



Sodobni pogled na drevo življenja: mikrobiologova zgodba

*Contemporary view of a tree of life:
the microbiologist's tale*

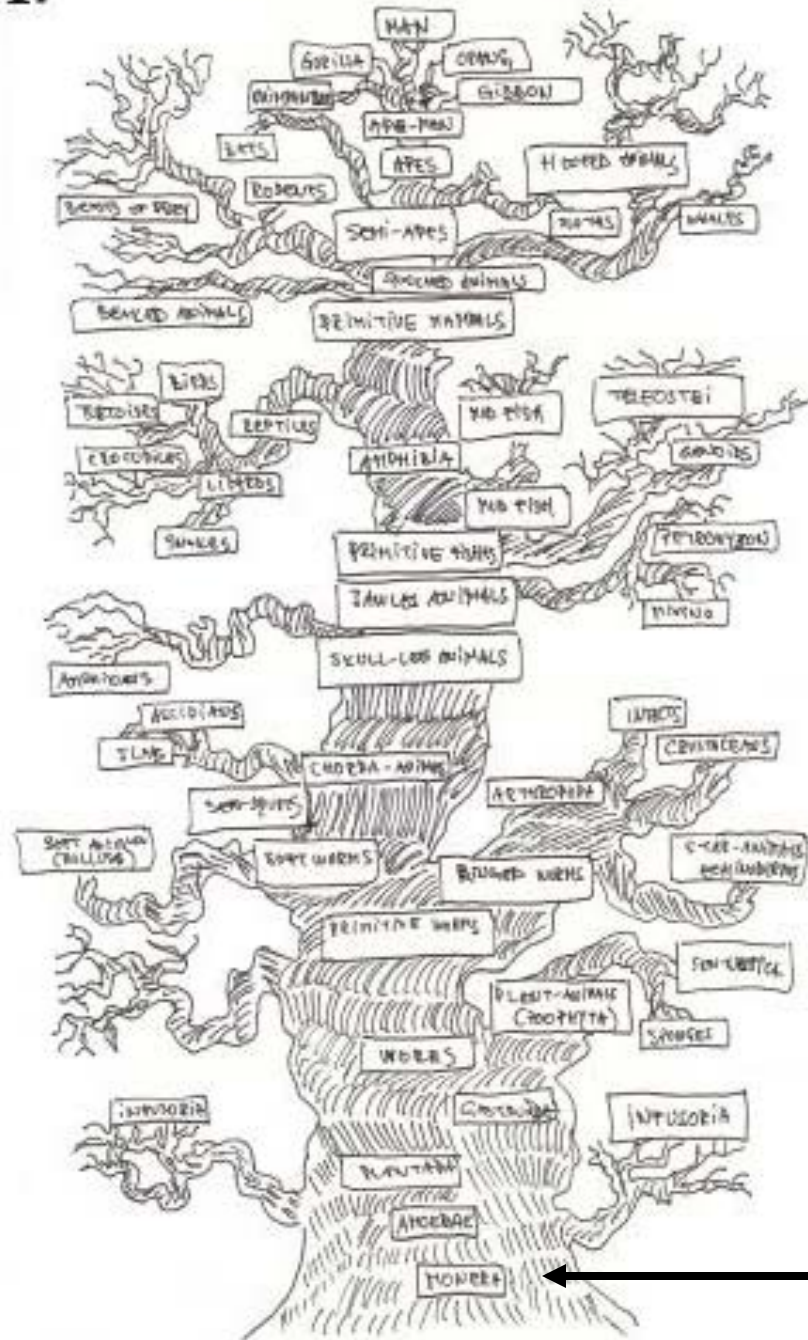
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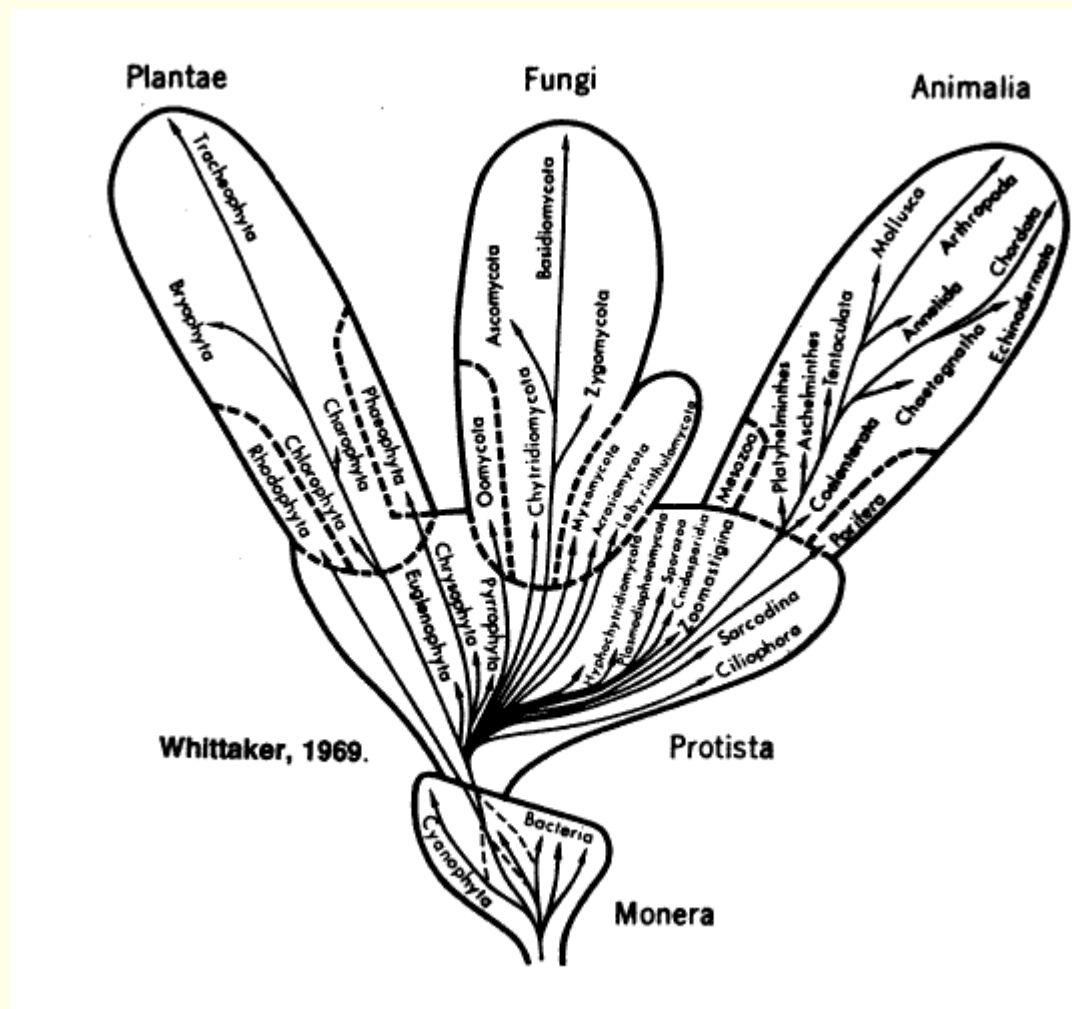


