

Two sides of four kingdoms and other things classifications

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Carolus Linnaeus (1735)

NATURALIA sunt corpora cuncta Creatoris manu composita, Tellurem constituentia, in **REGNA NATURÆ** tria divisa, quorum limites concurrunt in Zoophytis.

LAPIDES corpora *congesta*, nec viva, nec sentientia.

VEGETABILIA corp. *organisata & viva*, non sentientia.

ANI-

(g) Senec. (h) Helmontii definitio. (i) Senec. III: 10: (k) Senec. III: 29.

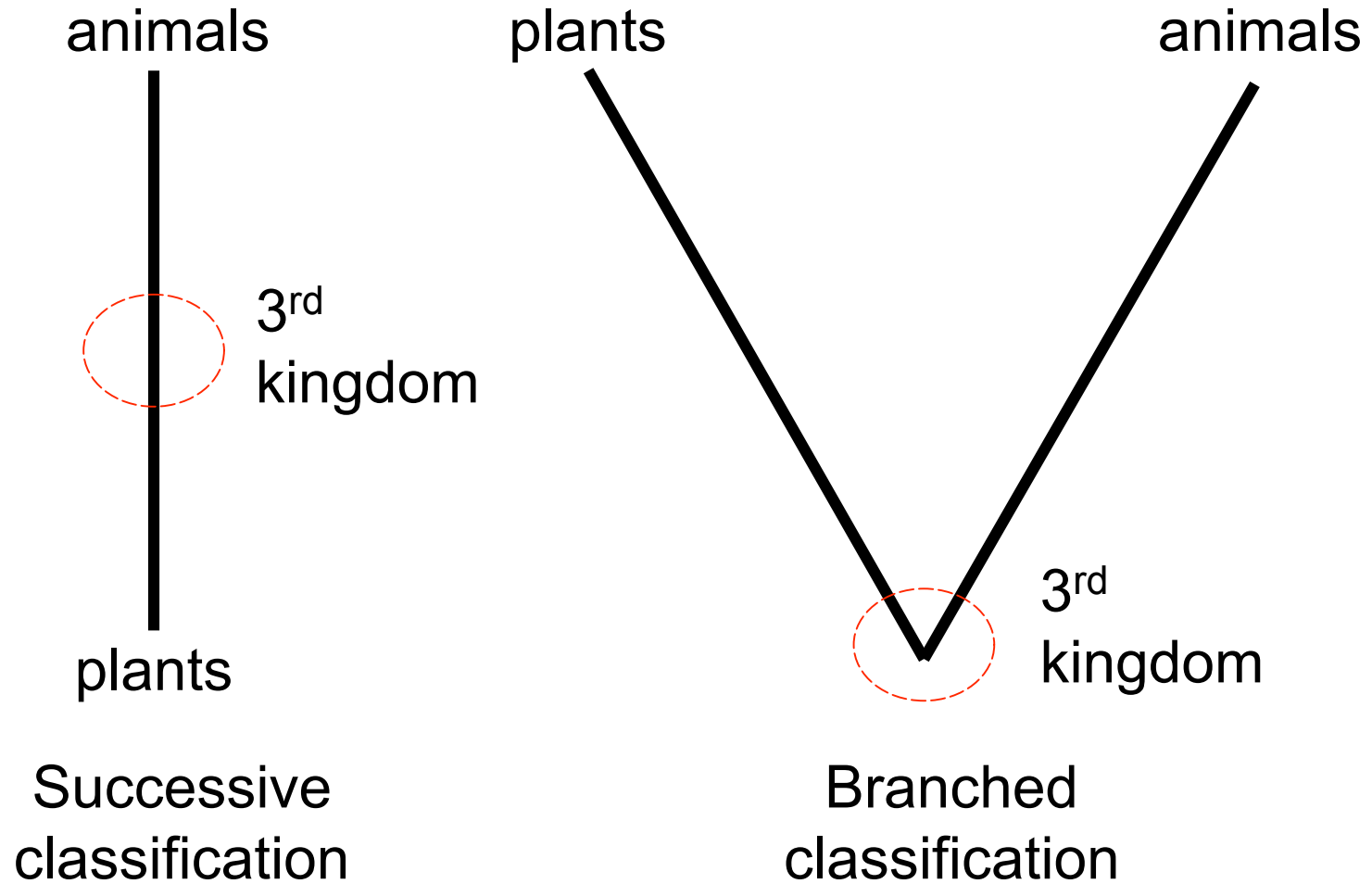
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IMPERIUM NATURÆ.

