on character 914: Production of silk in the third tarsal article of the prothorax appendages (Embioptera).
914. Production of silk in the third tarsal article of the prothorax appendages (Embioptera): absent (0), present (1). Contingent on character 853: Subdivided tarsus (Ectognatha) and character 826: Thorax of three segments [1] (Insecta).
915. Forewings sclerotised (Orthopteromorpha): absent (0), present (1). Contingent on character 868: Forewings [1] (Pterygota).
916. Overlapping of the pro-, meso-, and metasternum (Blattopteriformia): absent (0), present (1). Contingent on characters 328: Segmentation (metamerism) [1] (Articulata).
917. Prognathous head (Notoptera): absent (0), present (1). Contingent on character 403: Acron and three segments form head [1] Arthropoda.
918. Sternite of the first abdominal segment with an extrusible sac (Notoptera): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
919. Asymmetric gonopods in the male (Notoptera): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
920. Low numbers of ommatidia separated from one another (Notoptera): absent (0), present (1). Contingent on character 430: Ommatidia with corneal lens [1] (Euarthropoda).
921. Female genital opening and the strongly reduced ovipositor lie in a genital chamber, which is limited ventrally by the subgenital plate (NN_All_other_Roach-like_Paurometabola): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
922. Glossae and paraglossae are fused in the labium (Dermaptera): absent (0), present (1). Contingent on character 822: Labium from fused second maxillae, medially with glossae and paraglossae, laterally with multiarticulate labial palps (Insecta).
923. Long, single-articled cerci are differentiated into a forceps-like structure (Dermaptera): absent (0), present (1). Contingent on character 824: Cerci [2] (Insecta).

924. Forewings modified into short, rigid wing covers (Dermaptera): absent (0), present (1). Contingent on character 868: Forewings [1] (Pterygota).
925. Large hindwings due to strong development of the anal field (Dermaptera): absent (0), present (1). Contingent on character 869: Hindwings [1] (Pterygota).
926. Prognathous head (Dermaptera): absent (0), present (1). Contingent on character 403: Acron and three segments form head [1] Arthropoda.
927. Ootheca formation (Dictyoptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
928. Genital pouch (Dictyoptera): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
929. Anterior appendages are differentiated into predacious legs (Mantodea): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
930. The head is freely moveable against the prothorax (Mantodea): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
931. Strongly elongated narrow prothorax with a mobile connection to the mesothorax (Mantodea): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
932. Ootheca formation in vestibulum (Blattodea): absent (0), present (1). Contingent on character 927: Ootheca formation (Dictyoptera).
933. Gonapophyses end in the vestibulum (Blattodea): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
934. Loss of the frontal ocellus in the imago [3] (Blattodea): absent (0), present (1). Contingent on character 857: Three median ocelli (Ectognatha).
935. Fusion of the labial stipites to a plate (Orthopteroidea): absent (0), present (1). Contingent on character 822: Labium from fused second maxillae, medially with glossae and paraglossae, laterally with multiarticulate labial palps (Insecta).
936. Jumping legs (Saltatoria): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
937. Tibia of the posterior appendage with two dorsal rows of teeth (Saltatoria): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
938. Tarsi with a maximum of four segments, originating through fusion of segments one and two (Saltatoria): absent (0), present (1). Contingent on character 853: Subdivided tarsus (Ectognatha).
939. Cryptopleury (Saltatoria): absent (0), present (1). Contingent on character 405: Alpha-chitin cuticle [1] (Arthropoda).
940. Spiracles of the tracheal system horizontally subdivided in the prothorax (Saltatoria): absent (0), present (1). Contingent on character 759: Trachaea with spiracles [1] (Tracheata).
941. During rest the anal field and the cubital region of the hindwings are folded underneath the remigium (Ensifera): absent (0), present (1). Contingent on character 869: Hindwings [1] (Pterygota).
942. Proventricle in the foregut with armature of six longitudinal rows of complex attachments, separated by sclerotized sections (Ensifera): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
943. Male accessory glands open into paired or unpaired gland sacs (Ensifera): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa). And meiosis with male.
944. Short antennae with few annulae (Caelifera): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
945. In the female the gonapophyses form a short, stocky ovipositor (Caelifera): absent (0), present (1). Contingent on character 856: Ovipositor from gonapophyses (Ectognatha).

946. The single-articled cerci in the male become very long and can be differentiated into grasping organs (Phasmatodea): absent (0), present (1). Contingent on character 824: Cerci.
947. Paired repugnatorial glands in the prothorax (Phasmatodea): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
948. Posterior section of the midgut with pear- or skittle-shaped glands that are furnished with a tube-like appendage (Phasmatodea): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
949. Eggs thickly shelled, with operculum (Phasmatodea): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
950. Sclerotized clasp on the jugal field of the hindwing (Eumetabola): absent (0), present (1). Contingent on character 869: Hindwings [1] (Pterygota).
951. Morphogenesis of the male genitalia from the ventral side of the tenth abdominal segment (Eumetabola): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).
952. In the ovarioles a nutritive cord is formed from the cytoskeleton of the anterior oocytes (Eumetabola): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
953. Concentration of the abdominal ventral nerves (Paraneoptera). 1 = concentration to two ganglion masses, 2 = further concentration to one abdominal ganglion mass, 3 = unification of abdominal and metathoracic masses. Contingent on character 94: Central nervous system (Bilateria).
954. Tarsi with only two articles [4] (Zoraptera). This character is present in many entities - whilst they may have been reduced convergently, these independent losses were combined into a single character. Contingent on character 853: Subdivided tarsus (Ectognatha).
955. Wings with greatly reduced simple venation (Zoraptera): absent (0), present (1). Contingent on characters 868: Forewings [1] (Pterygota) and/or 869: Hindwings [1] (Pterygota).
956. Hindwing is clearly smaller than the forewing (Zoraptera): absent (0), present (1). Contingent on characters 868: Forewings [1] (Pterygota) and 869: Hindwings [1] (Pterygota).
957. Rupture-facilitating mechanism for the antenna through cuticular modifications on the basis of the flagellum (Psocodea): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
958. Anchoring of the fore- and hindwings through a binding device (Psocodea): absent (0), present (1). Contingent on characters 868: Forewings [1] (Pterygota) and 869: Hindwings [1] (Pterygota).
959. Apparatus for the oral uptake of water vapor from the atmosphere (Psocodea): absent (0), present (1). Contingent on character 187: Anus is separate from mouth (Euspiralia).
960. Transformation of the mouthparts towards a piercing-sucking apparatus (Acercaria): absent (0), present (1). Contingent on character 572: First maxilla (Mandibulata).
961. Thin chorion with micropyles absent [2] (Psocoptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
962. Embryo dorsal in the egg [2] (Psocoptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
963. Appendages with hook structures for anchoring between feathers and in fur or hair (Phthiraptera): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
964. Ontogeny with three larval stages (Phthiraptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
965. Ectoparasite on a homeothermic vertebrate (Phthiraptera).
966. Spiracles on the mesothorax and segments 3-8 (Phthiraptera): absent (0), present (1). Contingent on character 759: Trachaea with spiracles [1] (Tracheata) and 826: Thorax of 3 segments.
967. Deposition of the eggs on the host (Phthiraptera): absent (0), present (1). Contingent on character 965: Ectoparasite on a homeothermic vertebrate (Phthiraptera).

968. Development of an egg cover (Phthiraptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
969. Compound eyes reduced to two ommatidia (Phthiraptera): absent (0), present (1). Contingent on character 430: Ommatidia with corneal lens [1] (Euarthropoda).
970. Continued development of the mouthparts into a piercing-sucking apparatus (Condylognatha): absent (0), present (1). Contingent on character 960: Transformation of the mouthparts towards a piercing-sucking apparatus (Acercaria).
971. Asymmetric mouthparts (Thysanoptera): absent (0), present (1). Contingent on character 970: Continued development of the mouthparts into a piercing-sucking apparatus (Condylognatha).
972. Pretarsus with protrusible adhesive arolium (Thysanoptera): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
973. Claws in the adult atrophied (Thysanoptera): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
974. Wings transformed into narrow bands with long setae on the edges (Thysanoptera): absent (0), present (1). Contingent on characters 868: Forewings [1] (Pterygota) and/or 869: Hindwings [1] (Pterygota).
975. Last larval stage inactive and with extensive internal reorganization (Thysanoptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
976. Only two pairs of spiracles present in the abdomen (Thysanoptera): absent (0), present (1). Contingent on characters 825: Abdomen [1] (Insecta) and on character 759: Trachea with spiracles [1] (Tracheata).
977. The maxillae are folded into one another and form a double tube (Hemiptera): absent (0), present (1). Contingent on characters 571: Second maxilla [1] (Mandibulata) and 572: First maxilla (Mandibulata).
978. The labium is differentiated into a rostrum of four articles (Hemiptera): absent (0), present (1). Contingent on character 822: Labium from fused second maxillae, medially with glossae and paraglossae, laterally with multiarticulate labial palps (Insecta).
979. Anal field of the forewings separated from the rest of the wing as a "clavus" (Hemiptera): absent (0), present (1). Contingent on character 868: Forewings [1] (Pterygota).
980. The base of the proboscis is shifted backwards to between the front coxae (Sternorrhyncha): absent (0), present (1). Contingent on character 960: Transformation of the mouthparts towards a piercing-sucking apparatus (Acercaria).
981. Bases of the wing veins radius, media and cubitus are fused (Sternorrhyncha): absent (0), present (1). Contingent on characters 868: Forewings [1] (Pterygota) and/or 869: Hindwings [1] (Pterygota).
982. Embryo with frontal carina to break egg-shell (Sternorrhyncha): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
983. Stems of the radius, media and cubitus are widely fused (Aphidomorpha): absent (0), present (1). Contingent on characters 868: Forewings [1] (Pterygota) and/or 869: Hindwings [1] (Pterygota).
984. Coxae of the posterior legs are broadened and lie close together (Psyllomorpha): absent (0), present (1). Contingent on character 828: Coxal organs. Changed from arthropodium.
985. Abdomen is stalk-like and displaced (Psyllomorpha): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).
986. Sperm pump at the entrance of the ductus ejaculatorius (Psyllomorpha): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
987. Short bristle-like flagellum on antennae [2] (Euhemiptera): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).

988. Posterior lobes of the pronotum partly cover the anterior margin of the mesonotum (Euhemiptera): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
989. Lateral mesoscutellum process connected to the mesosubulare (Euhemiptera): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
990. Manifestation of a marginal vein in the fore- and hindwings which runs around the whole edge of the wing (Cicadomorpha): absent (0), present (1). Contingent on characters 868: Forewings [1] (Pterygota) and 869: Hindwings [1] (Pterygota).
991. Apical fusion of anal veins to form a Y-vein (NN_Fulgoromorpha_Heteropteroidea): absent (0), present (1). Contingent on character 868: Forewings [1] (Pterygota).
992. Differentiation of the penis into two sections (NN_Fulgoromorpha_Heteropteroidea): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
993. Pedicellus of the antenna is greatly enlarged, with sensory structures (Fulgoromorpha): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
994. Antennae lie beneath the compound eye (Fulgoromorpha): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda) and 429: Compound eyes.
995. Coxae of the metathorax appendages are immobile (Fulgoromorpha): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
996. Lateral ocelli are adjacent to the antennae and compound eyes (Fulgoromorpha): absent (0), present (1). Contingent on character 857: Three median ocelli (Ectognatha).
997. Antennae have four articles (Heteropteroidea): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
998. The forewings lie flat on a flattened body (Heteropteroidea): absent (0), present (1). Contingent on character 868: Forewings [1] (Pterygota)
999. Head is erect (Heteropteroidea): absent (0), present (1). Contingent on character .403: Acron and three segments form head [1] Arthropoda.
1000. One-piece anal cone (Heteropteroidea): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
1001. Horseshoe-shaped sclerite at the basis of the aedeagus (Heteropteroidea): absent (0), present (1). Contingent on character 405: Alpha-chitin cuticle [1] (Arthropoda).
1002. Tergites have been reshaped into flat elements (Heteropteroidea): absent (0), present (1). Contingent on character 405: Alpha-chitin cuticle [1] (Arthropoda).
1003. Antenna are inserted hidden between the eyes and oral opening, with a propleural antennal sheath (Coleorrhyncha): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda) and 429: Compound eyes.
1004. Special structure of the frontal lobes (Coleorrhyncha). Contingent on character 403: Acron and three segments form the head [1] (Arthropoda).
1005. Hemielytra (Heteroptera): absent (0), present (1). Contingent on character 868: Forewings [1] (Pterygota).
1006. Prognathous head with a sclerotized gular region (Heteroptera): absent (0), present (1). Contingent on character .403: Acron and three segments form head [1] Arthropoda.
1007. Formation of stink glands (Heteroptera): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1008. Shortened heart with few ostia only in abdominal segments 5-8 (Gymnocerata): absent (0), present (1). Contingent on character 404: Heart with ostia (Arthropoda).
1009. Paired intersegmental sclerite between the two last antennal segments (Gymnocerata): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
1010. Corpora allata fused (Gymnocerata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).

1011. Limiting of the ileum to the pylorus region (Gymnocerata): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1012. Very small antennae with insertion under or behind the eyes (Cryptocerata): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda) and 429: Compound eyes.
1013. Aquatic lifestyle with air-bubble respiration (Cryptocerata).
1014. Subesophageal ganglion and prothoracic ganglion fused (Cryptocerata): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
1015. Spiracles 1-3 with sieve plates (Cryptocerata): absent (0), present (1). Contingent on character 759: Trachea with spiracles [1] (Tracheata).
1016. Three pair of tympanic organs on the mesothorax, metathorax and on abdominal segment one (Cryptocerata): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
1017. Endopterygote development (Holometabola): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1018. Holometabolous development (Holometabola): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1019. Degeneration of the larval stemmata and new formation of the imaginal compound eyes (Holometabola): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1020. Gula (Neuropteriformia): absent (0), present (1). Contingent on character 822: Labium from fused second maxillae, medially with glossae and paraglossae, laterally with multiarticulate labial palps (Insecta).
1021. Reduction of the paraglossae in the labium of the imago [3] (Neuropteroidea): absent (0), present (1): absent (0), present (1). Contingent on character 822: Labium from fused second maxillae, medially with glossae and paraglossae, laterally with multiarticulate labial palps (Insecta).
1022. Raptorial feeding in the larva (Neuropteroidea): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
1023. Sucking tube (laciniae) formed from the mandibles and maxillae (Planipennia): absent (0), present (1). Contingent on characters 571: Second maxilla [1] (Mandibulata), 572: First maxilla (Mandibulata), 573: Mandibles on the third head segment [1] (Mandibulata).
1024. Reduction of the tarsi to one article (Planipennia): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
1025. Abdominal spool [1] (Planipennia): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).
1026. Closure of the midgut during larval stage [3] (Planipennia): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1027. Sucking out of prey (Planipennia): absent (0), present (1). Contingent on characters 1023: Sucking tube (laciniae) formed from the mandibles and maxillae (Planipennia), 1028: Closure of the mouth to form a slit (Planipennia).
1028. Closure of the mouth to form a slit (Planipennia): absent (0), present (1). Contingent on character 187: Anus is separate from mouth (Euspiralia).
1029. Production of cocoon silk from the malpighian tubules [1] (Planipennia): absent (0), present (1). Contingent on character 763: Malpighian tubules from a pair of outgrowths of the proctodaeum at the midgut-hindgut boundary (Tracheata).
1030. Opening of the majority of the malpighian tubules into the proctodaeum (Planipennia): absent (0), present (1). Contingent on character 763: Malpighian tubules from a pair of outgrowths of the proctodaeum at the midgut-hindgut boundary (Tracheata).
1031. Modified tergite of the second abdominal segment (NN_Megaloptera_Raphidioptera): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).

1032. Cleaning behavior (NN_Megaloptera_Raphidioptera): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
1033. Racemose branching of the ovaries and a high number of ovarioles (NN_Megaloptera_Raphidioptera): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
1034. Stipes of the maxilla divided [1] (Megaloptera): absent (0), present (1). Contingent on character 572: First maxilla (Mandibulata).
1035. Aquatic larvae with long tracheal gills [1] (Megaloptera): absent (0), present (1). Contingent on character 759: Trachea with spiracles [1] (Tracheata).
1036. Third article of the tarsus of the imago broadened into a heart-shape (Raphidioptera): absent (0), present (1). Contingent on character 853: Subdivided tarsus (Ectognatha).
1037. Rostral tapering of the prognathous head capsule (Raphidioptera): absent (0), present (1). Contingent on character 403: Acron and three segments form head [1] Arthropoda.
1038. Elongation of the prothorax to a cylinder (Raphidioptera): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
1039. Derived flight mechanism - only the hindwings function in flight (Coleopteroidea): absent (0), present (1). Contingent on character 869: Hindwings [1] (Pterygota).
1040. Elytra (Coleoptera): absent (0), present (1). Contingent on character 868: Forewings [1] (Pterygota).
1041. Hindwings with a strong reduction of vein branching in the remigium (Coleoptera): absent (0), present (1). Contingent on character 869: Hindwings [1] (Pterygota).
1042. Withdrawal of the posterior end (Coleoptera): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).
1043. Protective casing over the abdomen (Coleoptera): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).
1044. Soft abdominal tergites (Coleoptera): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).
1045. Cryptopleury on the prothorax (Coleoptera): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
1046. Males have antennae of seven articles, the third article has a ventrolateral process, the fourth has an olfactory pit (Strepsiptera): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
1047. In males, the trochanter and femur of the pro- and mesothorax appendages are fused (Strepsiptera): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
1048. Males without cerci [3] (Strepsiptera): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
1049. Males have "halteres" (Strepsiptera): absent (0), present (1). Contingent on characters 868: Forewings [1] (Pterygota) and/or 869: Hindwings [1] (Pterygota).
1050. Males have fan-like hindwings (Strepsiptera): absent (0), present (1). Contingent on character 869: Hindwings [1] (Pterygota).
1051. Males have a short mesothorax and long metathorax (Strepsiptera): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
1052. Females are primitively free-living (Strepsiptera).
1053. Adult in both sexes without nutrient uptake (Strepsiptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1054. Larval parasitism (Strepsiptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).