A.



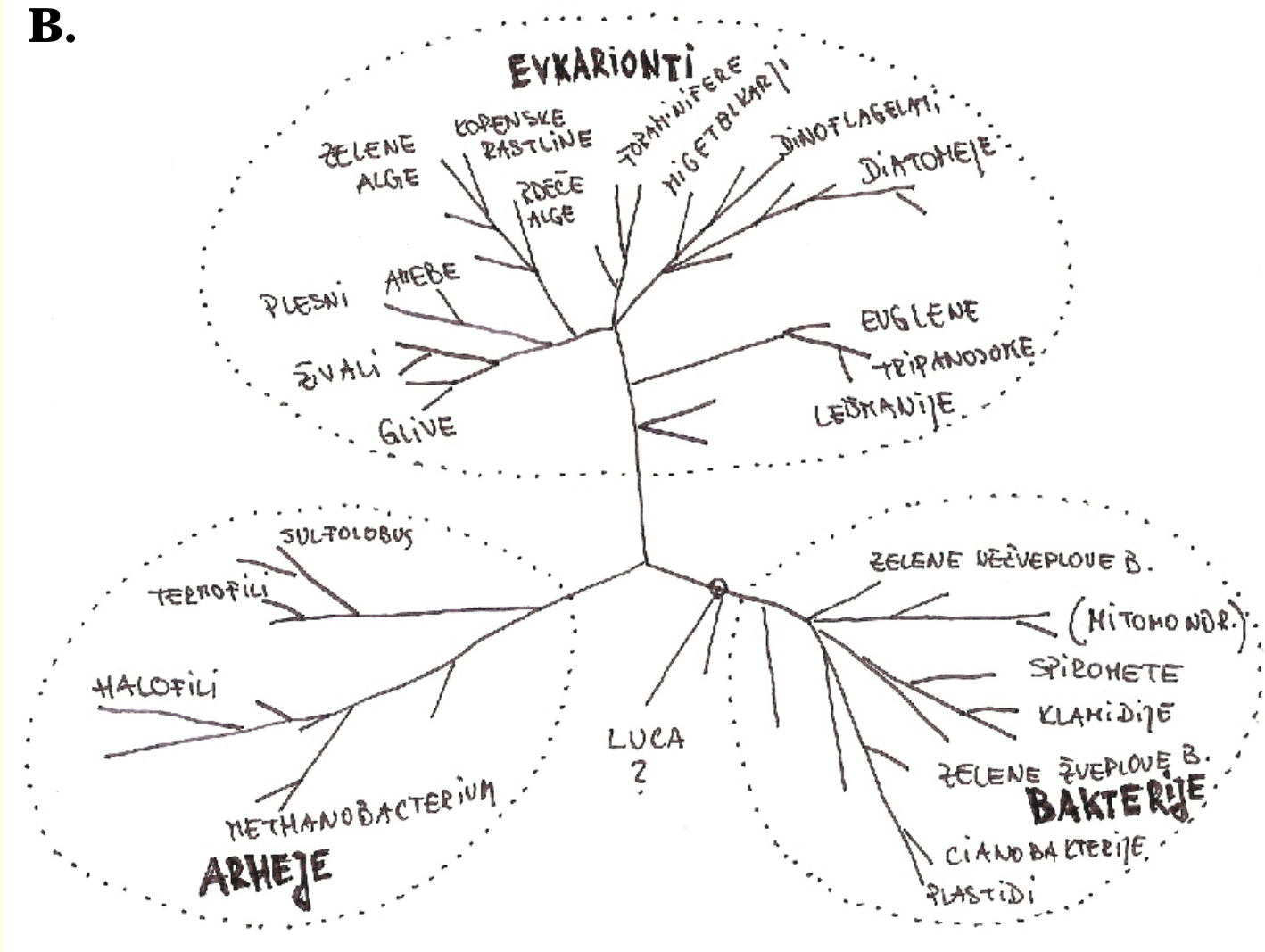
A: drevo življenja,
kot ga je narisal von
Haeckel leta 1866