ANIMALIA corp. *organisata & viva*, & *sentientia*, sponte-que se moventia.

His three kingdoms were based on physiological approach and located on successive manner, according to the “chain of being” – “scala naturae”

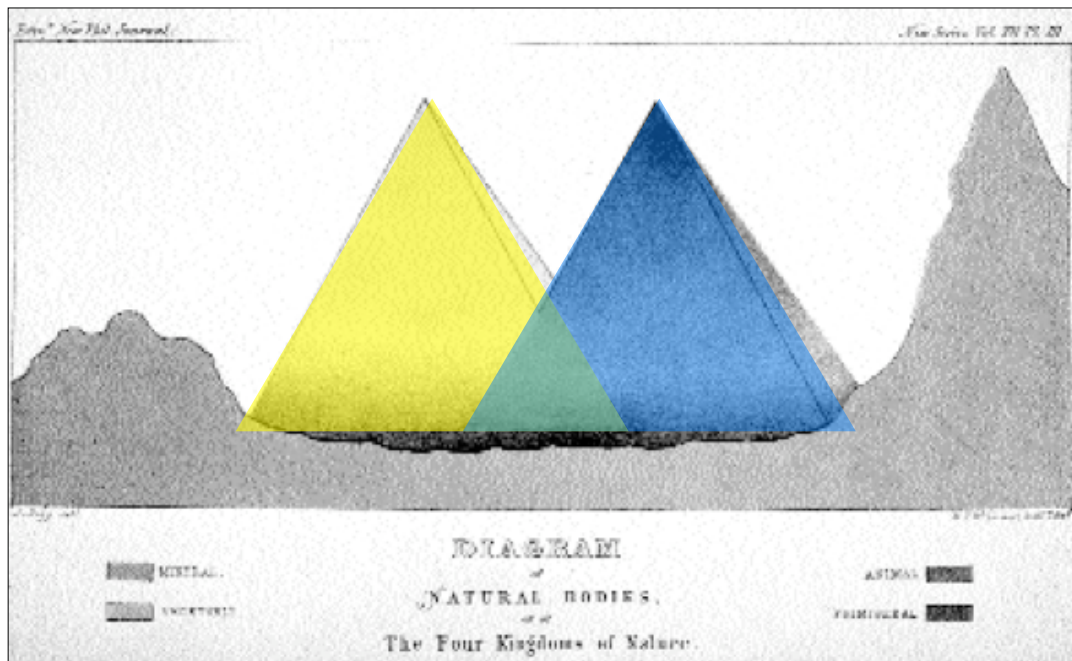
Chain or branches?