1055. Males have a supraesophageal ganglion plus two more concentrations of ganglia ventrally (Strepsiptera): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
1056. Males have a tracheal system with two thoracic and seven abdominal spiracle pairs (Strepsiptera): absent (0), present (1): absent (0), present (1). Contingent on character 759: Trachea with spiracles [1] (Tracheata) and abdomen.
1057. Females are viviparous (Strepsiptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1058. In males, the compound eyes of the imago are taken over from the larva as stemmata (Strepsiptera): absent (0), present (1). Contingent on character 1019: Degeneration of the larval stemmata and new formation of the imaginal compound eyes (Holometabola).
1059. Appendages of the larvae with an unpaired pretarsal claw (Mecopteriformia): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
1060. Formation of the pupal cocoon from silk secreted by labial glands (Mecopteriformia): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1061. Forewings are the main flight organ (Hymenoptera): absent (0), present (1). Contingent on character 868: Forewings [1] (Pterygota).
1062. Mesothorax bears flight musculature (Hymenoptera): absent (0), present (1). Contingent on character 868: Forewings [1] (Pterygota).
1063. Retinaculum for connecting wings (Hymenoptera): absent (0), present (1). Contingent on characters 868: Forewings [1] (Pterygota) and 869: Hindwings [1] (Pterygota).
1064. Anchoring of the forewing in the resting position (Hymenoptera): absent (0), present (1). Contingent on character 868: Forewings [1] (Pterygota).
1065. Pronotum firmly connected to the mesothorax (Hymenoptera): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
1066. Abdominal segment one is fused with the mesothorax (Hymenoptera): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
1067. Tergites and sternites of the abdomen overlap like scales (Hymenoptera): absent (0), present (1). Contingent on characters 825: Abdomen [1] (Insecta), 826: Thorax of three segments [1] (Insecta).
1068. Haplo-diploid sex determination (Hymenoptera).
1069. Larval phytophagy (Hymenoptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1070. Eyes of the larvae with a single corneal lens (Hymenoptera): absent (0), present (1). Contingent on character 2: Meiosis.
1071. Labial palps of the larvae without muscles [3] (Mecopteroidea): absent (0), present (1): absent (0), present (1). Contingent on character 822: Labium from fused second maxillae, medially with glossae and paraglossae, laterally with multiarticulate labial palps (Insecta).
1072. Stipes of the larval maxillae transversly divided into basistipes and dististipes (Mecopteroidea): absent (0), present (1). Contingent on character 572: First maxilla (Mandibulata).
1073. Ovipositor is vestigial (Mecopteroidea): absent (0), present (1). Contingent on character 46: Ectoderm completely surrounds the body (Eumetazoa).
1074. Prelabium and hypopharynx are fused to a lobe from which the salivary glands open apically in the larva (Amphiesmenoptera): absent (0), present (1). Contingent on character 822: Labium from fused second maxillae, medially with glossae and paraglossae, laterally with multiarticulate labial palps (Insecta).
1075. Wings densely covered with hairs (Amphiesmenoptera). 1 = as hairs, 2 = developed as scales. Contingent on characters 868: Forewings [1] (Pterygota) and/or 869: Hindwings [1] (Pterygota).

1076. Double Y-shaped loop formation of the anal vein (Amphiesmenoptera): absent (0), present (1). Contingent on character 868: Forewings [1] (Pterygota).
1077. Paired glands in the abdomen opening in the fifth sternite (Amphiesmenoptera): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).
1078. Insertion of the ventral diaphragm muscle into the ventral nerve cord (Amphiesmenoptera): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
1079. Heterogametic female (Amphiesmenoptera): absent (0), present (1). Contingent on character 2: Meiosis.
1080. Larvae with a three-part crystalline cone [1][4][3] (Amphiesmenoptera). This was convergent in Thecostraca and both were combined into this character. Contingent on character 581: Crystalline cone in ommatidia [1] Mandibulata).
1081. Pretarsus over the claws with a pseudempodium (Amphiesmenoptera): absent (0), present (1). Contingent on character 1059: Appendages of the larvae with an unpaired pretarsal claw (Mecopteriformia).
1082. Larval antennae reduced to papillae (Trichoptera): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
1083. Mandibles are strongly reduced and without articulation (Trichoptera): absent (0), present (1). Contingent on character 573: Mandibles on the third head segment [1] (Mandibulata).
1084. Haustellum (Trichoptera): absent (0), present (1). Contingent on characters 1074: Prelabium and hypopharynx are fused to a lobe from which the salivary glands open apically in the larva (Amphiesmenoptera).
1085. Clypeolabrum (Trichoptera): absent (0), present (1). Contingent on character 418: Labrum [1] (Euarthropoda).
1086. Larval tentorium only weakly developed (Trichoptera): absent (0), present (1). Contingent on character 405: Alpha-chitin cuticle [1] (Arthropoda).
1087. Aquatic larva (Trichoptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1088. Maxillary palps of imago with flexion points between 1/2 and 3/4 (Lepidoptera): absent (0), present (1): absent (0), present (1). Contingent on either characters 576: Second maxilla with palps [1] (Mandibulata), and character 575: First maxilla with palps (Mandibulata).
1089. Maxillary palps of the larvae with less than five articles [3] (Lepidoptera): absent (0), present (1). Contingent on either characters 576: Second maxilla with palps [1] (Mandibulata), and character 575: First maxilla with palps (Mandibulata).
1090. Labial palps of imago have a group of sensilla in a depression on the end article (Lepidoptera): absent (0), present (1). Contingent on character 822: Labium from fused second maxillae, medially with glossae and paraglossae, laterally with multiarticulate labial palps (Insecta).
1091. Tibia of the prothorax appendages with epiphysse process for cleaning antennae or proboscis (Lepidoptera): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
1092. Corpotentorium with posteromedian process (Lepidoptera): absent (0), present (1). Contingent on character 405: Alpha-chitin cuticle [1] (Arthropoda).
1093. Loss of the median ocellus in the adult (Lepidoptera): absent (0), present (1). Contingent on character 857: Three median ocelli (Ectognatha).
1094. Dagger-like mandibles in the imago (Antliophora): absent (0), present (1). Contingent on character 573: Mandibles on the third head segment [1] (Mandibulata).
1095. Larval mouthparts without a lateral labral retractor, hypopharynx retractor and ventral salivarium opener [3] (Antliophora): absent (0), present (1). Contingent on character 418: Labrum [1] (Euarthropoda).

1096. Winged segments with a "posterior notal wing process" as an attachment point for pleural muscles (Antliophora): absent (0), present (1). Contingent on character 899: Roof-like arrangement of the folded wings over the abdomen through a pleural muscle inserted on the third pterale (axillare) of the wing joint (Neoptera).
1097. Absence of external labral muscles in the imago [3] (NN_Mecoptera_Siphonaptera): absent (0), present (1). Contingent on character 418: Labrum [1] (Euarthropoda).
1098. Acanthae in the proventriculus (NN_Mecoptera_Siphonaptera): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1099. Sexual dimorphism in the concentration of ventral ganglia (NN_Mecoptera_Siphonaptera). The male has one pair more than the female. Contingent on character 94: Central nervous system (Bilateria).
1100. Axoneme coiled into a spiral around the mitochondrial body in sperm (NN_Mecoptera_Siphonaptera): absent (0), present (1). Contingent on character 16: Sperm mid-section has mitochondria [1] (Metazoa).
1101. Clypeus and labrum fused to a uniform appendage (Mecoptera): absent (0), present (1). Contingent on character 418: Labrum [1] (Euarthropoda).
1102. Perineustic larva (Mecoptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1103. Short antennae (Siphonaptera): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
1104. Lateral pits on the head capsule into which the antennae can be retracted while in hair or plumage (Siphonaptera): absent (0), present (1). Contingent on character 401: Antennae on segment one [1] (Arthropoda).
1105. Piercing-sucking mouthparts for the uptake of blood with three long stylets (Siphonaptera): absent (0), present (1). Contingent on character 572: First maxilla (Mandibulata).
1106. Metathorax appendages differentiated into jumping legs (Siphonaptera): absent (0), present (1). Contingent on character 826: Thorax of three segments [1] (Insecta).
1107. Pretarsi of the appendages with very long claws (Siphonaptera): absent (0), present (1). Contingent on character 1106: Metathorax appendages differentiated into jumping legs (Siphonaptera).
1108. Larvae have no appendages or eyes [3] (Siphonaptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1109. Ctenidium (Siphonaptera): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1110. Ten abdominal segments, the last of which forms a small sensory pygidial plate with trichobothria (Siphonaptera): absent (0), present (1). Contingent on character 825: Abdomen [1] (Insecta).
1111. Body is laterally compressed (Siphonaptera): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1112. Temporary ectoparasite on warm-blooded vertebrates (Siphonaptera).
1113. Compound eyes are small and strongly modified, with one lens over many ommatidia (Siphonaptera): absent (0), present (1). Contingent on character 429: Compound eyes uniting characters 430-432: [1] (Euarthropoda).
1114. Piercing and sucking proboscis (Diptera): absent (0), present (1). Contingent on characters 418: Labrum [1] (Euarthropoda); character 573: Mandibles on the third head segment [1] (Mandibulata).
1115. Thoracic legs are absent in the larval stages [3] (Diptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1116. Hindwings become halteres (Diptera): absent (0), present (1). Contingent on character 869: Hindwings [1] (Pterygota).
1117. Larvae with a prognathous head (Diptera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).

1118. Esophagus with a long ventral diverticulum (Diptera): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1119. Closing apparatus are absent on the spiracles of larvae [3] (Diptera): absent (0), present (1). Contingent on character 759: Trachea with spiracles [1] (Tracheata).
1120. Two-layered cuticled covering the entire body with a trilamellar epicuticle and a uniform basal layer (Nemathelminthes): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1121. Cuticle in the pharynx (Nemathelminthes): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1122. Cuticularized oesophagus (Nemathelminthes): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1123. Weak subepithelial pharyngeal musculature [2] (Nemathelminthes): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1124. Brain as a nerve ring around the anterior of the pharynx [2] (Nemathelminthes): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
1125. Dorsal nerve cord [2] (Nemathelminthes). The presence of a dorsal nerve cord is coded for all Nemathelminthes. Paired and unpaired forms are coded separately as the formation of the unpaired state, either fusion or loss, is unknown. Contingent on character 94: Central nervous system (Bilateria).
1126. Band-shaped habitus [2] (Gastrotricha): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1127. Pharynx with multisarcomeric myoepithelial cells (Gastrotricha): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1128. Adhesive papillae with duo-gland adhesive system [2] (Gastrotricha): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1129. Large dorsal commissure and thin ventral commissure [2] (Gastrotricha): absent (0), present (1). Contingent on character 1124: Brain as a nerve ring around the anterior of the pharynx [2] (Nemathelminthes).
1130. Direct transfer of filiform (thread-like) sperm (Gastrotricha): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
1131. Multilamellar epicuticle in an accumulation of trilamellar individual layers [2] (Gastrotricha): absent (0), present (1). Contingent on character 1120: Two-layered cuticled covering the entire body with a trilamellar epicuticle and a uniform basal layer (Nemathelminthes).
1132. Pharynx with a triradiate lumen with orientation of one flat surface on the ventral side (Macrodasyida): absent (0), present (1). Contingent on character 1127: Pharynx with multisarcomeric myoepithelial cells (Gastrotricha).
1133. Paired pharyngeal pores are lateral in the posterior region of the pharynx for draining off excess water from particulate food (Macrodasyida): absent (0), present (1). Contingent on character 1127: Pharynx with multisarcomeric myoepithelial cells (Gastrotricha).
1134. Pharynx with triradiate lumen with orientation of an edge to the ventral side (Chaetonotida): absent (0), present (1). Contingent on character 1127: Pharynx with multisarcomeric myoepithelial cells (Gastrotricha).
1135. Cuticle has three layers (a trilamellar epicuticle, a protein-containing exocuticle and a fibrillar endocuticle) (Cycloneuralia): absent (0), present (1). Contingent on character 1120: Two-layered cuticled covering the entire body with a trilamellar epicuticle and a uniform basal layer (Nemathelminthes).

1136. Chitin in the basal, fine fibrillary layer (Cycloneuralia): absent (0), present (1). Contingent on character 1135: Cuticle has three layers (a trilamellar epicuticle, a protein-containing exocuticle and a fibrillar endocuticle) (Cycloneuralia).
1137. Repeated moltings in development (Cycloneuralia): absent (0), present (1). Contingent on character 1120: Two-layered cuticled covering the entire body with a trilamellar epicuticle and a uniform basal layer (Nemathelminthes).
1138. Nerve ring of uniform thickness [1] (Cycloneuralia): absent (0), present (1). Contingent on character 1124: Brain as a nerve ring around the anterior of the pharynx [2] (Nemathelminthes).
1139. Frontocaudal division of the brain into three sections: anterior perikarya, middle neuropil and posterior perikarya [1] (Cycloneuralia): absent (0), present (1). Contingent on character 1124: Brain as a nerve ring around the anterior of the pharynx [2] (Nemathelminthes).
1140. Close combination of the paired main longitudinal nerve cords on the ventral side (Cycloneuralia): absent (0), present (1). Contingent on character 1141: Ventral paired nerve cord [2] (Cycloneuralia).
1141. Ventral paired nerve cord [2] (Cycloneuralia): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
1142. Long, thin body (Nematoida): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1143. Chitin confined to earlier stages of development [3] (Nematoida): absent (0), present (1). Contingent on character 1136: Chitin in the basal, fine fibrillary layer (Cycloneuralia).
1144. Undulatory movements of the body (Nematoida): absent (0), present (1). Contingent on character 1142: Long, thin body (Nematoida).
1145. Dorsal and ventral inward reaching epidermal cords in which the corresponding nerve cords run (Nematoida). Loss in Gordiida is assumed with the loss of the nerve cord and the displacement of the ventral nerve cord into the body cavity. Contingent on character 1125: Dorsal nerve cord [2] (Nemathelminthes), character 1141: Ventral paired nerve cord [2] (Cycloneuralia).
1146. Ventral main nerves fused caudally (Nematoida): absent (0), present (1). Contingent on character 1141: Ventral paired nerve cord [2] (Cycloneuralia).
1147. Dorsal nerve cord is paired (Nematoida): absent (0), present (1). Contingent on character 1125: Dorsal nerve cord [2] (Nemathelminthes).
1148. Dorsal nerve cord is unpaired (Nematoida): absent (0), present (1). Contingent on character 1125: Dorsal nerve cord [2] (Nemathelminthes).
1149. Sperm with accessory centrioles [2] (Nematoida). This character is lost in this taxon but present elsewhere. Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
1150. Paired spicula in the male as anchoring organs (Nematoda): absent (0), present (1). Contingent on character 1158: Cloaca in the male (Nematoda).
1151. Lateral epidermal cords (Nematoda): absent (0), present (1). Contingent on character 1145: Dorsal and ventral inward reaching epidermal cords in which the corresponding nerve cords run (Nematoida).
1152. Postembryogenesis with four juvenile stages (Nematoda): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1153. Pharynx with triradiate Y-shaped lumen [1] (Nematoda): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1154. Ventral glands and caudal glands (Nematoda): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1155. Undulations are dorsoventral (Nematoda): absent (0), present (1). Contingent on character 1144: Undulatory movements of the body (Nematoida).

1156. Gonads have opposing orientation (Nematoda): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
1157. Vulva in the middle of the female (Nematoda): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1158. Cloaca in the male (Nematoda): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1159. Sensilla at the anterior end arranged in a 6+6+4 pattern (Nematoda): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1160. Lateral organs (Nematoda): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1161. Cuticle of adults with fibrils in a crossed arrangement (Nematomorpha): absent (0), present (1). Contingent on character 1135: Cuticle has three layers (a trilamellar epicuticle, a protein-containing exocuticle and a fibrillar endocuticle) (Cycloneuralia).
1162. Free-living larval phase (Nematomorpha): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1163. Parasitic larval phase (Nematomorpha): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1164. Larvae with two (or three) circlets of hooks (Nematomorpha): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1165. Gut with subterminal opening of the mouth (Nematomorpha): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1166. Longitudinal musculature of numerous cells, myofibrils arranged peripherally in the basal regions (Nematomorpha): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1167. Brain with internal neuropil and uniformly distributed perikarya (Nematomorpha): absent (0), present (1). Contingent on character 1124: Brain as a nerve ring around the anterior of the pharynx [2] (Nemathelminthes).
1168. Brain mainly ventral under the pharynx (Nematomorpha): absent (0), present (1). Contingent on character 1124: Brain as a nerve ring around the anterior of the pharynx [2] (Nemathelminthes).
1169. Female with gonoparenchyma [1] (Nectonema): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
1170. Male with unpaired sperm sac [1] (Nectonema): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
1171. Swim bristles, bundles of hair-like structures of the epicuticle (Nectonema): absent (0), present (1). Contingent on character 1120: Two-layered cuticled covering the entire body with a trilamellar epicuticle and a uniform basal layer (Nemathelminthes).
1172. Parenchyma (Gordiida): absent (0), present (1). Contingent on character 1120: Two-layered cuticled covering the entire body with a trilamellar epicuticle and a uniform basal layer (Nemathelminthes).
1173. Life in fresh water (Gordiida).
1174. Subepidermal displacement of the ventral cord into the body cavity (Gordiida): absent (0), present (1). Contingent on character character 1141: Ventral paired nerve cord [2] (Cycloneuralia).
1175. Cloaca in both sexes (Gordiida): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1176. Ovarian tubes with ovaries as lateral protrusions (Gordiida): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
1177. Neck [1] (Scalidophora): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1178. Abdomen [1] (Scalidophora): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).

1179. Introvert (Scalidophora): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1180. Frontal displacement of the circumpharyngeal nerve ring (Scalidophora): absent (0), present (1). Contingent on character 1124: Brain as a nerve ring around the anterior of the pharynx [2] (Nemathelminthes).
1181. Scalids arranged in 30 rows [1] (Scalidophora): absent (0), present (1). Contingent on character 1182: Scalids [1] (Scalidophora).
1182. Scalids [1] (Scalidophora). This character is subdivided to reflect similarity in Loricifera and Kinorhyncha. Priapulids have a different arrangement of scalids. Contingent on character 1179: Introvert (Scalidophora).
1183. Flosculi (Scalidophora): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
1184. Mouth cone with scalid-like sensilla (Scalidophora): absent (0), present (1). Contingent on character 1179: Introvert (Scalidophora).
1185. Larva with tessellation of the neck region (Vinctiplicata): absent (0), present (1). Contingent on character 1177: Neck [1] (Scalidophora).
1186. Abdomen of the larvae with longitudinal folded lorica (Vinctiplicata): absent (0), present (1). Contingent on character 1135: Cuticle has three layers (a trilamellar epicuticle, a protein-containing exocuticle and a fibrillar endocuticle) (Cycloneuralia).
1187. Larval stage (Vinctiplicata): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1188. Adult with urogenital system (Vinctiplicata): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa), character 98: Protonephridia of ectodermal origin [1] (Bilateria).
1189. Primary body cavity is highly expanded (Priapulida): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1190. Cuticularized oesophagus following the pharynx extends as a U-shaped turned over tissue fold into the midgut [1] (Priapulida): absent (0), present (1). Contingent on character 1121: Cuticle in the pharynx (Nemathelminthes).
1191. Strong, multicellular sphincter [1] (Priapulida): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1192. Completely dentate pharynx with cuspidate teeth (Priapulida): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1193. Simultaneous formation of new teeth in a pocket-like diverticulum at the end of the dentated pharynx (Priapulida). Contingent on character 1192: Completely dentate pharynx with cuspidate teeth (Priapulida).
1194. Closed body wall musculature in the abdomen in combination with the evolution of a novel mode of locomotion by means of peristaltic contraction waves (Priapulida): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1195. Completely unpaired state of the ventral nerve system in introvert and abdomen (Priapulida): absent (0), present (1). Contingent on character 1141: Ventral paired nerve cord [2] (Cycloneuralia).
1196. Scalids in 25 rows (Priapulida): absent (0), present (1). Contingent on character 1182: Scalids [1] (Scalidophora).
1197. Scalids with apical and lateral receptor tubules (Priapulida): absent (0), present (1). Contingent on character 1182: Scalids [1] (Scalidophora).
1198. Protonephridia - terminal cell complexes form branched solenocyte trees (Priapulida): absent (0), present (1). Contingent on character 98: Protonephridia of ectodermal origin [1] (Bilateria).