Monera

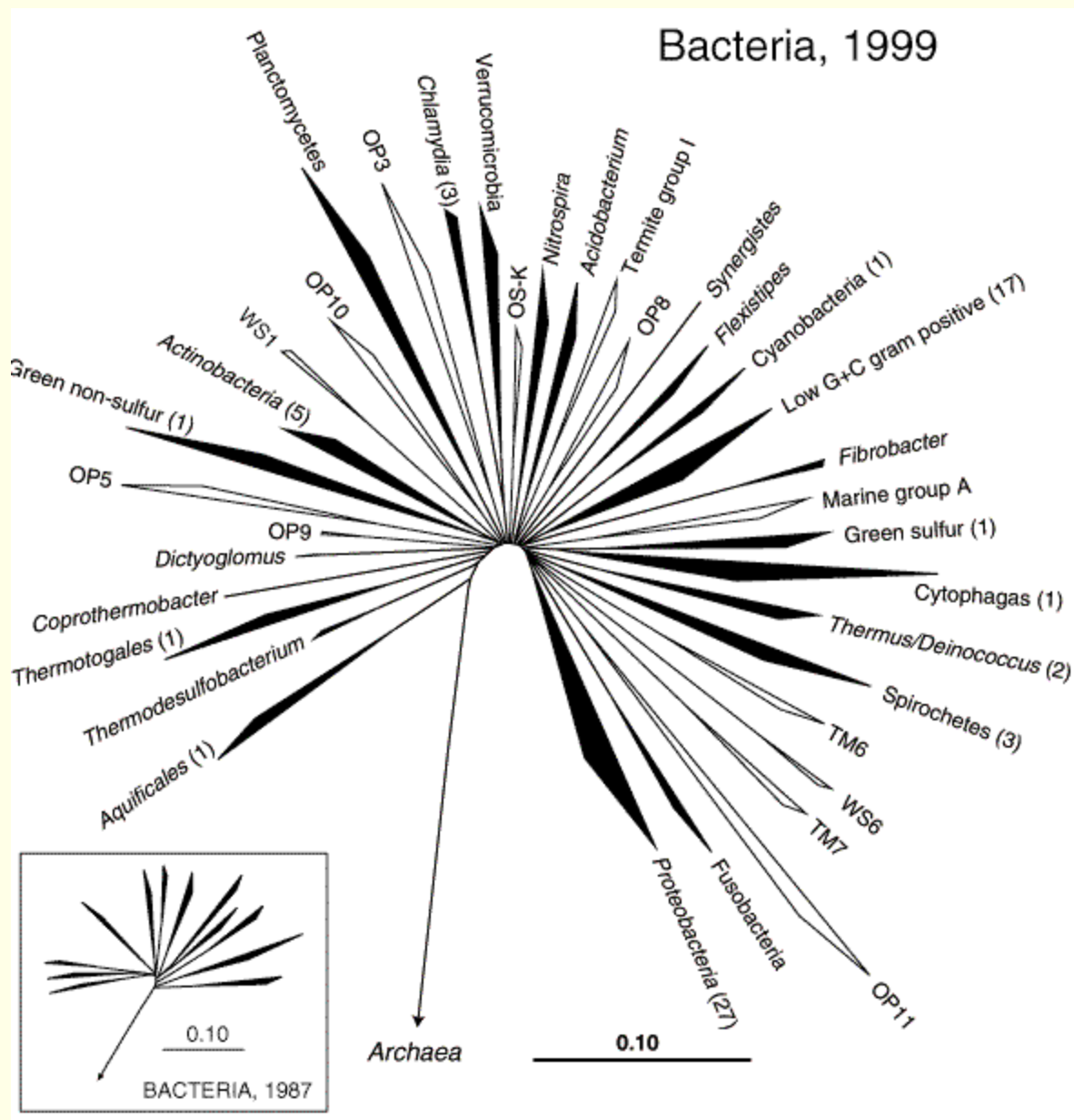




B.



B. drevo življenja, kot je narisano v večini modernih bioloških in mikrobioloških visokošolskih učbenikov





Koncept vrste (species) in debla (phylum) v mikrobiologiji