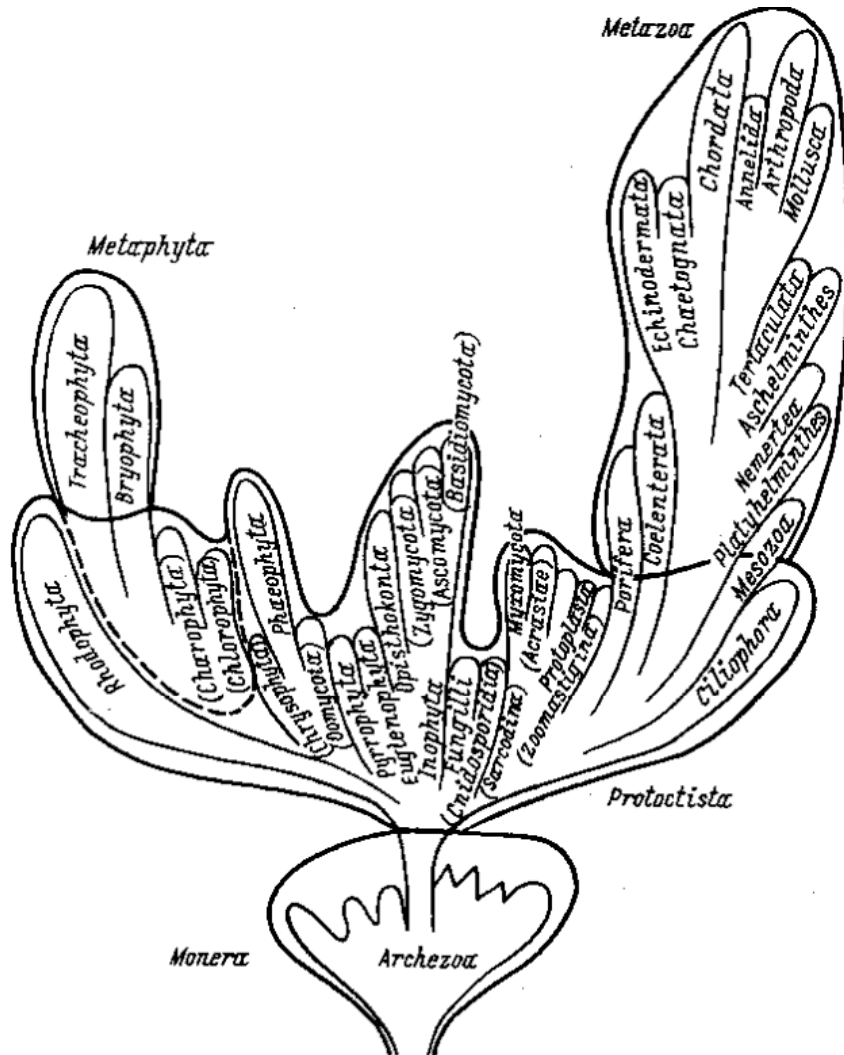
In the search of third kingdom

R.Owen (1860), introduced the third kingdom “Protozoa”; J.Hogg (1860) listed kingdoms Protocista, Vegetabilia and Animalia. E.Haeckel (1866) called third kingdom “Protista”.

The emergence of concepts of evolution played a great role in the process of establishing the third kingdom of life. Th.Wilson and J.Cassin (1864) intentionally pointed that in the light of evolution “chain of being” should be disregarded.