1199. Larvae with toes (Loricifera): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1200. Mobile spine with basal joint and musculature (Loricifera): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1201. Y-shaped pharynx with myoepithelium (Loricifera): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1202. Cuticularized buccal tube (Loricifera): absent (0), present (1). Contingent on character 1121: Cuticle in the pharynx (Nemathelminthes).
1203. Mouth cone at the anterior end with a retractable introvert (Loricifera): absent (0), present (1). Contingent on character 1184: Mouth cone with scalid-like sensilla (Scalidophora).
1204. Neck region with trichoscalids (Loricifera): absent (0), present (1). Contingent on character 1177: Neck [1] (Scalidophora), character 1182: Scalids [1] (Scalidophora).
1205. Adult with lorica (Loricifera): absent (0), present (1). Contingent on character 1186: Abdomen of the larvae with longitudinal folded lorica (Vinctiplicata).
1206. Spinoscalids on the introvert (Loricifera): absent (0), present (1). Contingent on character 1179: Introvert (Scalidophora), character 1182: Scalids [1] (Scalidophora).
1207. Eversible mouth cone with external and internal oral styles (Kinorhyncha): absent (0), present (1). Contingent on character 1184: Mouth cone with scalid-like sensilla (Scalidophora).
1208. Introvert and neck are invaginated upon retraction of the anterior end (Kinorhyncha): absent (0), present (1). Contingent on character 1179: Introvert (Scalidophora), character 1177: Neck [1] (Scalidophora).
1209. The first zonite of the abdomen forms a closure apparatus (Kinorhyncha): absent (0), present (1). Contingent on character 1210: Division of the abdomen into 11 zonites [1] (Kinorhyncha).
1210. Division of the abdomen into 11 zonites [1] (Kinorhyncha): absent (0), present (1). Contingent on character 1178: Abdomen [1] (Scalidophora).
1211. Cuticle of zonites 3-11 ventral with longitudinal indentation (Kinorhyncha): absent (0), present (1). Contingent on character 1210: Division of the abdomen into 11 zonites [1] (Kinorhyncha).
1212. Neck region with closure apparatus of at least 14 placids (Kinorhyncha): absent (0), present (1). Contingent on character 1177: Neck [1] (Scalidophora).
1213. Six juvenile stages in development (Kinorhyncha): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1214. Zonites 1-10 with paired lateral spines and an unpaired dorsal spine. Zonite 11 has two pairs of lateral spines and a posterior spine (Kinorhyncha): absent (0), present (1). Contingent on character 1210: Division of the abdomen into 11 zonites [1] (Kinorhyncha).
1215. Pharynx with multilamellar epicuticle (Kinorhyncha): absent (0), present (1). Contingent on character 1121: Cuticle in the pharynx (Nemathelminthes).
1216. Midgut with monociliary sensomotory cells (Kinorhyncha): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1217. Hindgut with a slit-like, transverse lumen (Kinorhyncha): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1218. Paired dorsoventral and periperical longitudinal muscles [1] (Kinorhyncha): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1219. Subepithelial musculature cells with circular muscles and radial muscles joined together in a regular, alternating pattern (Kinorhyncha): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1220. Paired ganglia in zonites [2] (Kinorhyncha): absent (0), present (1). Contingent on character 1210: Division of the abdomen into 11 zonites [1] (Kinorhyncha).

1221. Penile spine [2] (Kinorhyncha): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1222. Seminal receptacle in female and genital pores on last zonite [2] (Kinorhyncha): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
1223. Spinoscalids [2] (Kinorhyncha): absent (0), present (1). Contingent on character 1182: Scalids [1] (Scalidophora).
1224. Trichoscalids [2] (Kinorhyncha): absent (0), present (1). Contingent on character 1182: Scalids [1] (Scalidophora).
1225. Two pairs of protonephridia [2] (Kinorhyncha): absent (0), present (1). Contingent on character 98: Protonephridia of ectodermal origin [1] (Bilateria).
1226. Mastax with seven extracellular hard parts joined by ligaments (trophi) [2] (Syndermata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1227. Primary body cavity in the form of cavities between skin and gut in which organs lie (Syndermata): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1228. Insertion of the cilium at the anterior end of the sperm (Syndermata): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
1229. Head ciliation [2] (Syndermata): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1230. Syncytial epidermis (Syndermata): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1231. Intrasyncytial thickenings in periphery of epidermis (Syndermata): absent (0), present (1). Contingent on character 1230: Syncytial epidermis (Syndermata).
1232. Canals as infoldings of the outer cell membrane penetrate the intrasyncytial thickenings and run in the underlying cytoplasm (Syndermata): absent (0), present (1). Contingent on character 1232: Intrasyncytial thickenings in periphery of epidermis (Syndermata).
1233. Differentiation of the ovary into germarium and vitellarium (Rotifera): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
1234. Filtration structure of the protonephridium with longitudinal slits (Rotifera): absent (0), present (1). Contingent on character 98: Protonephridia of ectodermal origin [1] (Bilateria).
1235. Unpaired germovitellarium (Monogononta): absent (0), present (1). Contingent on character 1233: Differentiation of the ovary into germarium and vitellarium (Rotifera).
1236. Fluke-like locomotion (Bdelloida).
1237. Wheel organ of two disks of cilia that represent differentiation products of the ventral buccal field (Bdelloida): absent (0), present (1). Contingent on character 1229: Head ciliation [2] (Syndermata).
1238. Purely parthenogenetic reproduction with complete reduction of the male (Bdelloida): absent (0), present (1). Contingent on character 1: Mitosis in somatic cells (Eukaryota).
1239. Epibiotic way of life [1] (Seison_Acanthocephalan_stem): absent (0), present (1). Contingent on character 1240: Feeding by sucking uptake of bacteria and haemolymph from the body of the host organism [1] (Seison_Acanthocephalan_stem), character 1241: Modeling of the rami of the masticatory apparatus to a suction tube [1] (Seison_Acanthocephalan_stem).
1240. Feeding by sucking uptake of bacteria and haemolymph from the body of the host organism [1] (Seison_Acanthocephalan_stem): absent (0), present (1). Contingent on character 1241: Modeling of the rami of the masticatory apparatus to a suction tube [1] (Seison_Acanthocephalan_stem).
1241. Modeling of the rami of the masticatory apparatus to a suction tube [1] (Seison_Acanthocephalan_stem): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).

1242. Sperm with dense bodies (Seison_Acanthocephalan_stem): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
1243. Filament bundles in the epidermal syncytium (Seison_Acanthocephalan_stem): absent (0), present (1). Contingent on character 1231: Syncytial epidermis (Syndermata).
1244. Spermatophores formed by a glandular organ (Seison): absent (0), present (1). Contingent on character 14: Spermatogenesis: four structurally identical sperm from one spermatocyte (Metazoa).
1245. Protonephridia with extensive supporting structures in the canal region (Seison): absent (0), present (1). Contingent on character 98: Protonephridia of ectodermal origin [1] (Bilateria).
1246. Trunk [1] (Acanthocephala): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1247. Presoma [1] (Acanthocephala): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1248. Proboscis hooks which are derivatives of the ECM under the epidermis (Acanthocephala): absent (0), present (1). Contingent on character 23: Extracellular matrix with collagen fibrils (Metazoa).
1249. Ligament sacs (Acanthocephala): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
1250. An extensive lacunar system runs through the epidermis (Acanthocephala): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1251. Acanthor develops in ovarian balls (Acanthocephala): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
1252. Acanthor with complete syncytial organization (Acanthocephala): absent (0), present (1). Contingent on character 1252: Acanthor develops in ovarian balls (Acanthocephala).
1253. Parasite with an arthropod as an intermediary host [1] (Acanthocephala): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1254. Parasite with a vertebrate as a final host [1] (Acanthocephala): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1255. Syncytial circomyarian muscle cords (Acanthocephala): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1256. Central musculature as antagonist on movement of the proboscis (Acanthocephala): absent (0), present (1). Contingent on character 1247: Presoma [1] (Acanthocephala).
1257. Retinacula (Acanthocephala): absent (0), present (1). Contingent on character 1256: Central musculature as antagonist on movement of the proboscis (Acanthocephala).
1258. Cerebral ganglion in a ventral position (Acanthocephala): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
1259. Sexual dimorphism (Acanthocephala): absent (0), present (1). Contingent on character 2: Meiosis (Metazoa).
1260. Uterine bell and vagina [1] (Acanthocephala): absent (0), present (1). Contingent on character 1260: Sexual dimorphism (Acanthocephala).
1261. Cement glands [1] (Acanthocephala): absent (0), present (1). Contingent on character 1262: Penis [1] (Acanthocephala).
1262. Penis [1] (Acanthocephala): absent (0), present (1). Contingent on character 1260: Sexual dimorphism (Acanthocephala).
1263. Bursa [1] (Acanthocephala): absent (0), present (1). Contingent on character 1262: Penis [1] (Acanthocephala).
1264. In the female the ovaries decompose into single balls [1] (Acanthocephala): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
1265. Lemnisci - two long ingrowths of the presomal epidermis (Acanthocephala): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).

1266. Inner frontal band of cilia rows [1] (Radialia). 0 = absent, 1 = monociliated, 2 = multiciliated. Contingent on character 1268: Lophophore with two arms bearing tentacles [1] (Radialia).
1267. Laterofrontal row of cilia [1] (Radialia). 0 = absent, 1 = monociliated, 2 = multiciliated. Contingent on character 1268: Lophophore with two arms bearing tentacles [1] (Radialia).
1268. Lophophore with two arms bearing tentacles [1] (Radialia): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1269. Mesosome [1] (Radialia): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1270. Metasome [1] (Radialia): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1271. Subdivision of the coelom into mesocoel and metacoel [1] (Radialia): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1272. Blood vessel system (Radialia): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1273. Planktotrophic larvae (Radialia). Lost in Phylactolaemata, Cyclostomata, Brachiopoda, Rhabdopleura, Cephalodisca and Crinoida. Contingent on character 13: Ontogenesis (Metazoa).
1274. Two lateral cilia-rich longitudinal bands [1] (Radialia): absent (0), present (1). Contingent on character 1268: Lophophore with two arms bearing tentacles [1] (Radialia).
1275. Metanephridia pair (Radialia): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1276. Larvae with attachment sac [1] (Bryozoa): absent (0), present (1). Contingent on character 1273: Planktotrophic larvae (Radialia).
1277. Cystid [1] (Bryozoa): absent (0), present (1). Contingent on character 21: Somatic differentiation.
1278. Polypid [1] (Bryozoa): absent (0), present (1). Contingent on character 21: Somatic differentiation.
1279. Funiculus. A separate individual organ is present in each zooid [1] (Bryozoa): absent (0), present (1). Contingent on character 1271: Subdivision of the coelom into mesocoel and metacoel [1] (Radialia).
1280. Cyphonautes larva in bivalved shell [1] (Bryozoa): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1281. Sessile colony, from budding (Bryozoa): absent (0), present (1). Contingent on character 1280: Cyphonautes larva in bivalved shell [1] (Bryozoa).
1282. Larvae with vestibulum [1] (Bryozoa): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1283. Pharynx with triradiate lumen [1] (Bryozoa): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1284. Myoepithelial pharynx wall [1] (Bryozoa): absent (0), present (1). Contingent on character 1283: Pharynx with triradiate lumen [1] (Bryozoa).
1285. Funiculus with longitudinal muscles [1] (Bryozoa): absent (0), present (1). Contingent on character 1279: Funiculus. A separate individual organ is present in each zooid [1] (Bryozoa).
1286. Apical organ linked to pear-shaped tactile organ in larva [1] (Bryozoa): absent (0), present (1). Contingent on character 1280: Cyphonautes larva in bivalved shell [1] (Bryozoa).
1287. Development of young colonies in the embryo sacs of adult organisms (Phylactolaemata): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1288. Asexual formation of statoblasts on the funiculus to survive periods of unfavorable weather (Phylactolaemata): absent (0), present (1). Contingent on character 1279: Funiculus. A separate individual organ is present in each zooid [1] (Bryozoa).
1289. Freshwater inhabitants (Phylactolaemata).

1290. Ring-shaped, closed crown of tentacles around the opening of the mouth (Gymnolaemata): absent (0), present (1). Contingent on character 1268: Lophophore with two arms bearing tentacles [1] (Radialia).
1291. Calcification of the body wall (Bryozoa_Cyclostomata): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1292. Metacoel as a membranous sac lifted from the cystid wall (Bryozoa_Cyclostomata): absent (0), present (1). Contingent on character 1271: Subdivision of the coelom into mesocoel and metacoel [1] (Radialia).
1293. Primary body cavity between the metacoel and body wall (Bryozoa_Cyclostomata): absent (0), present (1). Contingent on character 1271: Subdivision of the coelom into mesocoel and metacoel [1] (Radialia).
1294. Lecithotrophic larvae develop under polyembryony in the zooids (Bryozoa_Cyclostomata): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1295. Gonozooids (Bryozoa_Cyclostomata): absent (0), present (1). Contingent on character 2: Meiosis (Metazoa).
1296. Circular muscles on outside wall of the metacoel (Bryozoa_Cyclostomata): absent (0), present (1). Contingent on character 1271: Subdivision of the coelom into mesocoel and metacoel [1] (Radialia).
1297. Closing apparatus at the opening of the cystid (Eurystomata): absent (0), present (1). Contingent on character 1277: Cystid [1] (Bryozoa).
1298. Branched funiculus vessels (Eurystomata): absent (0), present (1). Contingent on character 1279: Funiculus. A separate individual organ is present in each zooid [1] (Bryozoa).
1299. Parietal muscles passing through the cystid control the cystid's extension (Eurystomata): absent (0), present (1). Contingent on character 1277: Cystid [1] (Bryozoa).
1300. Cellular rosettes occupy the pores in the cystid wall between zooids (Eurystomata): absent (0), present (1). Contingent on character 1277: Cystid [1] (Bryozoa).
1301. Collar as closing apparatus that protrudes from the diaphragm (Ctenostomata): absent (0), present (1). Contingent on character 1277: Cystid [1] (Bryozoa).
1302. Opening of the cystid is closable with a mobile operculum (Cheilostomata): absent (0), present (1). Contingent on character 1277: Cystid [1] (Bryozoa).
1303. At least the vertical zooid walls are calcified (Cheilostomata): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1304. Radial arrangement of larval tentacles (Phoronida): absent (0), present (1). Contingent on character 1268: Lophophore with two arms bearing tentacles [1] (Radialia).
1305. Umbrella-like episphere (Phoronida): absent (0), present (1). Contingent on character 1273: Planktotrophic larvae (Radialia).
1306. Metasome diverticulum as an invagination of the ventral side of the larva in the region of the mesosome/metasome boundary (Phoronida): absent (0), present (1). Contingent on character 1270: Metasome [1] (Radialia).
1307. Actinotroch (Phoronida): absent (0), present (1). Contingent on character 1273: Planktotrophic larvae (Radialia).
1308. Metamorphosis (Phoronida): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1309. Unpaired median tentacle in early growth [2] (Brachiopoda): absent (0), present (1). Contingent on character 1268: Lophophore with two arms bearing tentacles [1] (Radialia).
1310. Pedicle (Brachiopoda): absent (0), present (1). Contingent on character 21: Somatic differentiation.
1311. Shell with dorsal and ventral valves as a product of the corresponding mantle folds [1] (Brachiopoda): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).

1312. Shell is uniform with flat valves [1] (Brachiopoda): absent (0), present (1). Contingent on character 1311: Shell with dorsal and ventral valves as a product of the corresponding mantle folds [1] (Brachiopoda).
1313. Shell is composed of calcium carbonate plus protein [1] (Brachiopoda): absent (0), present (1). Contingent on character 1311: Shell with dorsal and ventral valves as a product of the corresponding mantle folds [1] (Brachiopoda).
1314. Larval setal bundles [1] (Brachiopoda): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1315. Adult setae in rows [1] (Brachiopoda): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1316. Calcium phosphate shell with chitin [2] (Brachiopoda): absent (0), present (1). Contingent on character 1311: Shell with dorsal and ventral valves as a product of the corresponding mantle folds [1] (Brachiopoda).
1317. Lecithotrophic swimming larva (Brachiopoda): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1318. Planktonic swimming larvae [2] (Brachiopoda): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1319. Displacement of the gonads to the peripheral canals under the shell [2] (Brachiopoda): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
1320. Long pedicle (Lingulida): absent (0), present (1). Contingent on character 1310: Pedicle (Brachiopoda).
1321. Shortened stalk that emerges from a slit in the ventral valve (Discinida): absent (0), present (1). Contingent on character 1310: Pedicle (Brachiopoda).
1322. Adhesion of the ventral valve through a thickened epithelial region with microvilli (Craniida): absent (0), present (1). Contingent on character 1311: Shell with dorsal and ventral valves as a product of the corresponding mantle folds [1] (Brachiopoda).
1323. Hinge at the posterior end of the shell (Testicardines): absent (0), present (1). Contingent on character 1311: Shell with dorsal and ventral valves as a product of the corresponding mantle folds [1] (Brachiopoda).
1324. Hole or foramen for the emergence of the stalk in the ventral overhanging shell (Testicardines): absent (0), present (1). Contingent on character 1310: Pedicle (Brachiopoda).
1325. Rostrally directed reflection of the mantle valves during or after metamorphosis (Testicardines): absent (0), present (1). Contingent on character 1311: Shell with dorsal and ventral valves as a product of the corresponding mantle folds [1] (Brachiopoda).
1326. Protosome [1] (Deuterostomia): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1327. Protoel [1] (Deuterostomia): absent (0), present (1). Contingent on character 1326: Protosome [1] (Deuterostomia).
1328. Axial complex in protosome with heart, pericardium and glomerulus with podocytes (Deuterostomia): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1329. Blastopore turns into anus (Deuterostomia): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1330. Dipleurula (Deuterostomia): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1331. Pentamery with five radii and five interradii (Echinodermata): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).

1332. Water-vascular system (Echinodermata): absent (0), present (1). Contingent on character 1327: Protocoel [1] (Deuterostomia).
1333. Calcite-secreting stereoblasts [1] (Echinodermata). Stereoblasts are a feature of all echinoderm classes, whilst the stereom is reduced in Holothuroidea to microsclerites. Contingent on character 21: Somatic differentiation (Metazoa).
1334. Stereom from calcitic sclerites (Echinodermata): absent (0), present (1). Contingent on character 1333: Calcite-secreting stereoblasts [1] (Echinodermata).
1335. Mutable collagenous tissue (Echinodermata): absent (0), present (1). Contingent on character 23: Extracellular matrix with collagen fibrils (Metazoa).
1336. Primarily five arms with arm sections on the edge of the calyx [1] (Crinoida): absent (0), present (1). Contingent on character 1331: Pentamery with five radii and five interradii (Echinodermata).
1337. Crown [1] (Crinoida): absent (0), present (1). Contingent on character 1336: Primarily five arms with arm sections on the edge of the calyx [1] (Crinoida).
1338. Calyx with oral tegmen and theca [1] (Crinoida): absent (0), present (1). Contingent on character 1337: Crown [1] (Crinoida).
1339. Stalk with columnalia [1] (Crinoida): absent (0), present (1). Contingent on character 1337: Crown [1] (Crinoida).
1340. Chambered organ [1] (Crinoida): absent (0), present (1). Contingent on character 1331: Pentamery with five radii and five interradii (Echinodermata).
1341. Protocoel and left mesocoel are fused in the calyx to a labyrinth of communicating clefts [1] (Crinoida): absent (0), present (1). Contingent on character 1327: Protocoel [1] (Deuterostomia).
1342. Unpaired pore of the protocoel of the larva has multiplied in the adult to numerous, separate hydropores which open orally [1] (Crinoida): absent (0), present (1). Contingent on character 1327: Protocoel [1] (Deuterostomia).
1343. Numerous stone canals arise from the ring vessels of the mesocoel and open in the left metacoel [1] (Crinoida): absent (0), present (1). Contingent on character 1341: Protocoel and left mesocoel are fused in the calyx to a labyrinth of communicating clefts [1] (Crinoida).
1344. Doliolaria with ciliated strips [1] (Crinoida). Loss of planktotrophic and dipleura with the gain of this lecithotrophic life stage. Contingent on character 13: Ontogenesis (Metazoa).
1345. Sessility with anchor on stalk [2] (Crinoida). This feature is discussed as correlated with, but evolving before the stalk in the stem of echinoderms, so was coded separately. Contingent on character 1339: Stalk with columnalia [1] (Crinoida).
1346. Canal-like genital coelom in arms and pinnulae [1] (Crinoida): absent (0), present (1). Contingent on character 1336: Primarily five arms with arm sections on the edge of the calyx [1] (Crinoida).
1347. Gonads opposed to each other (Crinoida): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
1348. Pinnules as finger-like appendices with alternating insertion on the sides of the arms [1] (Crinoida): absent (0), present (1). Contingent on character 1336: Primarily five arms with arm sections on the edge of the calyx [1] (Crinoida).
1349. Conically running ambulacral tube foot (Eleutherozoa): absent (0), present (1). Contingent on character 1332: Water-vascular system (Echinodermata).
1350. Oral side oriented to the ground (Eleutherozoa): absent (0), present (1). Contingent on character 1331: Pentamery with five radii and five interradii (Echinodermata).
1351. Motile spines (Eleutherozoa): absent (0), present (1). Contingent on character 1333: Calcite-secreting stereoblasts [1] (Echinodermata). Stereoblasts are a feature of all echinoderm classes, whilst the stereom is reduced in Holothuroidea to microsclerites.
1352. Madreporic plate (aboral) (Eleutherozoa): absent (0), present (1). Contingent on character 1335: Stereom from calcitic sclerites (Echinodermata).