Biološki koncept vrste vs. filofenetski koncept vrste

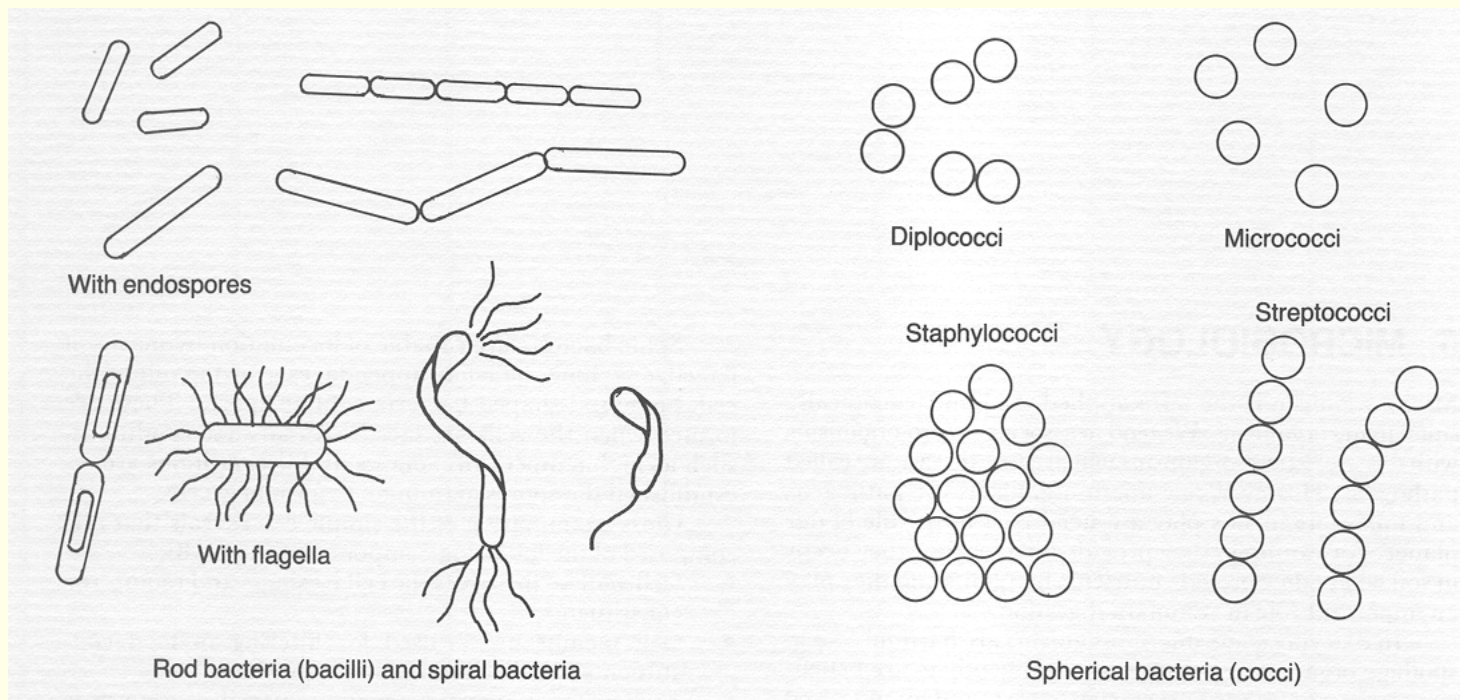






Tabela 1: Število znanih in opisanih vrst živih bitij in ocenjeno število vseh vrst živih bitij na našem planetu
(povzeto po: Savage (1995) BioScience, 45(10): 673–679)