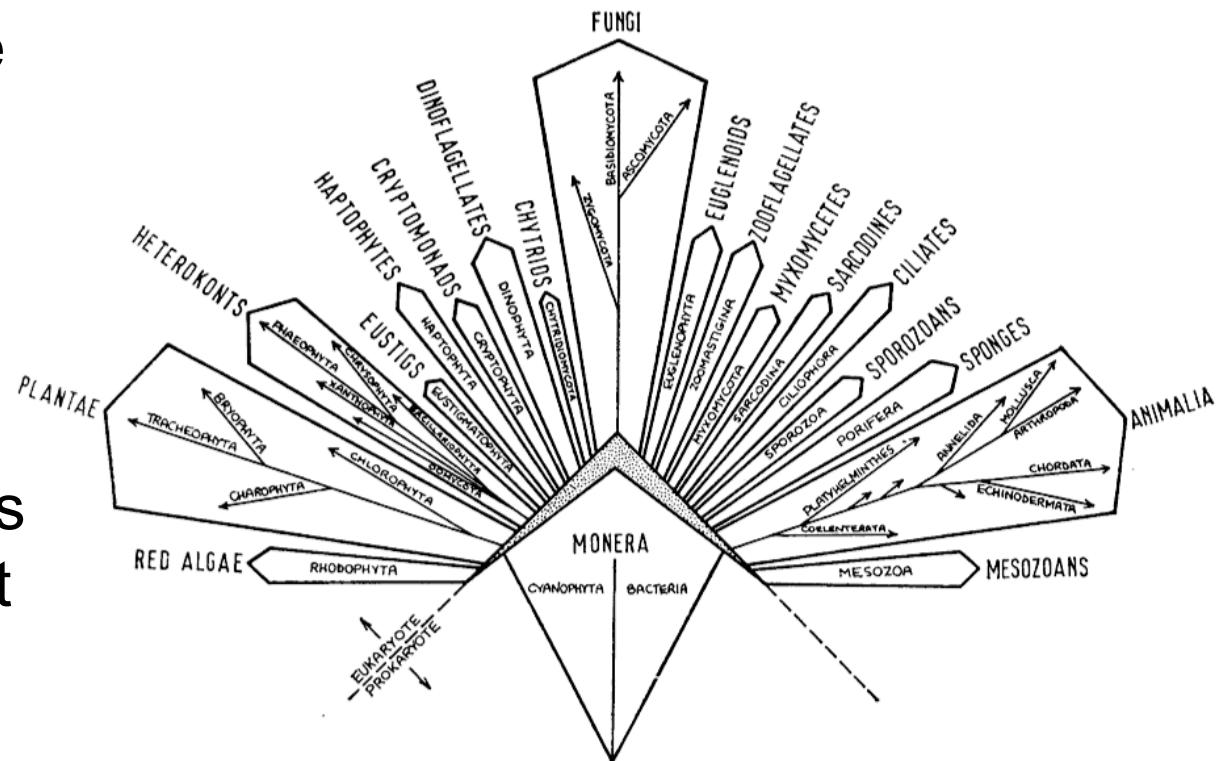
Monera is the fourth kingdom



H.F. Copeland (1938, 1954) developed a four-kingdom classification of organisms which have been subsequently popularized by R. Whittaker (1957, 1969) and L. Margulis (1971, 1978), who added the fifth (fungal) kingdom. Their classification differ mostly in the place of “dissection” plants from algae. Monera (Prokaryotae) were added as successive step, and Fungi were added as the third branch.

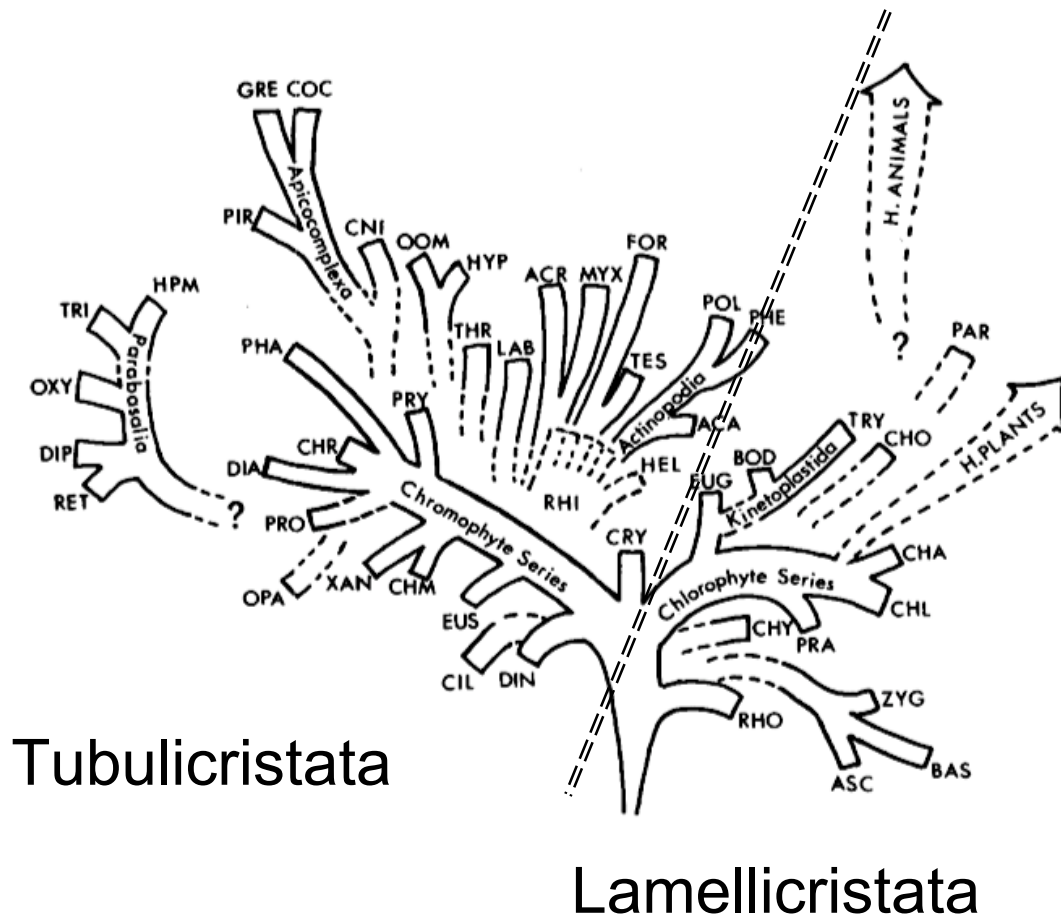
Barrier is broken: multiple kingdoms

“Classic” example: the 19-kingdom classification of G.F. Leedale (1974). During the last 30 years, many multi-kingdom classifications appeared. The biggest example is probably the classification of A.L. Drozdov (2003) with 26 kingdoms.