1353. Polian vesicles (Eleutherozoa): absent (0), present (1). Contingent on character 1332: Water-vascular system (Echinodermata).
1354. Supply of the ambulacral tube feet by lateral branches of radial canals (Eleutherozoa): absent (0), present (1). Contingent on character 1332: Water-vascular system (Echinodermata).
1355. Bipinnaria larva with separated preoral ciliary band (Asterozoa). This was interpreted as a modified dipleurula, so this is still coded as present for Asterozoa. Contingent on character 1330: Dipleurula (Deuterostomia).
1356. Paired intestinal diverticula in the arms (Asterozoa): absent (0), present (1). Contingent on character 1331: Pentamery with five radii and five interradia (Echinodermata).
1357. Gonads extend into the arms (Asterozoa): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
1358. Light-sensory organ at the tips of the arms (Asterozoa): absent (0), present (1). Contingent on character 1331: Pentamery with five radii and five interradia (Echinodermata).
1359. Epineural canals in the arms, with radial nerves enclosed in the aboral wall (Cryptosyringida): absent (0), present (1). Contingent on character 1331: Pentamery with five radii and five interradia (Echinodermata).
1360. Habitus: five thin arms separate from a round central disc (Ophiurozoa): absent (0), present (1). Contingent on character 1331: Pentamery with five radii and five interradia (Echinodermata).
1361. Vertebrae or vertebral ossicles in the arms [1] (Ophiurozoa): absent (0), present (1). Contingent on character 1335: Stereom from calcitic sclerites (Echinodermata).
1362. Calcareous plates in the periphery of the arms (Ophiurozoa): absent (0), present (1). Contingent on character 1335: Stereom from calcitic sclerites (Echinodermata).
1363. Aboral-oral transfer of the madreporic plate (Ophiurozoa): absent (0), present (1). Contingent on character 1352: Madreporic plate (aboral) (Eleutherozoa).
1364. Ophiopluteus (Ophiurozoa): absent (0), present (1). Contingent on character 1330: Dipleurula (Deuterostomia).
1365. Muscles to link vertebral ossicles [1] (Ophiurozoa): absent (0), present (1). Contingent on character 1361: Vertebrae or vertebral ossicles in the arms [1] (Ophiurozoa).
1366. Ambulacral tube feet with an adhesive disk (Echinozoa): absent (0), present (1). Contingent on character 1349: Conically running ambulacral tube foot (Eleutherozoa).
1367. Habitus: the oral side is extended, with ambulacra under the aboral bulging and the aboral surface is reduced (Echinozoa): absent (0), present (1). Contingent on character 1331: Pentamery with five radii and five interradia (Echinodermata).
1368. Well-developed haemal system with rete mirabile (Echinozoa): absent (0), present (1). Contingent on character 47: Endoderm [1] (Eumetazoa).
1369. Internal skeletal system about the oesophagus (Echinozoa): absent (0), present (1). Contingent on character 1333: Calcite-secreting stereoblasts [1] (Echinodermata). Stereoblasts are a feature of all echinoderm classes, whilst the stereom is reduced in Holothurozoa to microsclerites.
1370. Sclerites on the ambulacral tube foot (Echinozoa): absent (0), present (1). Contingent on character 1349: Conically running ambulacral tube foot (Eleutherozoa).
1371. Perianal coelom (Echinozoa): absent (0), present (1). Contingent on character 1329: Blastopore turns into anus (Deuterostomia).
1372. Apical system of ten calcareous plates [1] (Echinoida). The apical system is complex and our subdivision into only two characters seems very conservative. Contingent on character 1335: Stereom from calcitic sclerites (Echinodermata).
1373. Aristotle's lantern of 40 calcareous elements [1] (Echinoida). This character was subdivided into the muscular and skeletal complexes. The system is complex and coding of only two characters here

- seems very conservative. Contingent on character 1369: Internal skeletal system about the oesophagus (Echinozoa).
1374. Perignathic girdle (Echinoida): absent (0), present (1). Contingent on character 1369: Internal skeletal system about the oesophagus (Echinozoa).
 1375. Corona. This is a rigid globular armour of ten calcareous plates (Echinoida): absent (0), present (1). Contingent on character 1331: Pentamery with five radii and five interradial plates (Echinodermata).
 1376. Peristome (Echinoida): absent (0), present (1). Contingent on character 1375: Corona.
 1377. Two pores per ambulacral tube foot in the ambulacral plates which connect to internal ampulla by two canals (Echinoida): absent (0), present (1). Contingent on character 1349: Conically running ambulacral tube foot (Eleutherozoa).
 1378. Periproct - membrane around the anus [1] (Echinoida): absent (0), present (1). Contingent on character 1372: Apical system of ten calcareous plates [1] (Echinoida). The apical system is complex and our subdivision into only two characters seems very conservative
 1379. Echinopluteus with eight arms (Echinoida): absent (0), present (1). Contingent on character 1330: Dipleurula (Deuterostomia).
 1380. Lantern muscular system of 60 elements [1] (Echinoida): absent (0), present (1). Contingent on character 1373: Aristotle's lantern of 40 calcareous elements [1] (Echinoida).
 1381. Socket-joint lantern (Cidaroida): absent (0), present (1). Contingent on character 1380: Lantern muscular system of 60 elements [1] (Echinoida).
 1382. Firm connection of pyramid halves over their length (Cidaroida): absent (0), present (1). Contingent on character 1380: Lantern muscular system of 60 elements [1] (Echinoida).
 1383. Interambulacral auricle (Euechinoida): absent (0), present (1). Contingent on character 1374: Perignathic girdle (Echinoida).
 1384. Gills (Euechinoida): absent (0), present (1). Contingent on character 1369: Internal skeletal system about the oesophagus (Echinozoa) since the 'gills' compensate for the movement of the lantern in and out of the test during feeding.
 1385. Sphaeridia (Euechinoida): absent (0), present (1). Contingent on character 1351: Motile spines (Eleutherozoa).
 1386. Tentacles formed from ambulacral feet (Holothuroida): absent (0), present (1). Contingent on character 1349: Conically running ambulacral tube foot (Eleutherozoa).
 1387. Peripheral microsclerites (Holothuroida): absent (0), present (1). Contingent on character 1333: Calcite-secreting stereoblasts [1] (Echinodermata). Stereoblasts are a feature of all echinoderm classes, whilst the stereom is reduced in Holothuroidea to microsclerites.
 1388. Calcareous ring around the pharynx (Holothuroida): absent (0), present (1). Contingent on character 1333: Calcite-secreting stereoblasts [1] (Echinodermata). Stereoblasts are a feature of all echinoderm classes, whilst the stereom is reduced in Holothuroidea to microsclerites.
 1389. Auricularia larvae [2] (Holothuroida): absent (0), present (1). Contingent on character 1330: Dipleurula (Deuterostomia).
 1390. Peripheral circular and longitudinal musculature. Longitudinal muscles are in five separate bands in radii of the body (Holothuroida): absent (0), present (1). Contingent on character 21: Somatic differentiation.
 1391. Respiratory trees (Holothuroida): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
 1392. Head [1] (Stomochordata): absent (0), present (1). Contingent on character 1326: Protosome [1] (Deuterostomia).
 1393. Collar [1] (Stomochordata): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).

1394. Shield-shaped expansion on ventral side of head [2][1] (Stomochordata): absent (0), present (1). Contingent on character 1392: Head [1] (Stomochordata).
1395. Stomochord (Stomochordata): absent (0), present (1). Contingent on character 1326: Protosome [1] (Deuterostomia).
1396. Colonial organisms in coenecia (Stomochordata): absent (0), present (1). Contingent on character 23: Extracellular matrix with collagen fibrils (Metazoa).
1397. Lecithotrophic larva (Rhabdopleura): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1398. Vertical dwelling tube of regular rings (Rhabdopleura): absent (0), present (1). Contingent on character 1397: Colonial organisms in coenecia (Stomochordata).
1399. Zooids of the colony are linked life-long. (Rhabdopleura): absent (0), present (1). Contingent on character 1397: Colonial organisms in coenecia (Stomochordata).
1400. Unpaired gonad (Rhabdopleura): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
1401. Filter apparatus consisting of several arms with tentacles (Pharyngotremata): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1402. Gill slits (Pharyngotremata): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1403. Lecithotrophic larva (Cephalodiscida): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1404. Branchial region of the trunk (Cyrtotreta): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1405. Mucociliary mechanism for feeding (Cyrtotreta): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1406. Supporting skeleton for the stomochord (Enteropneusta): absent (0), present (1). Contingent on character 1396: Stomochord (Stomochordata).
1407. Tornaria with telotroch (Enteropneusta): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1408. Subepidermal dorsal nerve cord (Enteropneusta): absent (0), present (1). Contingent on character 1394: Trunk [1] (Stomochordata).
1409. Entodermal chorda dorsalis beneath the neural tube (Chordata): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1410. Freely moving larva with undulating tail [1] (Chordata): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1411. Sessile adult [1] (Chordata): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1412. Branchial gut as feeding apparatus for taking up particulate food from free water in the adult (Chordata): absent (0), present (1). Contingent on character 1406: Mucociliary mechanism for feeding (Cyrtotreta).
1413. Ectodermal neural tube in its entire length under the dorsal side (Chordata): absent (0), present (1). Contingent on character 94: Central nervous system (Bilateria).
1414. Neural tube differentiated into brain anteriorly [1] (Chordata): absent (0), present (1). Contingent on character 1414: Ectodermal neural tube in its entire length under the dorsal side (Chordata).
1415. Periodic reversal of heart beat - heart formed from infolding of the wall of the pericardium (Tunicata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1416. Tunica (mantle) with tunicin fibers and free cells (Tunicata): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).

1417. Existence in pelagic zone (Pelagotunicata).
1418. Displacement of the egestion opening to the posterior end (Pelagotunicata): absent (0), present (1). Contingent on character 1413: Branchial gut as feeding apparatus for taking up particulate food from free water in the adult (Chordata).
1419. Alternation between sexual reproduction and vegetative propagation (Pelagotunicata): absent (0), present (1). Contingent on character 2: Meiosis (Metazoa).
1420. Cylindrical colonies of blastozooids (Pyrosomida): absent (0), present (1). Contingent on character 1420: Alternation between sexual reproduction and vegetative propagation (Pelagotunicata).
1421. Regression of the oozoid generation (Pyrosomida): absent (0), present (1). Contingent on character 1420: Alternation between sexual reproduction and vegetative propagation (Pelagotunicata).
1422. Paired light organs (Pyrosomida): absent (0), present (1). Contingent on character 21: Somatic differentiation.
1423. Viviparous oozoid (Salpida): absent (0), present (1). Contingent on character 13: Ontogenesis.
1424. Colonial blastozooids (Salpida): absent (0), present (1). Contingent on character 1420: Alternation between sexual reproduction and vegetative propagation (Pelagotunicata).
1425. Two gill slits separated by a medial bar (Salpida): absent (0), present (1). Contingent on character 1403: Gill slits (Pharyngotremata).
1426. Periodic sloughing of the cuticle (Doliolida_Appendicularia): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1427. Oozoids with statocyst (Doliolida): absent (0), present (1). Contingent on character 1420: Alternation between sexual reproduction and vegetative propagation (Pelagotunicata).
1428. Three generations of blastozooids (Doliolida): absent (0), present (1). Contingent on character 1420: Alternation between sexual reproduction and vegetative propagation (Pelagotunicata).
1429. Adoption of the gonads and pharyngeal filter system by the larvae (Appendicularia): absent (0), present (1). Contingent on character 13: Ontogenesis.
1430. Gelatinous filter house with new filter apparatus (Appendicularia): absent (0), present (1). Contingent on character 1413: Branchial gut as feeding apparatus for taking up particulate food from free water in the adult (Chordata).
1431. Extensive circulatory system with veins and arteries (Vertebrata): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1432. Adoption of gonads by larvae to form a small adult (Vertebrata): absent (0), present (1). Contingent on character 13: Ontogenesis.
1433. Adoption of the gill apparatus with gill slits and endostyle that continues to produce an endless mucous filter by larva (Vertebrata). This is coded as absent in the craniotes as it is no longer used for feeding. Contingent on character 1413: Branchial gut as feeding apparatus for taking up particulate food from free water in the adult (Chordata).
1434. Extension of the chorda dorsalis from the tail of the larva to the back of the entire body (Vertebrata): absent (0), present (1). Contingent on character 1410: Entodermal chorda dorsalis beneath the neural tube (Chordata).
1435. Polymery under incorporation of the chorda dorsalis in a metameric musculature (Vertebrata): absent (0), present (1). Contingent on character 1410: Entodermal chorda dorsalis beneath the neural tube (Chordata).
1436. Formation of dorsal spinal nerves per segment (Vertebrata): absent (0), present (1). Contingent on character 1436: Polymery under incorporation of the chorda dorsalis in a metameric musculature (Vertebrata).
1437. Tight junctions [1] (Vertebrata). The plesiomorphic form seems to have been septate junctions, present in invertebrates Ax states that this is a vertebrate autapomorphy which, in his definition, includes cephalochordates. Contingent on character 21: Somatic differentiation (Metazoa).

1438. Endopsammic lifestyle (Acrania).
1439. Pelagic youth stage (Acrania): absent (0), present (1). Contingent on character 13: Ontogenesis (Metazoa).
1440. Oral cirri (Acrania). Primary filter-feeding device. Contingent on character 1413: Branchial gut as feeding apparatus for taking up particulate food from free water in the adult (Chordata).
1441. Subdivision of the splanchnocoel in the region of the branchial gut (Acrania): absent (0), present (1). Contingent on character 1413: Branchial gut as feeding apparatus for taking up particulate food from free water in the adult (Chordata).
1442. Chorda dorsalis with muscle plates (Acrania): absent (0), present (1). Contingent on character 1410: Entodermal chorda dorsalis beneath the neural tube (Chordata).
1443. Rostral expansion of the chorda dorsalis (Acrania): absent (0), present (1). Contingent on character 1435: Extension of the chorda dorsalis from the tail of the larva to the back of the entire body (Vertebrata).
1444. Large number of gonads - sac-like, paired and in rows (Acrania): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
1445. Pigment cup ocelli with pigment cell and photosensory cell (Acrania): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1446. Combination of a protonephridial solenocyte and metanephridial podocyte (Acrania): absent (0), present (1). Contingent on character 98: Protonephridia of ectodermal origin [1] (Bilateria).
1447. Trunk [1] (Craniota): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1448. Head with brain and sensory organs [1] (Craniota): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1449. Tail [1] (Craniota): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1450. Endothelium [1] (Craniota): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1451. Central muscular heart [1] (Craniota): absent (0), present (1). Contingent on character 1432: Extensive circulatory system with veins and arteries (Vertebrata).
1452. Erythrocytes with haemoglobin [1] (Craniota): absent (0), present (1). Contingent on character 21: Somatic differentiation.
1453. Bone (calcified connective tissue) (Craniota): absent (0), present (1). Contingent on character 21: Somatic differentiation.
1454. Bony dermal skeleton (Craniota): absent (0), present (1). Contingent on character 1454: Bone (calcified connective tissue) (Craniota).
1455. Cartilaginous endoskeleton (Craniota): absent (0), present (1). Contingent on character 21: Somatic differentiation.
1456. Neural crest (Craniota): absent (0), present (1). Contingent on character 1414: Ectodermal neural tube in its entire length under the dorsal side (Chordata).
1457. Pancreas (Craniota): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1458. Spiral valve of the intestine (Craniota): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1459. Thyroid (Craniota): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1460. Brain of five sections (Craniota): absent (0), present (1). Contingent on character 1449: Head with brain and sensory organs [1] (Craniota).

1461. Dorsal spinal ganglia and ventral spinal nerves (Craniota): absent (0), present (1). Contingent on character 1437: Formation of dorsal spinal nerves per segment (Vertebrata).
1462. Hypophysis with adenohypophysis and neurohypophysis in diencephalon (Craniota): absent (0), present (1). Contingent on character 1449: Head with brain and sensory organs [1] (Craniota).
1463. Gill apparatus as a "pure" respiratory organ (Craniota). 0 = absent, 1 = present, 2 = only in larvae. Contingent on character 1456: Cartilaginous endoskeleton (Craniota).
1464. Eyes with lens, cornea and musculature (Craniota). This is lost in Myxinoidea. Contingent on character 1465: Paired lateral eyes from diencephalon, with optic nerve and retina (Craniota).
1465. Paired lateral eyes from diencephalon, with optic nerve and retina (Craniota): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1466. Unpaired dorsal ocelli (Craniota): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1467. Lateralis system and labyrinth (Craniota): absent (0), present (1). Contingent on character 1449: Head with brain and sensory organs [1] (Craniota).
1468. Nasal organ (Craniota): absent (0), present (1). Contingent on character 1449: Head with brain and sensory organs [1] (Craniota).
1469. Skin with multilayered epidermis (Craniota): absent (0), present (1). Contingent on character 21: Somatic differentiation.
1470. Opisthonephros from nephrons with malphigian corpuscles (Craniota): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1471. Eel-like body (Cyclostomata): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1472. Tongue apparatus with two longitudinal rows of teeth (Cyclostomata): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1473. Gill pouch (Cyclostomata): absent (0), present (1). Contingent on character 1464: Gill apparatus as a "pure" respiratory organ (Craniota).
1474. Unpaired gonad (Cyclostomata): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Epitheliozoa).
1475. Ammocoete (Petromyzonta). Loss or absence in Myxinoidea. Contingent on character 13: Ontogenesis.
1476. Suction mouth (Petromyzonta): absent (0), present (1). Contingent on character 1473: Tongue apparatus with two longitudinal rows of teeth (Cyclostomata).
1477. Tentacles on the head (Myxinoidea): absent (0), present (1). Contingent on character 21: Somatic differentiation.
1478. Paired longitudinal tooth rows, teeth well-developed (Myxinoidea): absent (0), present (1). Contingent on character 1473: Tongue apparatus with two longitudinal rows of teeth (Cyclostomata).
1479. Dorsal arcualia [5] (Myxinoidea). Loss or absence in Myxinoidea. Contingent on character 1436: Polymery under incorporation of the chorda dorsalis in a metameric musculature (Vertebrata).
1480. Dermal glands with mucus production (Myxinoidea): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1481. Heterocercal tail fin [1] (Gnathostomata): absent (0), present (1). Contingent on character 1488: Tail fin [1] (Gnathostomata).
1482. Second dorsal fin [1] (Gnathostomata): absent (0), present (1). Contingent on character 1487: Dorsal fin [1] (Gnathostomata).
1483. Paired pectoral fins [1] (Gnathostomata): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1484. Paired pelvic fins [1] (Gnathostomata): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).