<u>Takson</u>	<u>Št. znanih vrst</u>	<u>Ocenjeno št. vseh vrst</u>
Virusi	5000	morda 500.000
Bakterije	3100	300.000–2,5 milijona
<u>Cianobakterije</u>	1700	6000
Alge	40.000	200.000–10 milijonov
Glive	70.000	1,0–1,5 milijona
Praživali	40.000	100.000–200.000
Lišaji	17.000	34.000–56.000
Mahovi	17.000	35.000
Rastline	250.000	300.000–500.000
Živali (izbrane skupine)		
Nematodi	15.000	500.000–1 milijon
Kolobarniki	12.000	50.000
Mehkušci	70.000	200.000
Iglokožci	6200	10.000
Raki	40.000	200.000
Pršice in pajki	75.000	750.000–1 milijon
Žuželke	950.000	8–10 milijonov
Ribe	20.000	40.000
Dvoživke	4500	6000
Plazilci	6400	7500
Ptice	9100	9500
Sesalci	4000	4100



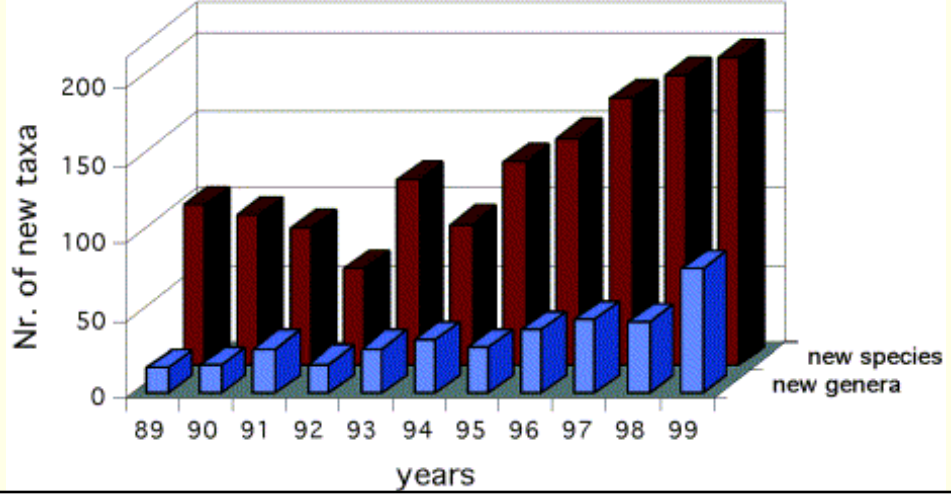


TABLE 1. Culturability determined as a percentage of culturable bacteria in comparison with total cell counts

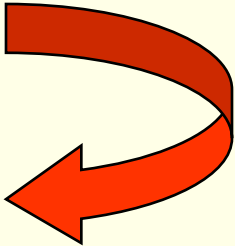
Habitat	Culturability (%) ^a	Reference(s)
Seawater	0.001–0.1	48, 81, 82
Freshwater	0.25	75
Mesotrophic lake	0.1–1	150
Unpolluted estuarine waters	0.1–3	48
Activated sludge	1–15	160, 161
Sediments	0.25	75
Soil	0.3	153

^a Culturable bacteria are measured as CFU.