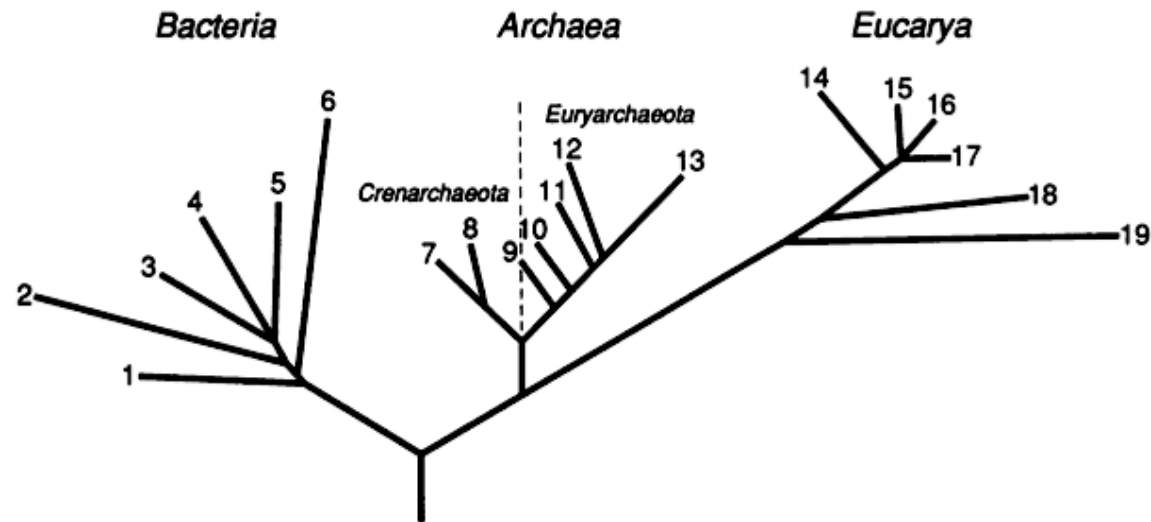


Attempts to reduce kingdoms

Several attempts have been made for reduction of the number of kingdoms. F.J.R. Taylor (1978) introduced the type of mitochondrial cristae (flat or tubular) as the main character for distinguishing eukaryotes. Unfortunately, this character turned out to be unstable.