1485. Ventral anal fin [1] (Gnathostomata): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1486. Dorsal fin [1] (Gnathostomata): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1487. Tail fin [1] (Gnathostomata): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1488. Splanchocranium (Gnathostomata): absent (0), present (1). Contingent on character 1456: Cartilaginous endoskeleton (Craniota).
1489. Endoskeleton with central cartilage and perichondral bone (Gnathostomata). Lost in Chondrichthyes. Contingent on character 1456: Cartilaginous endoskeleton (Craniota).
1490. Neurocranium (Gnathostomata): absent (0), present (1). Contingent on character 1449: Head with brain and sensory organs [1] (Craniota).
1491. Ventral arcualia in the axial skeleton [1] (Gnathostomata): absent (0), present (1). Contingent on character 1436: Polymery under incorporation of the chorda dorsalis in a metameric musculature (Vertebrata).
1492. Pelvic girdle [1] (Gnathostomata): absent (0), present (1). Contingent on character 1485: Paired pelvic fins [1] (Gnathostomata).
1493. Shoulder girdle [1] (Gnathostomata): absent (0), present (1). Contingent on character 1484: Paired pectoral fins [1] (Gnathostomata).
1494. Horizontal septum in muscle segments (Gnathostomata): absent (0), present (1). Contingent on character 1436: Polymery under incorporation of the chorda dorsalis in a metameric musculature (Vertebrata).
1495. Axons of the nerve cells are surrounded by myelin sheath (Gnathostomata): absent (0), present (1). Contingent on character 21: Somatic differentiation.
1496. The dorsal and ventral roots of the spinal nerves join to form uniform nerve cords (Gnathostomata): absent (0), present (1). Contingent on character 1437: Formation of dorsal spinal nerves per segment (Vertebrata).
1497. Five pairs of gill slits (Gnathostomata): absent (0), present (1). Contingent on character 1464: Gill apparatus as a "pure" respiratory organ (Craniota).
1498. Spiracle between the mandibular and hyoid arches (Gnathostomata). 0 = absent, 1 = present, 2 = closed. Contingent on character 1489: Splanchocranium (Gnathostomata).
1499. At least four pairs of gill slits associated with the gill arches [1] (Gnathostomata): absent (0), present (1). Contingent on character 1489: Splanchocranium (Gnathostomata).
1500. Labyrinth with horizontal semicircular canal (Gnathostomata): absent (0), present (1). Contingent on character 1468: Lateralis system and labyrinth (Craniota).
1501. Nasal organ with paired lateral sacs with a separate nasal opening [2] (Gnathostomata): absent (0), present (1). Contingent on character 1469: Nasal organ (Craniota).
1502. Testes and kidneys are linked (Gnathostomata): absent (0), present (1). Contingent on character 36: Localised gonads [2] (Euphysaria).
1503. Placoid scales [2] (Chondrichthyes): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1504. Teeth on jaws [2] (Chondrichthyes): absent (0), present (1). Contingent on character : Splanchocranium (Gnathostomata).
1505. Large basal cartilaginous plates carrying fin rays [2] (Chondrichthyes): absent (0), present (1). Contingent on character 1456: Cartilaginous endoskeleton (Craniota).
1506. Acquisition of prismatic, calcified cartilage (Chondrichthyes): absent (0), present (1). Contingent on character 1456: Cartilaginous endoskeleton (Craniota).

1507. Copulatory organ from pelvic fins (Chondrichthyes): absent (0), present (1). Contingent on character 1485: Paired pelvic fins [1] (Gnathostomata).
1508. Enameloid tissue of the teeth (Elasmobranchii): absent (0), present (1). Contingent on character 1505: Teeth on jaws [2] (Chondrichthyes).
1509. Ventral cartilaginous elements of the gill arches directed backwards (Elasmobranchii): absent (0), present (1). Contingent on character : Splanchocranium (Gnathostomata).
1510. Paired condyles on the skull (Elasmobranchii): absent (0), present (1). Contingent on character 1491: Neurocranium (Gnathostomata).
1511. Dorsoventral plated body with shifting of the gill slits to the ventral side (Batoida): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1512. The enlarged pectoral fins are joined with the braincase in front of the eyes by particular, antorbital cartilage (Batoida): absent (0), present (1). Contingent on character 1484: Paired pectoral fins [1] (Gnathostomata).
1513. Anterior vertebrae fused (Batoida): absent (0), present (1). Contingent on character 1492: Ventral arcualia in the axial skeleton [1] (Gnathostomata).
1514. Jaw with tooth plates (Holocephali): absent (0), present (1). Contingent on character 1505: Teeth on jaws [2] (Chondrichthyes).
1515. Holostyli (Holocephali): absent (0), present (1). Contingent on character : Splanchocranium (Gnathostomata).
1516. Large spine of the dorsal fin with articulation in a thick cartilaginous plate (Holocephali): absent (0), present (1). Contingent on character 1456: Cartilaginous endoskeleton (Craniota).
1517. Calcified rings surrounding the canals of the lateralis system (Holocephali): absent (0), present (1). Contingent on character 1468: Lateralis system and labyrinth (Craniota).
1518. Placoid scales restricted in distribution (Holocephali): absent (0), present (1). Contingent on character 1504: Placoid scales [2] (Chondrichthyes).
1519. Gill cover from a skin fold (Holocephali): absent (0), present (1). Contingent on character : Splanchocranium (Gnathostomata).
1520. Male with additional anchoring system for the copula - in the form of retractable claspers and an unpaired tenaculum (Holocephali): absent (0), present (1). Contingent on character 1508: Copulatory organ from pelvic fins (Chondrichthyes).
1521. Exoskeleton of dermal bones [1] (Osteognathostomata): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1522. Lepidotrichia (Osteognathostomata). This is presumed absent in tetrapods as unpaired fins are lost and the paired fins undergo reductions in the fin rays. Contingent on character 1455: Bony dermal skeleton (Craniota).
1523. Exoskeleton of scales over the body and fins [1] (Osteognathostomata). This is coded as present in mammals and birds, as homology with hair and scales is assumed. Contingent on character 1455: Bony dermal skeleton (Craniota).
1524. Operculum (Osteognathostomata): absent (0), present (1). Contingent on character : Splanchocranium (Gnathostomata).
1525. Ossified endoskeleton (Osteognathostomata): absent (0), present (1). Contingent on character 1456: Cartilaginous endoskeleton (Craniota).
1526. Pharynx with air-filled diverticula (Osteognathostomata): absent (0), present (1). Contingent on character : Splanchocranium (Gnathostomata).
1527. Nasal opening with paired openings (Osteognathostomata): absent (0), present (1). Contingent on character 1502: Nasal organ with paired lateral sacs with a separate nasal opening [2] (Gnathostomata).

1528. Labyrinth with large otoliths (Osteognathostomata): absent (0), present (1). Contingent on character 1468: Lateralis system and labyrinth (Craniota).
1529. Ganoid scales (Actinopterygii). This character is coded as absent in teleosts as ganoine is said to be missing with the evolution of cycloid scales, and convergently in the Halecostomi. Contingent on character 1522: Exoskeleton of dermal bones [1] (Osteognathostomata).
1530. Acrodine tooth cap [2] (Actinopterygii): absent (0), present (1). Contingent on character 1505: Teeth on jaws [2] (Chondrichthyes).
1531. Division of the dorsal fin into numerous small fins (Cladistia): absent (0), present (1). Contingent on character 1487: Dorsal fin [1] (Gnathostomata).
1532. Secondary diphyccercal tail fin (Cladistia): absent (0), present (1). Contingent on character 1487: Tail fin [1] (Gnathostomata).
1533. Articulation of the paired fins with the shoulder girdle over two large basal elements (Cladistia): absent (0), present (1). Contingent on character 1484: Paired pectoral fins [1] (Gnathostomata).
1534. Fulcra formed from pairing of rhomboid scales (Actinopteri): absent (0), present (1). Contingent on character 1522: Exoskeleton of dermal bones [1] (Osteognathostomata).
1535. Unpaired lung/air bladder organ dorsal of the intestine with mainly hydrostatic function (paired lungs from ventral side of the intestine like the Osteognatha) (Actinopteri): absent (0), present (1). Contingent on character 1527: Pharynx with air-filled diverticula (Osteognathostomata).
1536. Paired fins with muscular basal section covered with scales (Actinopteri): absent (0), present (1). Contingent on character 1484: Paired pectoral fins [1] (Gnathostomata).
1537. Formation of a rostrum with low-set mouth on the ventral side (Chondrostei): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1538. Skeleton mainly of cartilage with persisting chorda (Chondrostei). Bone is reduced but not absent. Contingent on character 1456: Cartilaginous endoskeleton (Craniota).
1539. Five longitudinal rows of large scales on the body that are modified to proper bone plates (Chondrostei): absent (0), present (1). Contingent on character 1530: Ganoid scales (Actinopterygii).
1540. Limitation of the ganoid scales to the root of the tail [3] (Chondrostei): absent (0), present (1). Contingent on character 1530: Ganoid scales (Actinopterygii).
1541. The palatoquadrates are joined at the front by a symphysis (Chondrostei): absent (0), present (1). Contingent on character : Splanchocranium (Gnathostomata).
1542. Evolution of barbels in front of the mouth to locate bottom-dwelling organisms (Chondrostei): absent (0), present (1). Contingent on character 21: Somatic differentiation.
1543. Homocercal tail fin (Neopterygii): absent (0), present (1). Contingent on character 1488: Tail fin [1] (Gnathostomata).
1544. Clavicle (Neopterygii): absent (0), present (1). Contingent on character 1494: Shoulder girdle [1] (Gnathostomata).
1545. Identical numbers of radii and lepidotrichia in the dorsal fin and tail fin (Neopterygii): absent (0), present (1). Contingent on character 1523: Lepidotrichia (Osteognathostomata).
1546. Position of dorsal and anal fins close in front of the tail (Ginglymodi): absent (0), present (1). Contingent on character 1486: Dorsal fin [1] (Gnathostomata), character 1485: Ventral anal fin [1] (Gnathostomata).
1547. Highly lengthened snout (Ginglymodi): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1548. Folded tooth (Ginglymodi): absent (0), present (1). Contingent on character 1505: Teeth on jaws [2] (Chondrichthyes).
1549. Opisthocoelous vertebrae - concave on one side, convex on the other (Ginglymodi): absent (0), present (1). Contingent on character 1492: Ventral arcualia in the axial skeleton [1] (Gnathostomata).

1550. Roof tiling-like coverage of the scales with overlap of the posterior edges - ganoid scales modified (Halecostomi): absent (0), present (1). Contingent on character 1522: Exoskeleton of dermal bones [1] (Osteognathostomata).
1551. Vertebrae with median neural spines (Halecostomi): absent (0), present (1). Contingent on character 1480: Dorsal arcualia [5] (Myxinoida).
1552. Freely motile maxilla and an interopercular bone (Halecostomi): absent (0), present (1). Contingent on character 1489: Splanchocranium (Gnathostomata).
1553. Quadratojugal reduced or fused with the quadratum (Halecostomi): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1554. Highly lengthened dorsal fin (Halecomorphi): absent (0), present (1). Contingent on character 1486: Dorsal fin [1] (Gnathostomata).
1555. Unique articulation of the jaw in which the quadrate and symplectium participate (Halecomorphi): absent (0), present (1). Contingent on character 1489: Splanchocranium (Gnathostomata).
1556. Diplospondyly - two biconcave vertebrae per segment in the posterior body section (Halecomorphi): absent (0), present (1). Contingent on character 1492: Ventral arcualia in the axial skeleton [1] (Gnathostomata).
1557. Fan-like arrangement of hypuralia at the caudal end of the vertebral column (Halecomorphi): absent (0), present (1). Contingent on character 1490: Endoskeleton with central cartilage and perichondral bone (Gnathostomata).
1558. Diural caudal skeleton - fused (Teleostei): absent (0), present (1). Contingent on character 1490: Endoskeleton with central cartilage and perichondral bone (Gnathostomata).
1559. Hypuralia with seven or less bone pieces (Teleostei): absent (0), present (1). Contingent on character 1559: Diural caudal skeleton - fused (Teleostei).
1560. Hypuralia are divided into two groups (Teleostei): absent (0), present (1). Contingent on character 1559: Diural caudal skeleton - fused (Teleostei).
1561. Hypuralia one and two are carried by one vertebra (Teleostei): absent (0), present (1). Contingent on character 1559: Diural caudal skeleton - fused (Teleostei).
1562. Hypuralia are enlarged to broad bone plates (Teleostei): absent (0), present (1). Contingent on character 1559: Diural caudal skeleton - fused (Teleostei).
1563. Uroneuralia (Teleostei): absent (0), present (1). Contingent on character 1480: Dorsal arcualia [5] (Myxinoida).
1564. Movable premaxilla (Teleostei): absent (0), present (1). Contingent on character 1489: Splanchocranium (Gnathostomata).
1565. Unpaired basibranchial tooth plate (Teleostei): absent (0), present (1). Contingent on character 1505: Teeth on jaws [2] (Chondrichthyes).
1566. Concentrically ringed cyloid scales without ganoine (Teleostei): absent (0), present (1). Contingent on character 1529: Ganoid scales (Actinopterygii): absent (0), present (1). Contingent on character 1522: Exoskeleton of dermal bones [1] (Osteognathostomata).
1567. Monobasally paired fins (Sarcopterygii): absent (0), present (1). Contingent on character 1484: Paired pectoral fins [1] (Gnathostomata), character 1485: Paired pelvic fins [1] (Gnathostomata).
1568. Vena cava is to the posterior (Sarcopterygii): absent (0), present (1). Contingent on character 1452: Central muscular heart [1] (Craniota).
1569. Sclerotic rings of more than five bone plates around the eyes (Sarcopterygii): absent (0), present (1). Contingent on character 1454: Bone (calcified connective tissue) (Craniota).
1570. Intercranial joint (Sarcopterygii): absent (0), present (1). Contingent on character 1491: Neurocranium (Gnathostomata).
1571. Genuine enamel covers the entire tooth (Sarcopterygii): absent (0), present (1). Contingent on character 1505: Teeth on jaws [2] (Chondrichthyes).

1572. Diphyccercal tail fin with equally sized dorsal and ventral parts (Actinistia): absent (0), present (1). Contingent on character 1487: Tail fin [1] (Gnathostomata).
1573. First dorsal fin with hollow spines (Actinistia): absent (0), present (1). Contingent on character 1486: Dorsal fin [1] (Gnathostomata).
1574. Vertebral column highly reduced - only thin dorsal and ventral arcualia are present (Actinistia): absent (0), present (1). Contingent on character 1492: Ventral arcualia in the axial skeleton [1] (Gnathostomata).
1575. Bone skeleton extensively replaced with cartilage (Actinistia): absent (0), present (1). Contingent on character 1490: Endoskeleton with central cartilage and perichondral bone (Gnathostomata).
1576. Chorda dorsalis as an unstricted, thick tube with fluid (Actinistia): absent (0), present (1). Contingent on character 1410: Entodermal chorda dorsalis beneath the neural tube (Chordata).
1577. Ovoviviparity - young develop in oviducts (Actinistia): absent (0), present (1). Contingent on character 13: Ontogenesis.
1578. Unpaired sac of the intestine that is filled with fatty substances (Actinistia): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1579. Basal muscular lobes in the second dorsal fin and in the anal fin (Actinistia): absent (0), present (1). Contingent on character 1483: Second dorsal fin [1] (Gnathostomata).
1580. Large rostral organ in the snout (Actinistia): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1581. Lymphatic system (Choanata): absent (0), present (1). Contingent on character 1452: Central muscular heart [1] (Craniota).
1582. Agreements in the circulatory system - lungs, arteries and veins, with an S-shaped conus arteriosus (Choanata): absent (0), present (1). Contingent on character 1452: Central muscular heart [1] (Craniota).
1583. Folded teeth with plicidentine (Choanata): absent (0), present (1). Contingent on character 1505: Teeth on jaws [2] (Chondrichthyes).
1584. Diphyccercal tail fin with an unpaired border that runs continuously around the fin (Dipnoi): absent (0), present (1). Contingent on character 1487: Tail fin [1] (Gnathostomata).
1585. Tooth plates (Dipnoi): absent (0), present (1). Contingent on character 1505: Teeth on jaws [2] (Chondrichthyes).
1586. Reduction of the bone substance to mostly cartilage (Dipnoi): absent (0), present (1). Contingent on character 1490: Endoskeleton with central cartilage and perichondral bone (Gnathostomata).
1587. Many mesomers and numerous radialia (Dipnoi): absent (0), present (1). Contingent on character 1484: Paired pectoral fins [1] (Gnathostomata), character 1485: Paired pelvic fins [1] (Gnathostomata).
1588. Nose with choana (Dipnoi): absent (0), present (1). Contingent on character 1528: Nasal opening with paired openings (Osteognathostomata).
1589. Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda): absent (0), present (1). Contingent on character 1568: Monobasally paired fins (Sarcopterygii).
1590. Pentadactyly [2] (Tetrapoda): absent (0), present (1). Contingent on character 1568: Monobasally paired fins (Sarcopterygii).
1591. Phalanges from distal radialia of the fins [1] (Tetrapoda): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1592. Heart with interauricular septum (Tetrapoda): absent (0), present (1). Contingent on character 1452: Central muscular heart [1] (Craniota).

1593. Dorsal extension of the pelvic girdle and connection with the vertebral column - the pelvis consists of the ilium, ischium and pubis (Tetrapoda): absent (0), present (1). Contingent on character 1493: Pelvic girdle [1] (Gnathostomata).
1594. Autostylic skull - the neurocranium is linked with the palatoquadrate (Tetrapoda): absent (0), present (1). Contingent on character 1491: Neurocranium (Gnathostomata).
1595. Skull with an unpaired condyle (Tetrapoda): absent (0), present (1). Contingent on character 1491: Neurocranium (Gnathostomata).
1596. Uniform vertebrae (Tetrapoda): absent (0), present (1). Contingent on character 1492: Ventral arcualia in the axial skeleton [1] (Gnathostomata).
1597. Ribs with two connections to the vertebral column (Tetrapoda): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).
1598. Eye glands [2] (Tetrapoda). Eye glands are lost in Rhynchocephalia but not the eyelids. Contingent on character 1466: Paired lateral eyes from diencephalon, with optic nerve and retina (Craniota).
1599. Lungs as the sole respiratory organ in the adult (Tetrapoda): absent (0), present (1). Contingent on character 1527: Pharynx with air-filled diverticula (Osteognathostomata).
1600. Trachea and larynx with tracheal closure apparatus (Tetrapoda): absent (0), present (1). Contingent on character 1489: Splanchochranium (Gnathostomata).
1601. Nose with choana (Tetrapoda): absent (0), present (1). Contingent on character 1528: Nasal opening with paired openings (Osteognathostomata).
1602. Middle ear with stapes (Tetrapoda): absent (0), present (1). Contingent on character 1489: Splanchochranium (Gnathostomata).
1603. Ear with tympanum and auditory canal [2] (Tetrapoda): absent (0), present (1). Contingent on character 1489: Splanchochranium (Gnathostomata).
1604. Eyelids [1] (Tetrapoda): absent (0), present (1). Contingent on character 1466: Paired lateral eyes from diencephalon, with optic nerve and retina (Craniota).
1605. Stratum corneum with keratin (Tetrapoda): absent (0), present (1). Contingent on character 1470: Skin with multilayered epidermis (Craniota).
1606. Anterior limbs with four fingers (Amphibia). Pentadactyly is still present in posterior limbs. Contingent on character 1591: Pentadactyly [2] (Tetrapoda).
1607. Operculum as an additional middle ear bone (Amphibia). This assumes this structure is not homologous to that in actinopterygians. Contingent on character 1489: Splanchochranium (Gnathostomata).
1608. Divided teeth with sharp points- bicuspidate (Amphibia): absent (0), present (1). Contingent on character 1505: Teeth on jaws [2] (Chondrichthyes).
1609. Large interpterygoid window in the palate (Amphibia): absent (0), present (1). Contingent on character 1454: Bone (calcified connective tissue) (Craniota).
1610. Skull with two condyles (Amphibia): absent (0), present (1). Contingent on character 1491: Neurocranium (Gnathostomata).
1611. Papilla amphibiorum (Amphibia): absent (0), present (1). Contingent on character 1468: Lateralis system and labyrinth (Craniota).
1612. Modification of the pronephros for the transport of sperm (Batrachia): absent (0), present (1). Contingent on character 1503: Testes and kidneys are linked (Gnathostomata).
1613. Macula neglecta in the ear labyrinth [5] (Batrachia). This evolves in gnathostomes, but there are precursors possibly in craniates. Contingent on character 1468: Lateralis system and labyrinth (Craniota).
1614. Auditory system for low frequencies (Batrachia): absent (0), present (1). Contingent on character 1608: Operculum as an additional middle ear bone (Amphibia).