okolje

genetska informacija



mutacije &
genetske
rekombinacije



Biološka raznovrstnost - fiziološka, morfološka, ekološka

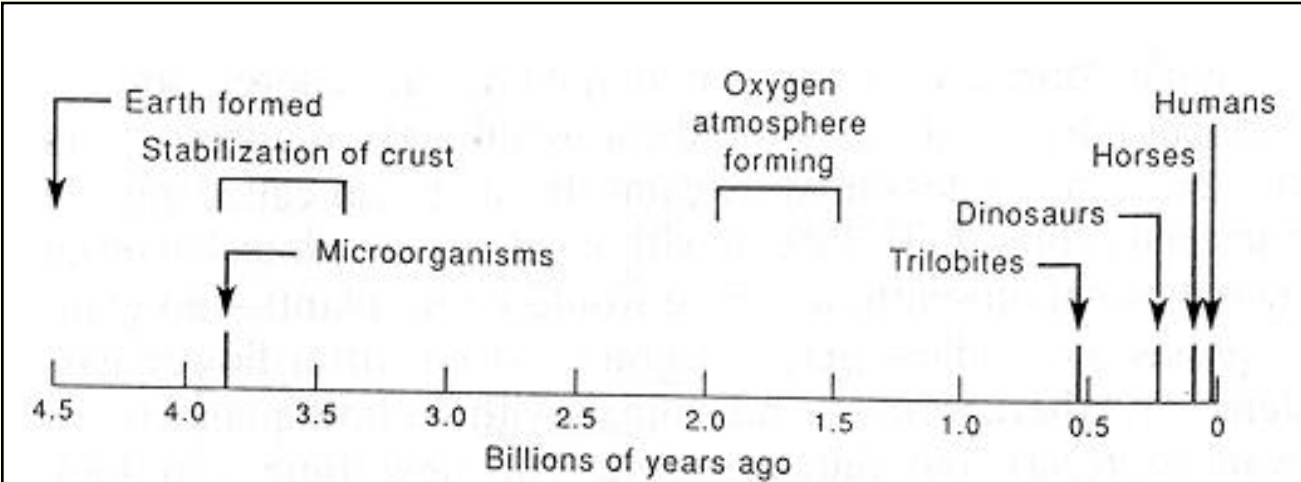
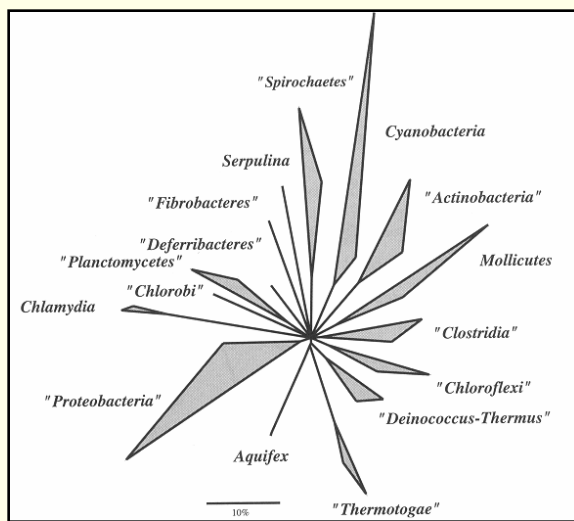
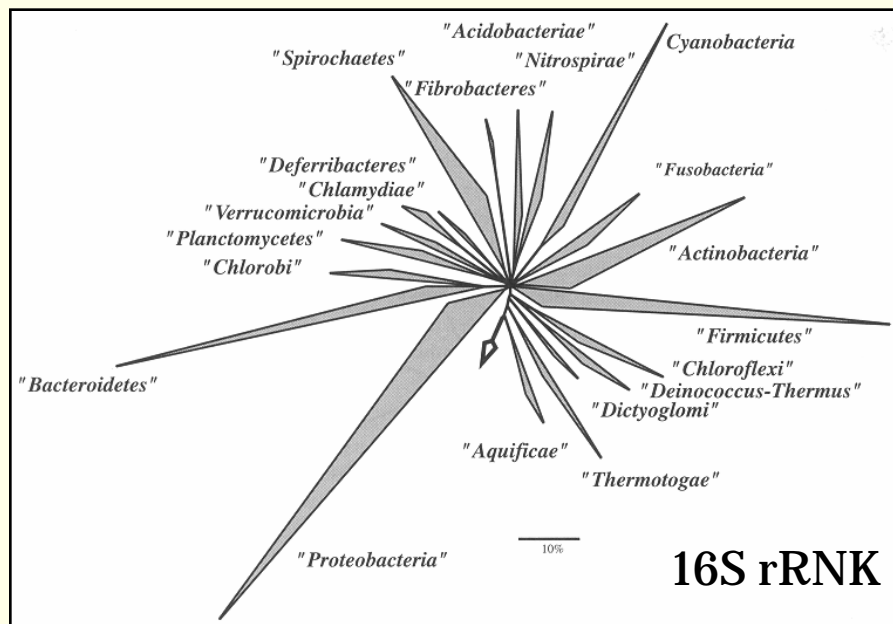
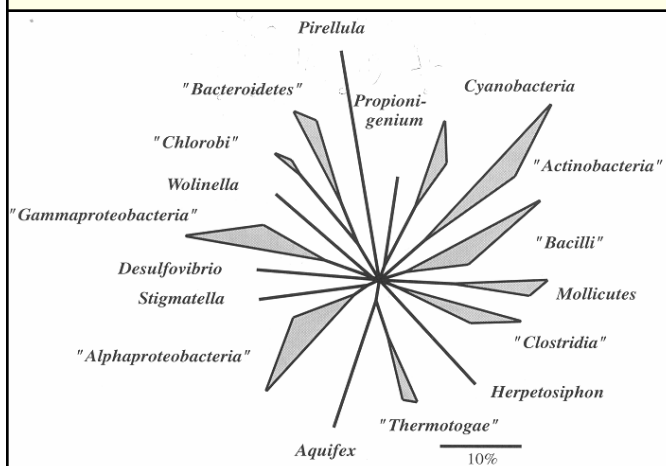


FIG. 2. Time line for the planet Earth. Various salient events in the planet's history are shown, including the times at which certain major evolutionary groups are thought, from fossil evidence, to have arisen.