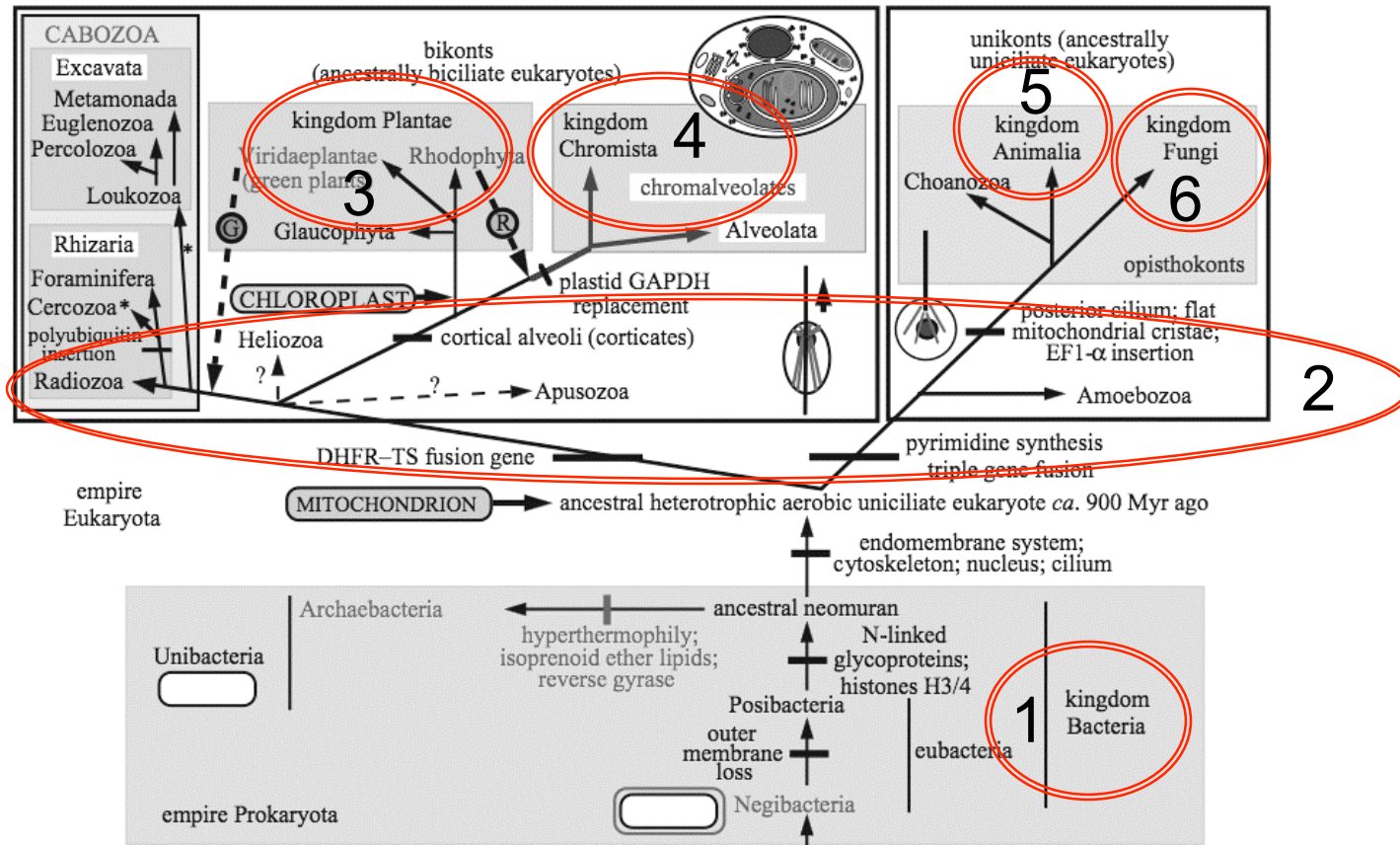


Archaea



C.R.Woese (1990–onwards) proposed another solution for small-number-of-kingdoms classification: just unite all eukaryotes, but separate Monera (prokaryotes) in two kingdoms (“domains”): Bacteria and new group Archaea, or Archebacteria. This mega-classification is the first based on phylogenetic trees obtained from DNA sequences.