1615. Vertebrae with a two-part rib support (Urodela): absent (0), present (1). Contingent on character 1598: Ribs with two connections to the vertebral column (Tetrapoda).
1616. Atlas with tuberculum interglenoideum (Urodela): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).
1617. Larvae with horny jaw and horn teeth (Anura): absent (0), present (1). Contingent on character 13: Ontogenesis.
1618. Shortening of the vertebral column (Anura): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).
1619. Urostyle (Anura): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).
1620. Rod-like extended ilium of the pelvic girdle (Anura): absent (0), present (1). Contingent on character 1493: Pelvic girdle [1] (Gnathostomata).
1621. Hind limbs are longer than forelimbs (Anura): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1622. Os cruris from the fusion of the tibia and fibula (Anura): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1623. Lengthening of the proximal tarsalia (Anura): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1624. Radius and ulna are fused to form a uniform bone rod (Anura): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1625. Paired tentacles (Gymnophiona): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1626. Shortened tail with position of the anus at the posterior end (Gymnophiona): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).
1627. Worm-shaped, stretched trunk with ringing of the skin and an increased number of vertebrae (Gymnophiona): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).
1628. Possession of more than 200 intersegmental lymphatic hearts under the skin (Gymnophiona): absent (0), present (1). Contingent on character 1582: Lymphatic system (Choanata).
1629. Phallodeum (Gymnophiona): absent (0), present (1). Contingent on character 18: Haploid male/female gametes [1] (Metazoa).
1630. Eyes reduced and overgrown with thick skin (Gymnophiona): absent (0), present (1). Contingent on character 1466: Paired lateral eyes from diencephalon, with optic nerve and retina (Craniota).
1631. Convex, semicircular occipital condyle; it is well ossified and concave in Tetrapoda (Amniota): absent (0), present (1). Contingent on character 1491: Neurocranium (Gnathostomata).
1632. Large exoccipitalia join over the basioccipital and under the occipital hole of the skull (Amniota): absent (0), present (1). Contingent on character 1491: Neurocranium (Gnathostomata).
1633. Eggs laid on land (Amniota): absent (0), present (1). Contingent on character 13: Ontogenesis.
1634. Meroblastic cleavage of yolk-rich eggs (Amniota): absent (0), present (1). Contingent on character 13: Ontogenesis.
1635. Amnion and serosa (Amniota): absent (0), present (1). Contingent on character 13: Ontogenesis.
1636. Allantois (Amniota): absent (0), present (1). Contingent on character 1432: Extensive circulatory system with veins and arteries (Vertebrata).
1637. Yolk sac (Amniota): absent (0), present (1). Contingent on character 13: Ontogenesis.

1638. Copulatory organ (Amniota): absent (0), present (1). Contingent on character 18: Haploid male/female gametes [1] (Metazoa).
1639. Multilayered stratum corneum (Amniota): absent (0), present (1). Contingent on character 1606: Stratum corneum with keratin (Tetrapoda).
1640. Tabular is small or absent (Sauropsida): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1641. Supratemporal is small or absent (Sauropsida): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1642. Supraoccipital has an anterior crest (Sauropsida): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1643. Suborbital window in the palatine (Sauropsida): absent (0), present (1). Contingent on character 1454: Bone (calcified connective tissue) (Craniota).
1644. A single coronoid in the lower jaw (Sauropsida): absent (0), present (1). Contingent on character 1489: Splanchoocranium (Gnathostomata).
1645. Fusion of the first two neck vertebrae, the atlas and axis (Sauropsida): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).
1646. Eye muscles: the iris and ciliary muscles have cross-striated musculature (Sauropsida): absent (0), present (1). Contingent on character 1465: Eyes with lens, cornea and musculature (Craniota).
1647. Nasal glands lie outside nasal capsule (Sauropsida): absent (0), present (1). Contingent on character 1469: Nasal organ (Craniota).
1648. 23353 pattern of phalanges (Chelonia): absent (0), present (1). Contingent on character 1592: Phalanges from distal radialis of the fins [1] (Tetrapoda).
1649. Parietal is closed (Chelonia): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1650. Horny sheaths in place of teeth (Chelonia): absent (0), present (1). Contingent on character 1489: Splanchoocranium (Gnathostomata).
1651. Body armour or protective shell of bone (Chelonia): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1652. To take up a resting position the neck is bent to the side and placed between the back and belly shells (Pleurodira): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).
1653. The neck is drawn back in the sagittal plane and takes on an S-shape (Cryptodira): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).
1654. Two temporal fenestrae (Diapsida): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1655. Suborbital window (Diapsida): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1656. The neck vertebrae are longer than the vertebrae in the middle of the back (Diapsida): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).
1657. Teeth are superficially linked to the borders of the jaws (Lepidosauria): absent (0), present (1). Contingent on character 1505: Teeth on jaws [2] (Chondrichthyes).
1658. The condyles of the mandible are formed from the articular only (Lepidosauria): absent (0), present (1). Contingent on character 1489: Splanchoocranium (Gnathostomata).
1659. Thyreoid window between the pubis and ischium in the pelvic girdle (Lepidosauria): absent (0), present (1). Contingent on character 1594: Dorsal extension of the pelvic girdle and connection with the vertebral column - the pelvis consists of the ilium, ischium and pubis (Tetrapoda).
1660. Caudal autotomy: breaking point in the basal tail vertebrae (Lepidosauria): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).

1661. Astralagus and calcaneus of the tarsus fuse in young animals (Lepidosauria): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1662. Bending of metatarsal five in two planes (Lepidosauria): absent (0), present (1). Contingent on character 1591: Pentadactyly [2] (Tetrapoda).
1663. Cloacal slit is placed transversely (Lepidosauria): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1664. Fusion of teeth of the premaxilla that are longer than the teeth of the maxilla (Rhynchocephalia): absent (0), present (1). Contingent on character 1505: Teeth on jaws [2] (Chondrichthyes).
1665. Skin with horny scales (Squamata): absent (0), present (1). Contingent on character 1606: Stratum corneum with keratin (Tetrapoda).
1666. Lower temporal window opens ventrally (Squamata): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1667. Mobile quadratum (Squamata): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1668. Tongue is split distally into two parts (Squamata): absent (0), present (1). Contingent on character 1489: Splanchocranium (Gnathostomata).
1669. Hemipenis and hemiclititoris (Squamata): absent (0), present (1). Contingent on character 1639: Copulatory organ (Amniota).
1670. Four toes in hindlimbs (Archosauria): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1671. Ventricles of the heart are completely separated (Archosauria): absent (0), present (1). Contingent on character 1452: Central muscular heart [1] (Craniota).
1672. Pulmonary diaphragm (Archosauria): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1673. Thecodont dentition in the jaws (Archosauria): absent (0), present (1). Contingent on character 1505: Teeth on jaws [2] (Chondrichthyes).
1674. Flattened teeth (Archosauria): absent (0), present (1). Contingent on character 1505: Teeth on jaws [2] (Chondrichthyes).
1675. Preorbital window (Archosauria): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1676. Mandibular window (Archosauria): absent (0), present (1). Contingent on character 1489: Splanchocranium (Gnathostomata).
1677. Fourth trochanter (Archosauria): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1678. Pubis and ischium are rod-like lengthened structures (Archosauria): absent (0), present (1). Contingent on character 1594: Dorsal extension of the pelvic girdle and connection with the vertebral column - the pelvis consists of the ilium, ischium and pubis (Tetrapoda).
1679. Transparent nictitating membrane in the eye (Archosauria): absent (0), present (1). Contingent on character 1466: Paired lateral eyes from diencephalon, with optic nerve and retina (Craniota).
1680. Eustachian tubes are fused medially (Archosauria): absent (0), present (1). Contingent on character 1604: Ear with tympanum and auditory canal [2] (Tetrapoda).
1681. Long tail which compresses at the sides (Crocodylia): absent (0), present (1). Contingent on character 1450: Tail [1] (Craniota).

1682. Frontalia and parietalia are fused (Crocodylia): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1683. Secondary palate (Crocodylia): absent (0), present (1). Contingent on character 1454: Bone (calcified connective tissue) (Craniota).
1684. Lengthening of radial and ulnar metacarpal bones (Crocodylia): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1685. Joint between astragalus and calcaneus (Crocodylia): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1686. Pubis without a connection to the acetabulum (Crocodylia): absent (0), present (1). Contingent on character 1594: Dorsal extension of the pelvic girdle and connection with the vertebral column - the pelvis consists of the ilium, ischium and pubis (Tetrapoda).
1687. Anus is developed as longitudinal slit (Crocodylia): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1688. Regression of the left efferent aortic arch (Aves): absent (0), present (1). Contingent on character 1452: Central muscular heart [1] (Craniota).
1689. Horny sheaths (Aves): absent (0), present (1). Contingent on character 1606: Stratum corneum with keratin (Tetrapoda).
1690. Bill forms as the premaxilla is elongated (Aves): absent (0), present (1): absent (0), present (1). Contingent on character 1606: Stratum corneum with keratin (Tetrapoda).
1691. Fusion of temporal windows with each other and with the orbit (Aves): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1692. Neognathy: pterygoid is in two articulated sections (Aves): absent (0), present (1). Contingent on character 1454: Bone (calcified connective tissue) (Craniota).
1693. Quadratum is loosely joined with the neurocranium (Aves): absent (0), present (1). Contingent on character 1491: Neurocranium (Gnathostomata).
1694. Prokinetic skull (Aves): absent (0), present (1). Contingent on character 1491: Neurocranium (Gnathostomata).
1695. Saddle joint on the neck vertebrae (Aves): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).
1696. Free thoracic vertebrae [1] (Aves): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).
1697. Synsacrum [1] (Aves): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).
1698. Pygostyle [1] (Aves): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).
1699. Long, thin scapula [1] (Aves): absent (0), present (1). Contingent on character 1494: Shoulder girdle [1] (Gnathostomata).
1700. Clavicles combined to form the furcula [1] (Aves): absent (0), present (1). Contingent on character 1494: Shoulder girdle [1] (Gnathostomata).
1701. Os innominatum [1] (Aves): absent (0), present (1). Contingent on character 1679: Pubis and ischium are rod-like lengthened structures (Archosauria).
1702. Thoracic vertebrae are flattened and linked to the sternum [1] (Aves): absent (0), present (1). Contingent on character 1597: Uniform vertebrae (Tetrapoda).
1703. Fusion and transformation of carpalia [1] (Aves): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).

1704. Forelimbs as carriers of remiges [1] (Aves): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1705. Ulna is more developed than radius [1] (Aves): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1706. Fusion of metacarpals one, two and three [1] (Aves): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1707. Three fingers on the forelimbs [1] (Aves): absent (0), present (1). Contingent on character 1591: Pentadactyly [2] (Tetrapoda).
1708. Maximum of 2-3-1 pattern on the phalanges [1] (Aves): absent (0), present (1). Contingent on character 1592: Phalanges from distal radialia of the fins [1] (Tetrapoda).
1709. Tibia and fibula fuse [1] (Aves): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1710. Intertarsal joint [1] (Aves): absent (0), present (1). Contingent on character 1712: Tibiotarsus [1] (Aves).
1711. Tibiotarsus [1] (Aves): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1712. Tarsometatarsus [1] (Aves): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1713. Opposable thumbs [1] (Aves): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1714. Feathers - down and contour (Aves): absent (0), present (1). Contingent on character 1606: Stratum corneum with keratin (Tetrapoda).
1715. Flying ability (Aves): absent (0), present (1). Contingent on character 1715: Feathers - down and contour (Aves).
1716. Homoiothermy (Aves): absent (0), present (1). Contingent on character 1432: Extensive circulatory system with veins and arteries (Vertebrata).
1717. Gizzard (Aves): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1718. Oil glands in a paired arrangement above the last tail vertebrae (Aves): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1719. Brain with an enlargement of the integration sites, tectum opticum, cerebellum and corpus striatum in the telencephalon (Aves): absent (0), present (1). Contingent on character 1461: Brain of five sections (Craniota).
1720. Air sacs in the body for respiration, which reach into the cavities of the bones (Aves): absent (0), present (1). Contingent on character 1600: Lungs as the sole respiratory organ in the adult (Tetrapoda).
1721. Syrinx as unique, sound-producing organ (Aves): absent (0), present (1). Contingent on character 1489: Splanchoocranium (Gnathostomata).
1722. Large eyes as central organs in the orientation system (Aves): absent (0), present (1). Contingent on character 1466: Paired lateral eyes from diencephalon, with optic nerve and retina (Craniota).

1723. Rhynchokinetics - anterior displacement of the flexion position between the neurocranium and upper jaw to the rostral third of the beak (Palaeognathae): absent (0), present (1). Contingent on character 1491: Neurocranium (Gnathostomata).
1724. Divided horny bill (Palaeognathae): absent (0), present (1). Contingent on character 1691: Bill forms as the premaxilla is elongated (Aves).
1725. Quadratum with double condyles (Neognathae): absent (0), present (1). Contingent on character 1694: Quadratum is loosely joined with the neurocranium (Aves).
1726. Rotation of the limbs under the body (Mammalia): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1727. Anuclear erythrocytes (Mammalia): absent (0), present (1). Contingent on character 1453: Erythrocytes with haemoglobin [1] (Craniota).
1728. Heterodonty (Mammalia). This was coded as present in Ornithorhynchus as the teeth are present early in development. Contingent on character 1489: Splanchoocranium (Gnathostomata).
1729. Diphyodonty (Mammalia). This was coded as present in Ornithorhynchus as the teeth are present early in development. Contingent on character 1489: Splanchoocranium (Gnathostomata).
1730. Synapsid skull (Mammalia): absent (0), present (1). Contingent on character 1455: Bony dermal skeleton (Craniota).
1731. Secondary jaw joint (Mammalia): absent (0), present (1). Contingent on character 1489: Splanchoocranium (Gnathostomata).
1732. Secondary palate (Mammalia): absent (0), present (1). Contingent on character 1454: Bone (calcified connective tissue) (Craniota).
1733. Dicondylic skull (Mammalia): absent (0), present (1). Contingent on character 1491: Neurocranium (Gnathostomata).
1734. Number of phalanges 23333 (Mammalia): absent (0), present (1). Contingent on character 1592: Phalanges from distal radialis of the fins [1] (Tetrapoda).
1735. Obturator foramen in the pubic bone (Mammalia): absent (0), present (1). Contingent on character 1594: Dorsal extension of the pelvic girdle and connection with the vertebral column - the pelvis consists of the ilium, ischium and pubis (Tetrapoda).
1736. Marsupial bones (Mammalia): absent (0), present (1). Contingent on character 1594: Dorsal extension of the pelvic girdle and connection with the vertebral column - the pelvis consists of the ilium, ischium and pubis (Tetrapoda).
1737. Hair (Mammalia): absent (0), present (1). Contingent on character 1606: Stratum corneum with keratin (Tetrapoda).
1738. Homiothermy (Mammalia): absent (0), present (1). Contingent on character 1432: Extensive circulatory system with veins and arteries (Vertebrata).
1739. Dermal glands - sebaceous, mammary and sweat glands (Mammalia): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1740. Two further ear ossicles and tympanicum (Mammalia): absent (0), present (1). Contingent on character 1604: Ear with tympanum and auditory canal [2] (Tetrapoda).
1741. Secondary skull side wall in the orbitotemporal region (Monotremata): absent (0), present (1). Contingent on character 1730: Synapsid skull (Mammalia).
1742. Crural gland and spur (Monotremata): absent (0), present (1). Contingent on character 1590: Quadrupedy - the first mesomer becomes the humerus and posteriorly the femur, first radial and second mesomer become the radius and ulna/tibia and fibula [1] (Tetrapoda).
1743. Musculus detrahens mandibulae (Monotremata): absent (0), present (1). Contingent on character 1489: Splanchoocranium (Gnathostomata).

1744. Spiny covering (Tachyglossidae): absent (0), present (1). Contingent on character 1737: Hair (Mammalia).
1745. Fingers and toes with strong claws for digging in the ground (Tachyglossidae): absent (0), present (1). Contingent on character 1591: Pentadactyly [2] (Tetrapoda).
1746. Long cleaning claws on toes two and three to clean the spiny coat (Tachyglossidae): absent (0), present (1). Contingent on character 1745: Fingers and toes with strong claws for digging in the ground (Tachyglossidae).
1747. Incubatorium [2] (Tachyglossidae): absent (0), present (1). Contingent on character 1470: Skin with multilayered epidermis (Craniota).
1748. Steering tail (Ornithorhynchidae): absent (0), present (1). Contingent on character 1450: Tail [1] (Craniota).
1749. Webbed limbs [1] (Ornithorhynchidae): absent (0), present (1). Contingent on character 1591: Pentadactyly [2] (Tetrapoda).
1750. Torpedo-shaped body [1] (Ornithorhynchidae): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1751. Coracoid process as the only remnant of the coracoids, with the loss of a connection between the sternum and scapula (Theria): absent (0), present (1). Contingent on character 1494: Shoulder girdle [1] (Gnathostomata).
1752. Facial hairs (Theria): absent (0), present (1). Contingent on character 1737: Hair (Mammalia).
1753. Scapula with fossa supraspinata (Theria): absent (0), present (1). Contingent on character 1494: Shoulder girdle [1] (Gnathostomata).
1754. Viviparity (Theria): absent (0), present (1). Contingent on character 13: Ontogenesis.
1755. Mammary papilla (Theria): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epithelozoa).
1756. Hindgut and urogenital openings are separate (Theria): absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining [1] (Eumetazoa).
1757. Spirally twisted cochlea in inner ear (Theria): absent (0), present (1). Contingent on character 1604: Ear with tympanum and auditory canal [2] (Tetrapoda).
1758. Greater number of incisors and molars (Marsupialia). This is in comparison to the placentals, so it is not coded in the monotremes. Contingent on character 1728: Heterodonty (Mammalia).
1759. Powerful claws on the forelimbs [2] (Marsupialia): absent (0), present (1). Contingent on character 1591: Pentadactyly [2] (Tetrapoda).
1760. Monophyodonty (Marsupialia): absent (0), present (1). Contingent on character 1729: Diphyodonty (Mammalia).
1761. Mouth as round suckling organ coupled with the swelling of the teats [2] (Marsupialia): absent (0), present (1). Contingent on character 1755: Mammary papilla (Theria).
1762. Marsupium [2] (Marsupialia): absent (0), present (1). Contingent on character 1470: Skin with multilayered epidermis (Craniota).
1763. Vaginal sinus with paired vagina (Marsupialia): absent (0), present (1). Contingent on character 1756: Hindgut and urogenital openings are separate (Theria).
1764. Extra premolar in upper and lower jaw (Placentalia). Actually a loss in Marsupialia. The primary arrangement is posited in the stem of the Theria, so this character was not coded as present in monotremes. Contingent on character 1728: Heterodonty (Mammalia).
1765. Corpus callosum (Placentalia): absent (0), present (1). Contingent on character 1461: Brain of five sections (Craniota).
1766. Trophoblast and chorioallantoic placenta (Placentalia): absent (0), present (1). Contingent on character 13: Ontogenesis.