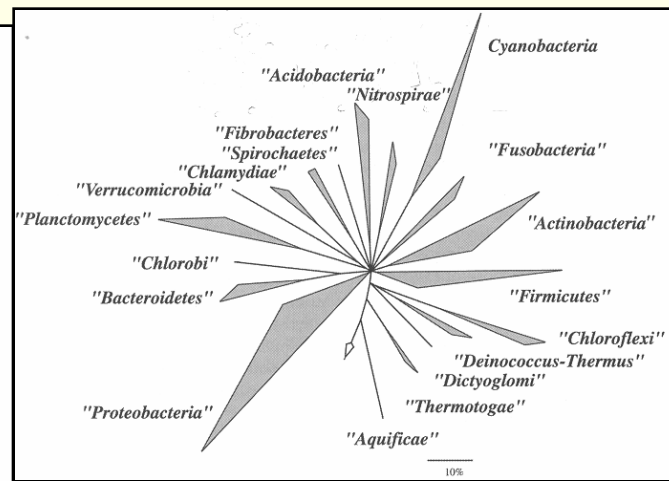
Molekularni kronometri (markerji) v mikrobní taksonomiji



Elongacijski faktor Tu



β -podenota ATPaze



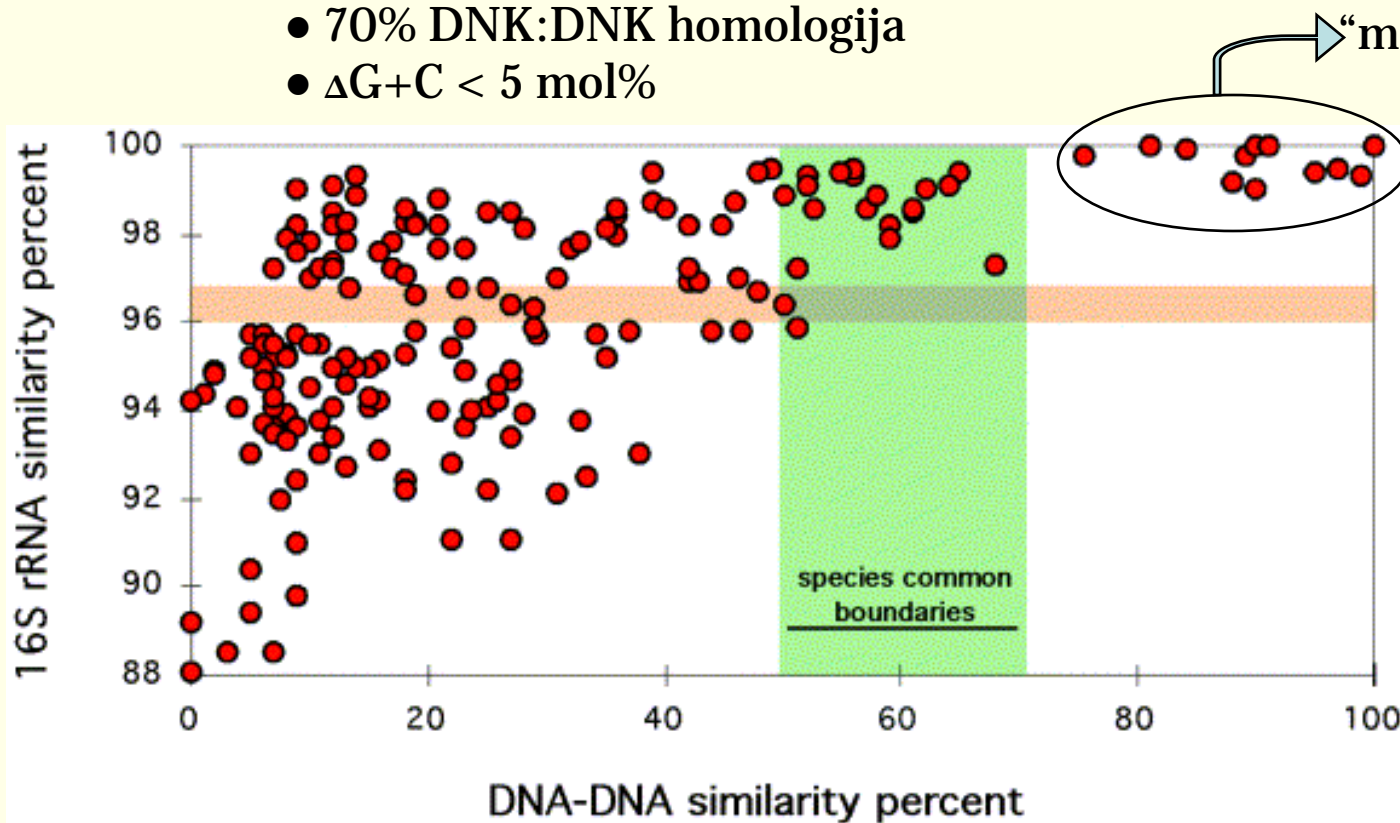
23S rRNK



Predlagani koncept prokariontske vrste (filofenetski koncept):

“vrsta je monofiletsko in genomsko skladna gruča individualnih organizmov, ki izkazujejo visoko stopnjo podobnosti v številnih neodvisnih značilnostih in jo lahko prepoznamo po diskriminativni fenotipski lastnosti”.