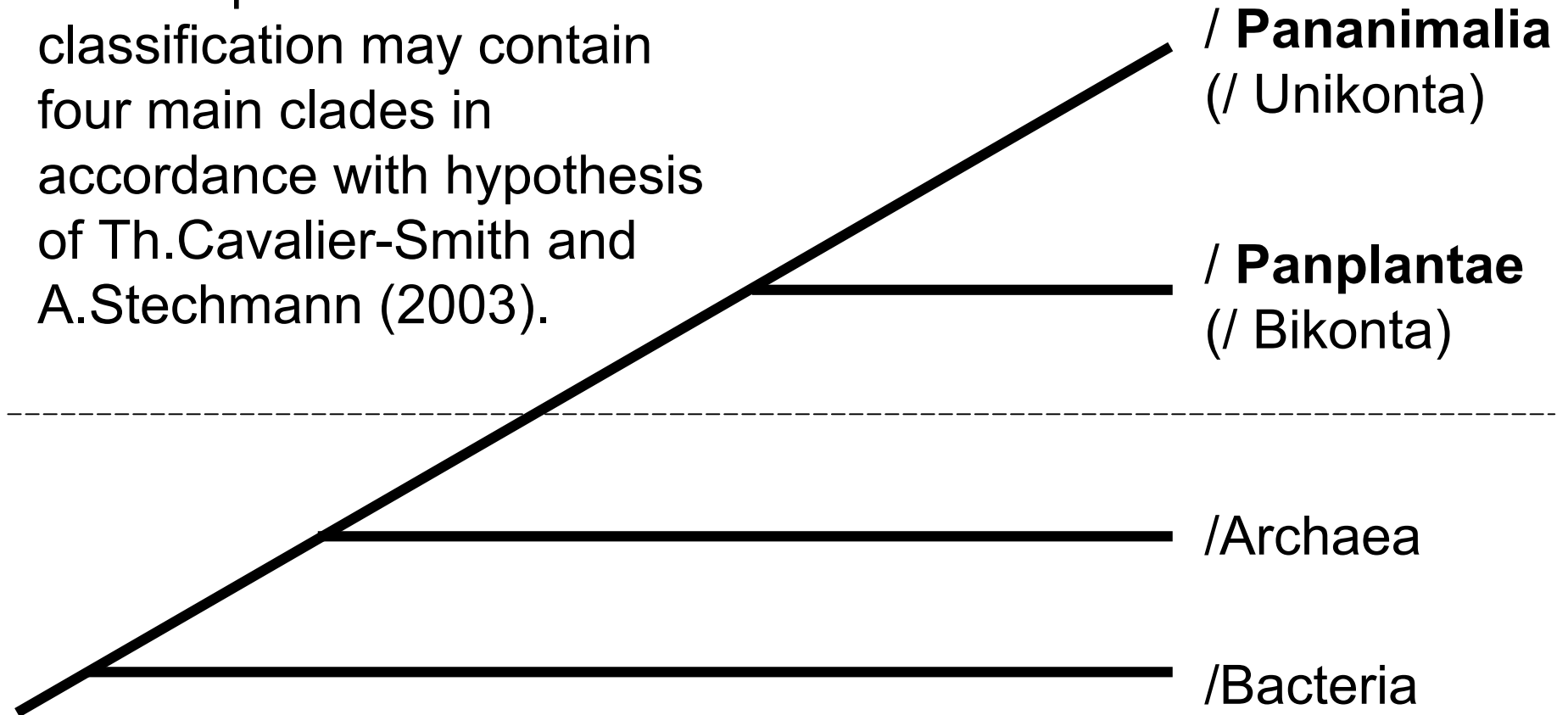
“Hybrid” approaches



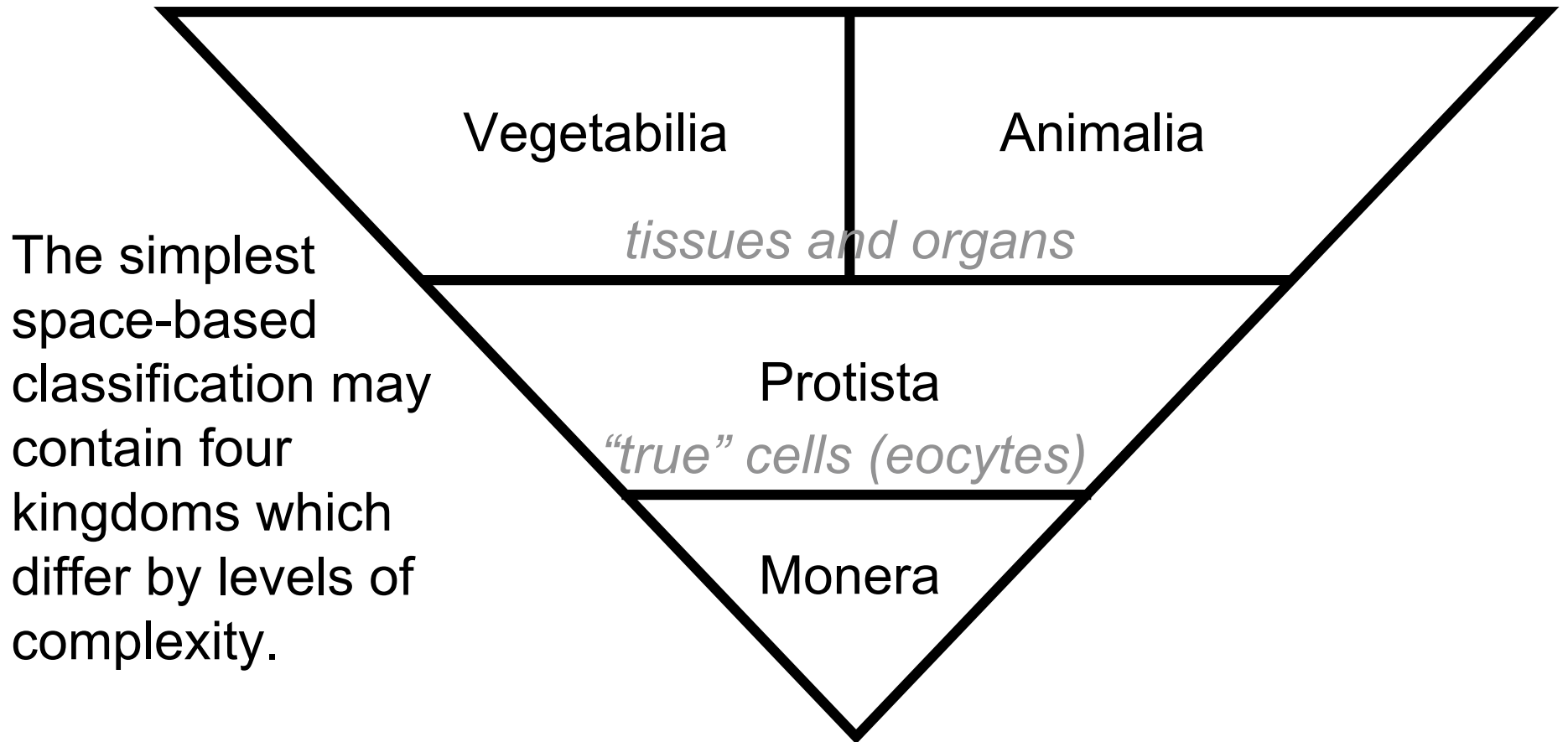
Six-kingdoms classification of Th. Cavalier-Smith (2004) is “hybrid”: some parts are branches, but his kingdom Protozoa is just a step.