1767. Monodelphy - vagina is unpaired and the oviducts open into the uterus (Placentalia): absent (0), present (1). Contingent on character 1756: Hindgut and urogenital openings are separate (Theria).
1768. Circumoral structures are plate-like and radial (Fossils: Anomalocaris): absent (0), present (1). Contingent on character 187: Anus is separate from mouth (Euspiralia).
1769. Circumoral structure has 32 plates (Fossils: Anomalocaris): absent (0), present (1). Contingent on character 1769: Circumoral structures are plate-like and radial.
1770. Arcuate anterior sclerite (Fossils: Anomalocaris): absent (0), present (1). Contingent on character 327: Prostomium/acron [1] (Articulata).
1771. Frontal appendage (Fossils: Anomalocaris, Aysheaia, Opabinia): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1772. Frontal appendage is ventral (Fossils: Anomalocaris, Opabinia): absent (0), present (1). Contingent on character 1772: Frontal appendage
1773. Arthropodised frontal appendage (Fossils: Anomalocaris): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
1774. Frontal appendage with 4+ spines along the inner margin (Fossils: Anomalocaris, Aysheaia, Opabinia): absent (0), present (1). Contingent on character 1772: Frontal appendage
1775. Five median eyes (Fossils: Opabinia): absent (0), present (1). Contingent on character 427: Median ocelli [1] (Euarthropoda).
1776. Lateral flaps (Fossils: Anomalocaris, Opabinia): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
1777. Flaps have strengthening rays (Fossils: Anomalocaris): absent (0), present (1). Contingent on character 1777 Lateral flaps
1778. Posterior tapering (Fossils: Anomalocaris): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1779. Dorsal bands of lanceolate blades (Fossils: Anomalocaris, Opabinia): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
1780. Posterior tagma of paired tail flaps (Fossils: Anomalocaris, Opabinia): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
1781. Anterior appendages are ventral, at base of the head (Fossils: Hallucigenia): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1782. Proboscis (Fossils: Aysheaia): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1783. Proboscis has elongated spines (Fossils: Hallucigenia): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1784. Tail spine (Fossils: Anomalocaris, Opabinia): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1785. Stalked eyes (Fossils: Anomalocaris, Opabinia): absent (0), present (1). Contingent on character 427: Median ocelli [1] (Euarthropoda).
1786. Frontal appendage with a branching tip (Fossils: Opabinia): absent (0), present (1). Contingent on character 1772: Frontal appendage
1787. Double row of short ventral spines on the frontal appendage (Fossils: Anomalocaris): absent (0), present (1). Contingent on character 1772: Frontal appendage
1788. Sclerites (Fossils: Wiwaxia, Orthrozanclus): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1789. Left-right exoskeleton zones (Fossils: Halkieria, Orthrozanclus, Wiwaxia): absent (0), present (1). Contingent on character 89: Bilateral symmetry (Bilateria).
1790. Up to 100 gills (Fossils: Odontogriphus): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata)

1791. Asymmetrical adult form (Fossils: echinoderms): absent (0), present (1). Contingent on character 89: Bilateral symmetry.
1792. Radial adult form (Fossils: echinoderms): absent (0), present (1). Contingent on character 89: Bilateral symmetry.
1793. Ambulacra present defining an axial surface (Fossils: echinoderms): absent (0), present (1). Contingent on character 1332: Water-vascular system (Echinodermata).
1794. Marginal frame (Fossils: echinoderms): absent (0), present (1). Contingent on character 1334: Stereom from calcitic sclerites (Echinodermata).
1795. Sac-like theca (Fossils: echinoderms): absent (0), present (1). Contingent on character 1334: Stereom from calcitic sclerites (Echinodermata).
1796. Ambulacra flooring plates forming an integral part of the theca (Fossils: echinoderms): absent (0), present (1). Contingent on character 1331: Pentamery with five radii and five interradial (Echinodermata).
1797. Ambulacra form a 2-1-2 symmetry (Fossils: echinoderms): absent (0), present (1). Contingent on character 1796: Ambulacra flooring plates forming an integral part of the theca (Fossils: echinoderms).
1798. Mouth central and apical (Fossils: echinoderms): absent (0), present (1). Contingent on character 1331: Pentamery with five radii and five interradial (Echinodermata).
1799. Interambulacral zones folded concertina-like structure (Fossils: echinoderms): absent (0), present (1). Contingent on character 1332: Water-vascular system (Echinodermata).
1800. Ambulacra curved and spiralling distally (Fossils: echinoderms): absent (0), present (1). Contingent on character 1332: Water-vascular system (Echinodermata).
1801. Fine brachioles without coelomic space (Fossils: echinoderms): absent (0), present (1). Contingent on character 1334: Stereom from calcitic sclerites (Echinodermata).
1802. Perforate flooring plates in theca (Fossils: echinoderms): absent (0), present (1). Contingent on character 1796: Ambulacra flooring plates forming an integral part of the theca (Fossils: echinoderms).
1803. Single appendage with extension of coelomic space (Fossils: echinoderms): absent (0), present (1). Contingent on character 1332: Water-vascular system (Echinodermata).
1804. Cup differentiated (Fossils: echinoderms): absent (0), present (1). Contingent on character 1334: Stereom from calcitic sclerites (Echinodermata).
1805. Epispires (Fossils: echinoderms): absent (0), present (1). Contingent on character 1332: Water-vascular system (Echinodermata).
1806. Periproct opens through oral membrane between ambulacra (Fossils: echinoderms): absent (0), present (1). Contingent on character 1331: Pentamery with five radii and five interradial (Echinodermata).
1807. Ctenoid plates (Fossils: echinoderms): absent (0), present (1). Contingent on character 1334: Stereom from calcitic sclerites (Echinodermata).
1808. Aulacophore (Fossils: echinoderms): absent (0), present (1). Contingent on character 1334: Stereom from calcitic sclerites (Echinodermata).
1809. Marginal appendage (Fossils: echinoderms): absent (0), present (1). Contingent on character 1334: Stereom from calcitic sclerites (Echinodermata).
1810. Tripartite steele (Fossils: echinoderms): absent (0), present (1). Contingent on character 1334: Stereom from calcitic sclerites (Echinodermata).
1811. Specialized respiratory structure (Fossils: echinoderms): absent (0), present (1). Contingent on character 1332: Water-vascular system (Echinodermata).
1812. Dorsal ecdysial suture (Fossils: arthropods): absent (0), present (1). Contingent on character 408: Ecdysis [1] (Arthropoda).

1813. Strongly tuberculate cuticle sculpture (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1814. Cephalic shield single unit or followed by a variable number of tergites (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1815. Cephalic shield bivalved (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1816. Posterior margin of carapace with a V-shaped invagination (Fossils: arthropods): absent (0), present (1). Contingent on character 1815 Cephalic shield bivalved (Fossils: arthropods).
1817. Carapace all-enveloping (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1818. Post-cephalic region with overlapping pleura (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1819. Trilobed (Fossils: arthropods): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).
1820. Doublure (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1821. Marginal rim (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1822. Pygidium (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1823. Genal spines (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1824. Eye ridges (Fossils: arthropods): absent (0), present (1). Contingent on character 427: Median ocelli [1] (Euarthropoda).
1825. Cardiac lobe (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1826. Articulating half rings (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1827. Outline of posterior trunk strongly curved (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1828. Prominent arm-like extensions of carapace (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1829. Transverse wrinkling of the dorsal cuticle (Fossils: arthropods): absent (0), present (1). Contingent on character 405: Alpha-chitin cuticle [1] (Arthropoda).
1830. Natant labrum (Fossils: arthropods): absent (0), present (1). Contingent on character 418: Labrum [1] (Euarthropoda).
1831. Biramous first appendage (Fossils: arthropods): absent (0), present (1). Contingent on character 402: Paired walking appendages on repeated segments (Arthropoda).
1832. Biramous raptorial first appendage with basket (Fossils: arthropods): absent (0), present (1). Contingent on character 1831: Biramous first appendage (Fossils: arthropods).
1833. Lateral deflection of the limbs (Fossils: arthropods): absent (0), present (1). Contingent on character 402: Paired walking appendages on repeated segments (Arthropoda).
1834. Trunks limbs decreasing in length distally (Fossils: arthropods): absent (0), present (1). Contingent on character 402: Paired walking appendages on repeated segments (Arthropoda).
1835. Border of the posterior body division flanked with fine spines (Fossils: arthropods): absent (0), present (1). Contingent on character 38: Differentiation of two epithelial layers [1] (Epitheliozoa).

1836. Short tapering telson (Fossils: arthropods): absent (0), present (1). Contingent on character 330: Pygidium/telson [1] (Articulata).
1837. *Agnostus*-like second post-acronal somite (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1838. *Marella*-like second post-acronal somite (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1839. Calcified cuticle (Fossils: arthropods): absent (0), present (1). Contingent on character 421: Skeleton formed from solid, flexible plates (Euarthropoda).
1840. Hypostomal wings (Fossils: arthropods): absent (0), present (1). Contingent on character 418: Labrum [1] (Euarthropoda).
1841. Three pairs of clawed uniramous appendages (Fossils: tardigrade): absent (0), present (1). Contingent on character 397: Appendages with claws [1] (Tardigrada).
1842. Compound lateral sclerites (Fossils: Lobopoda): absent (0), present (1). Contingent on character 328: Segmentation (metamerism) [1] (Articulata).
1843. Frontal appendage with elongated spine (Fossils: Lobopoda): absent (0), present (1). Contingent on character 1771: Frontal appendage (Fossils: Anomalocaris, Aysheaia, Opabinia).
1844. Bifurcated furcal branches (Fossils: phyllocarid): absent (0), present (1). Contingent on character 596: Abdomen [1] (Eucrustacea).
1845. Short and bladed bifurcated furcal branches (Fossils: phyllocarid): absent (0), present (1). Contingent on character 1844: Bifurcated furcal branches (Fossils: phyllocarid).
1846. Dorsal exoskeleton divided into two shields (Fossils: arthropods): absent (0), present (1). Contingent on character 1814: Strongly tuberculate cuticle sculpture (Fossils: arthropods)
1847. Biramous cephalic appendages with rasping and locomotory function (Fossils: arthropods): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
1848. Two overlapping pleura in thoracic region (Fossils: arthropods): absent (0), present (1). Contingent on character 1818: Post-cephalic region with overlapping pleura (Fossils: arthropods).
1849. Cephalic exopodites expanded into broad paddles for locomotion (Fossils: arthropods): absent (0), present (1). Contingent on character 419: Arthropodium (Euarthropoda).
1850. Opistharian cephalic suture (Fossils: arthropods): absent (0), present (1). Contingent on character 1812: Dorsal ecdysial suture (Fossils: arthropods)
1851. Pygidium fused (Fossils: arthropods): absent (0), present (1). Contingent on character 1812: Dorsal ecdysial suture (Fossils: arthropods).
1852. Cuticular folds and denticles on basipods of limbs (Fossils: arthropods): absent (0), present (1). Contingent on character 444: Thin walking legs [1] (Pantopoda).
1853. Cheilera with extra finger (Fossils: arthropods): absent (0), present (1). Contingent on character 435: Prosoma segment two has chelicerae [1] (Chelicerata).
1854. Bivalved cephalic shell with posterior spine (Fossils: arthropods): absent (0), present (1). Contingent on character 1815: Cephalic shield bivalved (Fossils: arthropods).
1855. Bivalved cephalic shell with anterior spines (Fossils: arthropods): absent (0), present (1). Contingent on character 1815: Cephalic shield bivalved (Fossils: arthropods).
1856. Bivalved cephalic shell with dorsal cuticle (Fossils: arthropods): absent (0), present (1). Contingent on character 1815: Cephalic shield bivalved (Fossils: arthropods).
1857. Appendage-less abdomen in line with thorax (Fossils: arthropods): absent (0), present (1). Contingent on character 596: Abdomen [1] (Eucrustacea).
1858. Coned-shaped furcal branches (Fossils: arthropods): absent (0), present (1). Contingent on character 1844: Bifurcated furcal branches (Fossils: phyllocarid)
1859. Leaf-shaped furcal branches (Fossils: arthropods): absent (0), present (1). Contingent on character 1844: Bifurcated furcal branches (Fossils: phyllocarid)

1860. Elongated spicules that extend beyond central disc (Fossils: poriferans): absent (0), present (1). Contingent on character 31: Existence of sclerocytes, which intracellularly secrete a spicule made of SiO₂ around an axial filament made of scleroprotein (Silicea).
1861. Large four-ray spicules (Fossils: poriferans): absent (0), present (1). Contingent on character 31: Existence of sclerocytes, which intracellularly secrete a spicule made of SiO₂ around an axial filament made of scleroprotein (Silicea).
1862. Cruciform spicules (Fossils: poriferans): absent (0), present (1). Contingent on character 31: Existence of sclerocytes, which intracellularly secrete a spicule made of SiO₂ around an axial filament made of scleroprotein (Silicea).
1863. Rigid skeleton of simple tetractine calcareous spicules (Fossils: poriferans): absent (0), present (1). Contingent on character 30: Existence of sclerocytes which extracellularly secrete calcareous spicules without an axial filament (Calcarea).
1864. Skeleton consists of microcrystalline micron-scale calcareous plates (Fossils: poriferans): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1865. Cone within a cone skeletal structure (Fossils: poriferans): absent (0), present (1). Contingent on character 1864: Skeleton consists of microcrystalline micron-scale calcareous plates (Fossils: poriferans).
1866. Septa between cones (Fossils: poriferans): absent (0), present (1). Contingent on character 1865: Cone within a cone skeletal structure (Fossils: poriferans).
1867. Triradial tubular skeleton (Fossils: Cnidaria): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1868. Numerous Tabellae (Fossils: Cnidaria): absent (0), present (1). Contingent on character 50: Sessile polyp (Cnidaria).
1869. Twelve tentacles (Fossils: Cnidaria): absent (0), present (1). Contingent on character 49: Tentacles [2] (Cnidaria).
1870. Radial furrow spacing similar to width (Fossils: Cnidaria): absent (0), present (1). Contingent on character 66: Medusa [1] (Rhopaliophora).
1871. Calcium phosphate skeletal bars (Fossils: Cnidaria): absent (0), present (1). Contingent on character 21: Somatic differentiation (Metazoa).
1872. Transversed ornamentation of skeletal bars (Fossils: Cnidaria): absent (0), present (1). Contingent on character 1871: Calcium phosphate skeletal bars (Fossils: Cnidaria).
1873. Attachment stalk (Fossils: Cnidaria): absent (0), present (1). Contingent on character 1871: Calcium phosphate skeletal bars (Fossils: Cnidaria).
1874. 16 comb rows (Fossils: Ctenophora): absent (0), present (1). Contingent on character 88: Eight comb rows which are the primary means of locomotion (Ctenophora).
1875. Machaeridian shell plates [fossils: *Plumulites*]: absent (0), present (1). Contingent on character 351: Parapodial cirri.
1876. Dorsal flank chaeta (paleae) [fossils: *Canadia*, *Wiwaxia*]: absent (0), present (1). Contingent on character 342: Chaeta in rows.
1877. Inter-ramal gills [fossils: *Canadia*]: absent (0), present (1). Contingent on character 341: Parapodia.
1878. Gut with anterior anus without helical coiling [fossils: *Cambrosipuncula*]: absent (0), present (1). Contingent on character 42: Gut cavity with endodermal lining.

Table S3: Phyla included in each comparison

Morphology (Ax 1996, 2000, 2003)	miRNA	Amount of genetic material - c-value (Gregory 2012)	Number of cell types	Proteins	Body size (McClain and Boyer 2005)	Diversity (Chapman 2005)	Origination (Erwin et al. 2011)
n=34	n=23	n=22	n=28	n=12	n=28	n=32	n=11
Acanthocephala	Acoelomorpha	Annelida	Annelida	Annelida	Acanthocephala	Acanthocephala	Annelida
Acoelomorpha	Annelida	Arthropoda	Arthropoda	Arthropoda	Annelida	Annelida	Arthropoda
Annelida	Arthropoda	Brachiopoda	Brachiopoda	Cephalochorda	Arthropoda	Arthropoda	Brachiopoda
Arthropoda	Brachiopoda	Cephalochorda	Bryozoa	Chordata	Brachiopoda	Brachiopoda	Bryozoa
Brachiopoda	Cephalochorda	Chaetognatha	Cephalochordata	Cnidaria	Bryozoa	Bryozoa	Vertebrata
Bryozoa	Chaetognatha	Chordata	Chordates	Echinodermata	Cephalochordata	Cephalochordata	Cnidaria
Cephalochorda	Cnidaria	Cnidaria	Cnidaria	Eukaryote	Chaetognatha	Chaetognatha	Echinodermata
Chaetognatha	Demospogia	Ctenophora	Ctenophora	Mollusca	Vertebrata	Vertebrata	Mollusca
Cnidaria	Echinodermata	Echinodermata	Echinodermata	Nematoda	Cnidaria	Cnidaria	Nematoda
Ctenophora	Hemichordata	Gastrotricha	Gastrotricha	Placozoa	Ctenophora	Ctenophora	Nemertea
Echinodermata	Mollusca	Mollusca	Gnathostomulida	Platyhelminthes	Echinodermata	Echinodermata	Demospogia
Entoprocta	Nematoda	Nematoda	Hemichordata	Porifera	Gastrotricha	Gastrotricha	
Eukaryote	Nemertea	Nemertea	Kinorhynchs		Gnathostomulida	Gnathostomulida	
Gastrotricha	Onychophora	Onychophora	Loricifera		Hemichordata	Hemichordata	
Gnathostomulida	Phoronida	Placozoa	Mollusca		Loricifera	Entoprocta	
Hemichordata	Platyhelminthes	Platyhelminthes	Nematoda		Mollusca	Kinorhynchs	
Kinorhyncha	Porifera	Porifera	Nematomorpha		Nematoda	Loricifera	
Loricifera	Priapulida	Priapulida	Nemertines		Nematomorpha	Mollusca	
Mollusca	Sipunculida	Rotifera	Onychophora		Nemertea	Nematoda	
Nematoda	Tardigrada	Sipunculidida	Phoronida		Onychophora	Nematomorpha	
Nematomorpha	Urochordata	Tardigrada	Placozoa		Phoronida	Nemertea	
Nemertea	Vertabrata	Urochordata	Platyhelminthes		Platyhelminthes	Onychophora	
Onychophora	Xenoturbella		Priapulida		Porifera	Phoronida	
Phoronida			Rotifera		Priapulida	Placozoa	
Placozoa			Sipunculida		Rotifera	Platyhelminthes	
Platyhelminthes			Sponge		Sipunculida	Porifera	
Demospogia			Tardigrada		Tardigrada	Priapulida	
Priapulida			Urochordata		Urochordata	Rotifera	
Rotifera						Sipunculida	
Sipunculida						Tardigrada	
Tardigrada						Urochordata	
Urochordata						Xenoturbella	
Vertabrata							
Xenoturbella							

Table S4: Compilation of other datasets

Phyla	Number of cell Types	Amount of genetic material -c-value (Gregory 2012)	Diversity (Chapman 2005)	Minimum body size (McClain and Boyer 2005)	Maximum body size (McClain and Boyer 2005)	Range in body size (McClain and Boyer 2005)	Disparity	Origination (Erwin et al. 2011)
Acanthocephala	-	-	1500	0.0408	20600	20599.9592	0	-
Acoelomorpha	-	-	-	-	-	-	3.31E-06	-
Annelida	94	1.315	16763	0.0000263	1470000	1470000	2.91E-05	477
Arthropoda	73	2.129	3693340	0.0000421	97300000	97300000	0.0030316	538
Brachiopoda	52	0.400	550	1	2050000	2049999	4.33E-07	528
Bryozoa	77	-	5700	314000	5020000	4706000	3.59E-06	533
Cephalochordata	68	0.590	23	1140	9100	7960	0	-
Chaetognatha	-	0.880	121	0.0154	15.4	15.3846	0	-
Cnidaria	34	1.009	9795	0.00526	2800000000	2800000000	8.07E-06	687
Ctenophora	30	1.735	166	3.38	1260000	1259996.62	0	-
Echinodermata	45	1.306	7003	0.13248367	13400000	13399999.87	4.44E-05	509
Entoprocta	na	-	170	-	-	-	0	-
Gastrotricha	42	0.226	400	0.00000778	1.45	1.44999222	5.50E-09	-
Gnathostomulida	25	-	97	0.000366	0.0341	0.033734	7.15E-08	-
Hemichordata	35	-	108	6.6	4910000	4909993.4	9.75E-08	-
Kinorhynchs	35	-	130	-	-	-	0	-
Loricifera	31	-	28	0.000231	0.00877	0.008539	0	-
Mollusca	83	2.085	85000	0.0184	5880000000	5880000000	0.000148	560
Nematoda	38	0.173	25000	0.0000942	1080000	1080000	0	493
Nematomorpha	11	-	331	1.94	1260	1258.06	1.75E-06	-
Nemertea	51	1.400	1200	0.018	589000	588999.982	8.11E-08	547
Onychophora	64	5.655	165	6.03	64200	64193.97	0	-
Phoronida	31	-	10	2.65	8830	8827.35	0	-
Placozoa	4	0.040	1	-	-	-	0	-
Platyhelminthes	30	2.110	20000	0.000283	1570000	1570000	2.29E-05	-
Demospongia	25	0.660	6000	0.125	1870000000	1870000000	0	700
Priapulida	25	0.560	16	0.0228	183000	182999.9772	0	-
Rotifera	51	0.680	2180	0.0000393	3.55	3.5499607	0.0004784	-
Sipunculida	46	1.280	144	0.0959	126000	125999.9041	0	-
Tardigrada	35	0.369	1045	0.008	0.729	0.721	0	-
Urochordata	77	0.140	1250	0.125	100000000	99999999.88	2.20E-06	-
Vertebrata	172.5	5.729	58000	44.3	1.9E+11	1.9E+11	0.0009745	658
Xenoturbella	-	-	2	-	-	-	0	-

Additional dataset S1 (separate file)

Categorical character dataset for living metazoans based on Ax (1-3) and observational codings for fossil taxa.

Additional dataset S2 (separate file)

Inferred character states for fossil taxa and ancestral character states

References cited in the SI Appendix

1. Ax P (1996) *Multicellular animals: a new approach to the phylogenetic order in nature* (Springer-Verlag, Berlin).
2. Ax P (2000) *Multicellular Animals: The Phylogenetic System of the Metazoa* (Springer Verlag, Berlin); trans Kinsey S.
3. Ax P (2003) *Multicellular Animals: Order in Nature - System Made by Man* (Springer_Verlag, Berlin); trans Dunmur RE.
4. Deline B (2009) The effects of rarity and abundance distributions on measurements of local morphological disparity. *Paleobiology* 35(2):175-189.
5. Deline B & Ausich WI (2011) Testing the plateau: a reexamination of disparity and morphologic constraints in early Paleozoic crinoids. *Paleobiology* 37(2):214-236.
6. Huntley JW, Xiao S, & Kowalewski M (2006) 1.3 Billion years of acritarch history: An empirical morphospace approach. *Precambrian Research* 144(1-2):52-68.
7. Lyson TR, Sperling EA, Gauthier JA, Heimberg AM, & Peterson KJ (2011) MicroRNAs support a Testudines-Lepidosaur clade. *Integrative and Comparative Biology* 51:E222-E222.
8. Blackledge TA, *et al.* (2009) Reconstructing web evolution and spider diversification in the molecular era. *Proc. Natl. Acad. Sci. U. S. A.* 106(13):5229-5234.
9. Brinkmann H, Venkatesh B, Brenner S, & Meyer A (2004) Nuclear protein-coding genes support lungfish and not the coelacanth as the closest living relatives of land vertebrates. *Proc. Natl. Acad. Sci. U. S. A.* 101(14):4900-4905.
10. Coddington JA & Levi HW (1991) SYSTEMATICS AND EVOLUTION OF SPIDERS (ARANEAE). *Annual Review of Ecology and Systematics* 22:565-592.
11. Cohen BL (2000) Monophyly of brachiopods and phoronids: reconciliation of molecular evidence with Linnaean classification (the subphylum Phoroniformea nov.). *Proc. R. Soc. Lond. Ser. B-Biol. Sci.* 267(1440):225-231.
12. Collins AG, *et al.* (2006) Medusozoan phylogeny and character evolution clarified by new large and small subunit rDNA data and an assessment of the utility of phylogenetic mixture models. *Systematic Biology* 55(1):97-115.
13. Daley AC, Budd GE, Caron JB, Edgecombe GD, & Collins D (2009) The Burgess Shale Anomalocaridid *Hurdia* and Its Significance for Early Euarthropod Evolution. *Science* 323(5921):1597-1600.
14. Delsuc F, Brinkmann H, Chourrout D, & Philippe H (2006) Tunicates and not cephalochordates are the closest living relatives of vertebrates. *Nature* 439(7079):965-968.
15. Dunn CW, *et al.* (2008) Broad phylogenomic sampling improves resolution of the animal tree of life. *Nature* 452(7188):745-U745.
16. Fuchs J, Obst M, & Sundberg P (2009) The first comprehensive molecular phylogeny of Bryozoa (Ectoprocta) based on combined analyses of nuclear and mitochondrial genes. *Mol. Phylogenet. Evol.* 52(1):225-233.
17. Heimberg AM, Cowper-Sallari R, Semon M, Donoghue PCJ, & Peterson KJ (2010) microRNAs reveal the interrelationships of hagfish, lampreys, and gnathostomes and the nature of the ancestral vertebrate. *Proc. Natl. Acad. Sci. U. S. A.* 107(45):19379-19383.
18. Hurley IA, *et al.* (2007) A new time-scale for ray-finned fish evolution. *Proc. R. Soc. B-Biol. Sci.* 274(1609):489-498.
19. Morris SC & Caron JB (2007) Halwaxiids and the early evolution of the lophotrochozoans. *Science* 315(5816):1255-1258.
20. Perez-Losada M, Hoeg JT, Kolbasov GA, & Crandall KA (2002) Reanalysis of the relationships among the cirripedia and the ascothoracida and the phylogenetic position of the facetotecta (Maxillopoda : thecostraca) using 18S rDNA sequences. *Journal of Crustacean Biology* 22(3):661-669.
21. Perseke M, *et al.* (2010) Mitochondrial genome evolution in Ophiuroidea, Echinoidea, and Holothuroidea: Insights in phylogenetic relationships of Echinodermata. *Mol. Phylogenet. Evol.* 56(1):201-211.
22. Philippe H, *et al.* (2011) Acoelomorph flatworms are deuterostomes related to Xenoturbella. *Nature* 470(7333):255-258.

23. Regier JC, *et al.* (2010) Arthropod relationships revealed by phylogenomic analysis of nuclear protein-coding sequences. *Nature* 463(7284):1079-1083.
24. Shear WA & Edgecombe GD (2010) The geological record and phylogeny of the Myriapoda. *Arthropod Structure & Development* 39(2-3):174-190.
25. Sierwald P & Bond JE (2007) Current status of the myriapod class diplopoda (Millipedes): Taxonomic diversity and phylogeny. *Annual Review of Entomology* 52:401-420.
26. Sigwart JD & Sutton MD (2007) Deep molluscan phylogeny: synthesis of palaeontological and neontological data. *Proc. R. Soc. B-Biol. Sci.* 274(1624):2413-2419.
27. Simon S, Strauss S, von Haeseler A, & Hadrys H (2009) A Phylogenomic Approach to Resolve the Basal Pterygote Divergence. *Mol. Biol. Evol.* 26(12):2719-2730.
28. Sorensen MV & Giribet G (2006) A modern approach to rotiferan phylogeny: Combining morphological and molecular data. *Molecular phylogenetics and evolution* 40(2):585-608.
29. Spears T & Abele LG (2000) Branchiopod monophyly and interordinal phylogeny inferred from 18S ribosomal DNA. *Journal of Crustacean Biology* 20(1):1-24.
30. Sperling EA, Peterson KJ, & Pisani D (2009) Phylogenetic-Signal Dissection of Nuclear Housekeeping Genes Supports the Paraphyly of Sponges and the Monophyly of Eumetazoa. *Mol. Biol. Evol.* 26(10):2261-2274.
31. Sperling EA, Pisani D, & Peterson KJ (2011) Molecular paleobiological insights into the origin of the Brachiopoda. *Evol. Dev.* 13(3):290-303.
32. Struck TH, *et al.* (2011) Phylogenomic analyses unravel annelid evolution. *Nature* 471(7336):95-U113.
33. Sundberg P, Turbeville JM, & Lindh S (2001) Phylogenetic relationships among higher nemertean (Nemertea) taxa inferred from 18S rDNA sequences. *Mol. Phylogenet. Evol.* 20(3):327-334.
34. Tsagkogeorga G, *et al.* (2009) An updated 18S rRNA phylogeny of tunicates based on mixture and secondary structure models. *BMC Evol. Biol.* 9:16.
35. Wheeler WC, Whiting M, Wheeler QD, & Carpenter JM (2001) The phylogeny of the extant hexapod orders. *Cladistics* 17(2):113-169.
36. Wiegmann BM, *et al.* (2009) Single-copy nuclear genes resolve the phylogeny of the holometabolous insects. *Bmc Biology* 7.
37. Wilson NG, Rouse GW, & Giribet G (2010) Assessing the molluscan hypothesis Serialia (Monoplacophora plus Polyplacophora) using novel molecular data. *Mol. Phylogenet. Evol.* 54(1):187-193.
38. Xie Q, Tian Y, Zheng L, & Bu W (2008) 18S rRNA hyper-elongation and the phylogeny of Euhemiptera (Insecta : Hemiptera). *Mol. Phylogenet. Evol.* 47(2):463-471.
39. Littlewood DTJ (2008) Platyhelminth systematics and the emergence of new characters. *Parasite-Journal De La Societe Francaise De Parasitologie* 15(3):333-341.
40. Benton MJ, *et al.* (2015) Constraints on the timescale of animal evolutionary history. *Paleontologica Electronica*.
41. Bapst DW (2012) paleotree: an R package for paleontological and phylogenetic analyses of evolution. *Methods in Ecology and Evolution* 3(5):803-807.
42. Liu JN, *et al.* (2011) An armoured Cambrian lobopodian from China with arthropod-like appendages. *Nature* 470(7335):526-530.
43. Huelsenbeck JP, Nielsen R, & Bollback JP (2003) Stochastic mapping of morphological characters. *Systematic Biology* 52(2):131-158.
44. Revell LJ (2012) phytools: An R package for phylogenetic comparative biology (and other things). *Methods in Ecology and Evolution* 3:217-223.
45. McClain CR & Boyer AG (2009) Biodiversity and body size are linked across metazoans. *Proceedings of the Royal Society B: Biological Sciences* 276:2209-2215.
46. Gregory TR (2012) Animal Genome Size Database.
47. Chapman A (2005) *Numbers of living species in Australia and the World* (Australian Biological Resources Study, Canberra) p 61.
48. Erwin DH, *et al.* (2011) The Cambrian conundrum: early divergence and later ecological success in the early history of animals. *Science* 334(6059):1091-1097.
49. Alberts B, *et al.* (1989) *Molecular Biology of the Cell* (Garland, New York) 2 Ed.

50. Benito J & Pardos F (1997) Hemichordata. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Ruppert EE (Wiley-Liss), Vol Volume 15: Hemichordata, Chaetognatha, and the Invertebrate Chordates.
51. Bresciani J (1991) Nematomorpha. *Microscopic Anatomy of Invertebrates*, ed Ruppert FWHaEE (Wiley-Liss), Vol Volume 4: Aschelminthes.
52. **Burighel P & Cloney RA** (1997) Urochordata: Ascidiacea. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Ruppert EE (Wiley-Liss), Vol Volume 15: Hemichordata, Chaetognatha, and the Invertebrate Chordates.
53. Clément P & Wurdak E (1991) Rotifera. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Ruppert EE (Wiley-Liss), Vol Volume 4: Aschelminthes.
54. Dewel RA, Nelson DR, & Dewel WC (1993) Tardigrada. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Rice ME (Wiley-Liss), Vol Volume 12: Onychophora, Chilopoda, and Lesser Protostomata.
55. Dunagan TT & Miller DM (1991) Acanthocephala. *Microscopic Anatomy of Invertebrates*, ed Ruppert FWHaEE (Wiley-Liss), Vol Volume 4: Aschelminthes.
56. Fried B & Haseeb MA (1990) Platyhelminthes: Aspidogastrea, Monogenea, and Digenea. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Bogitsh BJ (Wiley-Liss), Vol Volume 3: Platyhelminthes and Nemertinea.
57. Grell KG & Ruthmann A (1990) Placozoa. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Ruppert EE (Wiley-Liss), Vol Volume 2: Placozoa, Porifera, Cnidaria, and Ctenophora.
58. Harrison FW & Vos LD (1990) Porifera. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Ruppert EE (Wiley-Liss), Vol Volume 2: Placozoa, Porifera, Cnidaria, and Ctenophora.
59. Heinzeller T & Welsch U (1994) Crinoidea. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Chia FS (Wiley-Liss), Vol Volume 14: Echinodermata.
60. Hernandez-Nicaise M-L (1990) Ctenophora. *Microscopic Anatomy of Invertebrates*, ed Ruppert FWHaEE (Wiley-Liss), Vol Volume 2: Placozoa, Porifera, Cnidaria, and Ctenophora.
61. Herrmann K (1997) Phoronida. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Woollacott RM (Wiley-Liss), Vol Volume 13: Lophophorates, Entoprocta, and Cycliophora.
62. James MA (1997) Brachiopoda: Section 2: Internal Anatomy, Embryology, and Development. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Woollacott RM (Wiley-Liss), Vol Volume 13: Lophophorates, Entoprocta, and Cycliophora.
63. Jamieson BGM (1992) Oligochaeta. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Gardiner SL (Wiley-Liss), Vol Volume 7: Annelida.
64. Kristensen RM & Higgins RP (1991) Kinorhyncha. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Ruppert EE (Wiley-Liss), Vol Volume 4: Aschelminthes.
65. Lammert V (1991) Gnathostomulida. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Ruppert EE (Wiley-Liss), Vol Volume 4: Aschelminthes.
66. Martin JW (1992) Branchiopoda. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Humes AG (Wiley-Liss), Vol Volume 9: Crustacea.
67. Morse MP & Zardus JD (1996) Bivalva. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Kohn AJ (Wiley-Liss), Vol Volume 6A: Mollusca II.
68. Mukai H, Terakado K, & Reed CG (1997) Bryozoa. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Woollacott RM (Wiley-Liss), Vol Volume 13: Lophophorates, Entoprocta, and Cycliophora.
69. Nielsen C & Jespersen Å (1997) Entoprocta. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Woollacott RM (Wiley-Liss), Vol Volume 13: Lophophorates, Entoprocta, and Cycliophora.
70. Pilger JF (1993) Echiura. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Rice ME (Wiley-Liss), Vol Volume 12: Onychophora, Chilopoda, and Lesser Protostomata.
71. Rice ME (1993) Sipuncula. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Rice ME (Wiley-Liss), Vol Volume 12: Onychophora, Chilopoda, and Lesser Protostomata.
72. Ruppert EE (1991) Gastrotricha. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Ruppert EE (Wiley-Liss), Vol Volume 4: Aschelminthes.
73. Ruppert EE (1997) Cephalochordata (Acrania). *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Ruppert EE (Wiley-Liss), Vol Volume 15: Hemichordata, Chaetognatha, and the Invertebrate Chordates.

74. Shinn GL (1997) Chaetognatha. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Ruppert EE (Wiley-Liss), Vol Volume 15: Hemichordata, Chaetognatha, and the Invertebrate Chordates.
75. Storch V (1991) Priapulida. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Ruppert EE (Wiley-Liss).
76. Storch V & Ruhberg H (1993) Onychophora. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Rice ME (Wiley-Liss), Vol Volume 12: Onychophora, Chilopoda, and Lesser Protostomata.
77. Thomasand MB & Edwards NC (1990) Cnidaria: Hydrozoa. *Microscopic Anatomy of Invertebrates*, ed Ruppert FWHaEE (Wiley-Liss), Vol Volume 2: Placozoa, Porifera, Cnidaria, and Ctenophora.
78. Turbeville JM (1990) Nemertinea. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Bogitsh BJ (Wiley-Liss), Vol Volume 3: Platyhelminthes and Nemertinea.
79. Williams A (1997) Brachiopoda: Section 1: Introduction and Integumentary System. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Woollacott RM (Wiley-Liss), Vol Volume 13: Lophophorates, Entoprocta, and Cycliophora.
80. Wright KA (1991) Nematoda. *Microscopic Anatomy of Invertebrates*, eds Harrison FW & Ruppert EE (Wiley-Liss), Vol Volume 4: Aschelminthes.
81. Anonymous (1981) *The Biology of Lampreys* (Academic Press, London).
82. Anonymous (1982) *The Biology of Lampreys* (Academic Press, London).
83. Anonymous (1982) *The Biology of Lampreys* (Academic Press, London).
84. Anonymous (1971) *The Biology of Lampreys*.
85. Anonymous (1972) *The Biology of Lampreys*.
86. Gough J, Karplus K, Hughey R, & Chothia C (2001) Assignment of homology to genome sequences using a library of hidden Markov models that represent all proteins of known structure. *J. Mol. Biol.* 313(4):903-919.
87. Murzin AG, Brenner SE, Hubbard T, & Chothia C (1995) SCOP - A STRUCTURAL CLASSIFICATION OF PROTEINS DATABASE FOR THE INVESTIGATION OF SEQUENCES AND STRUCTURES. *J. Mol. Biol.* 247(4):536-540.
88. R Development Core Team (R: A language and environment for statistical computing (R Foundation for Statistical Computing, Vienna).
89. Oksanen J, *et al.* (2012) Vegan: Community Ecology Package.), R package version 2.0-3
90. James DA & Debroy S (2011) RMySQL: R interface to the MySQL database.), R package version 0.8-0.