Four main braches

The simplest tree-based classification may contain four main clades in accordance with hypothesis of Th.Cavalier-Smith and A.Stechmann (2003).



Four main kingdoms



The simplest space-based classification may contain four kingdoms which differ by levels of complexity.

The concept of “Histonion”, or multitissued organisms originated from R.Owen (1860) and developed in several publications of J.Corliss (1983-onwards).

Complementary approaches

Bacteria	Archaea	Panplantae	Pananimalia
Monera	Vegetabilia	Protista	Animalia

These two classifications could be used together because they used two complementary “taxon designations” (Oskolsky, 2007): “taxon as class” (space-based classifications) and “taxon as place” (tree-based). For practical purposes, second is preferable where ranks are used, and first is preferable for rank-free classifications.

Main problems of mega-classification

1. Paraphyly

This is mostly a problem of communication between tree- and space-based classifications. These conflicts should be avoided as much as possible.

2. Devaluation of ranks

Where tree-based approach is used, tons of ranks are needed and/or terminal taxa obtain much lower rank (e.g., flowering plants can receive the rank of order or even family). The best solution is to use rank-free classification for all tree-based classifications.

3. Rank designation

Many higher taxa are not typified, but when they finally became typified, the use of proposed endings (like “-mycetidae”, “-phytina”, “-formes” are often quite difficult. The solution is to use numbers for rank designations, like “⁵**Felis**” for Mammalia and “⁶**Felis**” for Chordata.

Main problems (contd.)

4. Inclusion of viruses

Whether or not include viruses to the classification of living things is unclear since their discovery. The solution depends from what we call “living”.

5. “Nanobacteria”

Authors of name (Kajander et al., 1998, 2006) propose that nanobacteria (propagating calcifying nanoparticles) are more primitive than prokaryotes and probably represent a “third branch of life”. But even the existence of this organisms is still doubtful.

6. “Environmental” groups

These taxa originated are just branches from environmental sequences trees so they lack morphological descriptions. Maybe the best way is to accept only well-characterized environmental groups (like “Picobiliphyta”).

Main problems (contd.)

7. Tissues in protists

Some protistan groups (members of Rhodophyta, Phaeophyceae and probably some fungi) have true tissues. However, complexity of their tissues is incomparable with tissues of Animalia and Vegetabilia (Corliss, 1984). In addition, many transitional forms are present there.

8. Some protists do not belong to Pananimalia or Panplantae

There are several examples: Apusomonadida, Collodictyonida, Breviatea and probably some non-sequenced organisms like Hemimastigophorea. However, their position could be resolved either in Pananimalia or Panplantae.

Acknowledgements

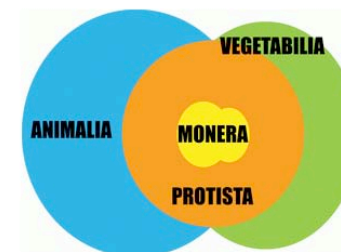
- Alexei Oskolsky (Botanical Institute, S.-Petersburg)
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- Igor Pavlinov (Zoological Museum, Moscow State University)

Web-site of the authors'
classification:

<http://herba.msu.ru/shipunov/os>

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Mode of access: <http://herba.msu.ru/shipunov/os/os-en.htm>

Systema Naturae



Current β version:

- [Classification itself](#), in PDF (version information inside)
- [What's new](#) since 5.4, plain text
- [Diagram of classification](#), in SVG
- [English References](#), in BibTeX

Stable version 5.6 (June 2007):

Shipunov, Alexey. Systema Naturae. Classification of living things. [Available from Nature Precedings](#) (2007).

You are very welcome to leave there all your corrections and suggestions.