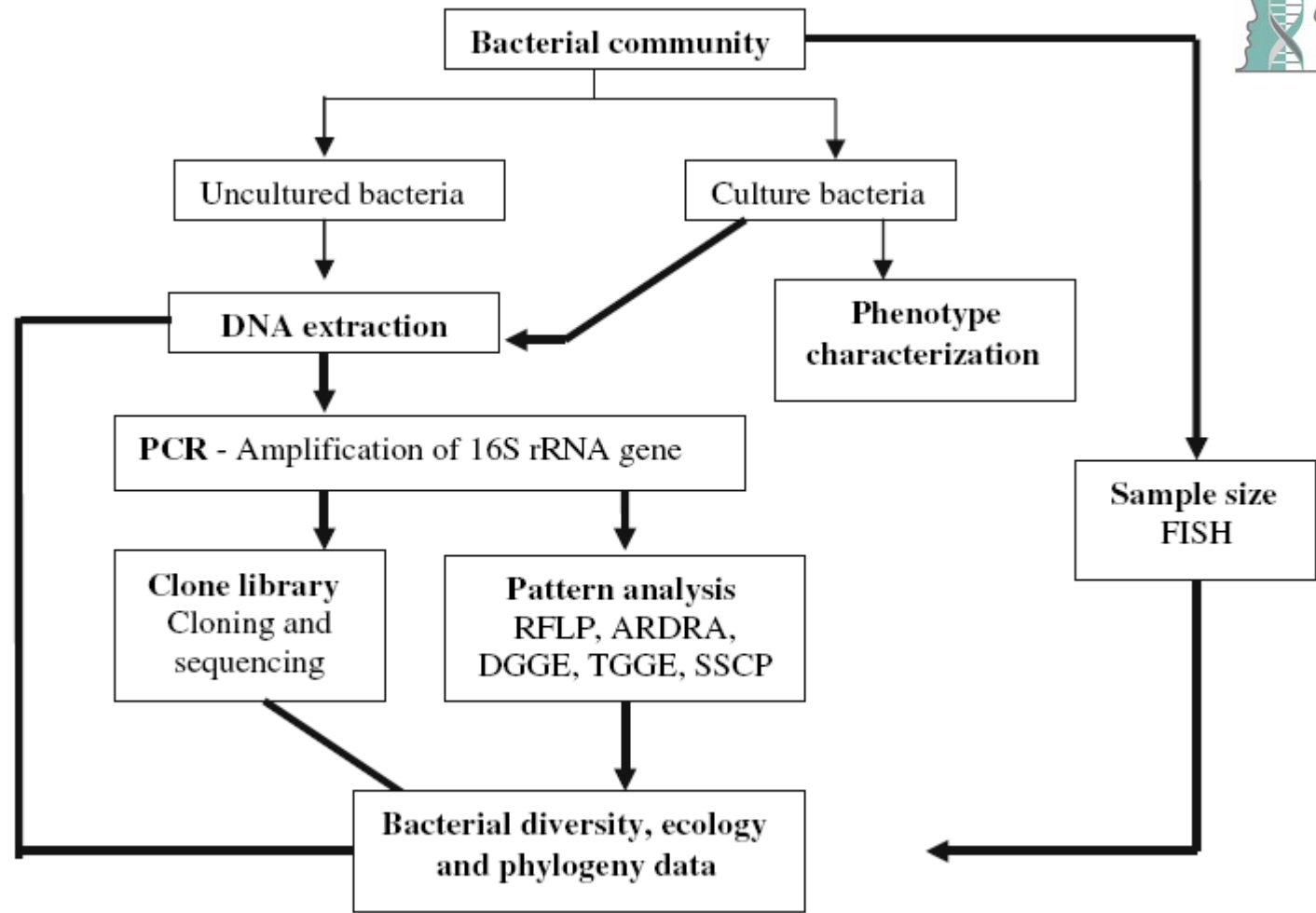
- Arbitrarne meje:
- 97% identitete 16S rRNK
 - 70% DNK:DNK homologija
 - $\Delta G+C < 5$ mol%





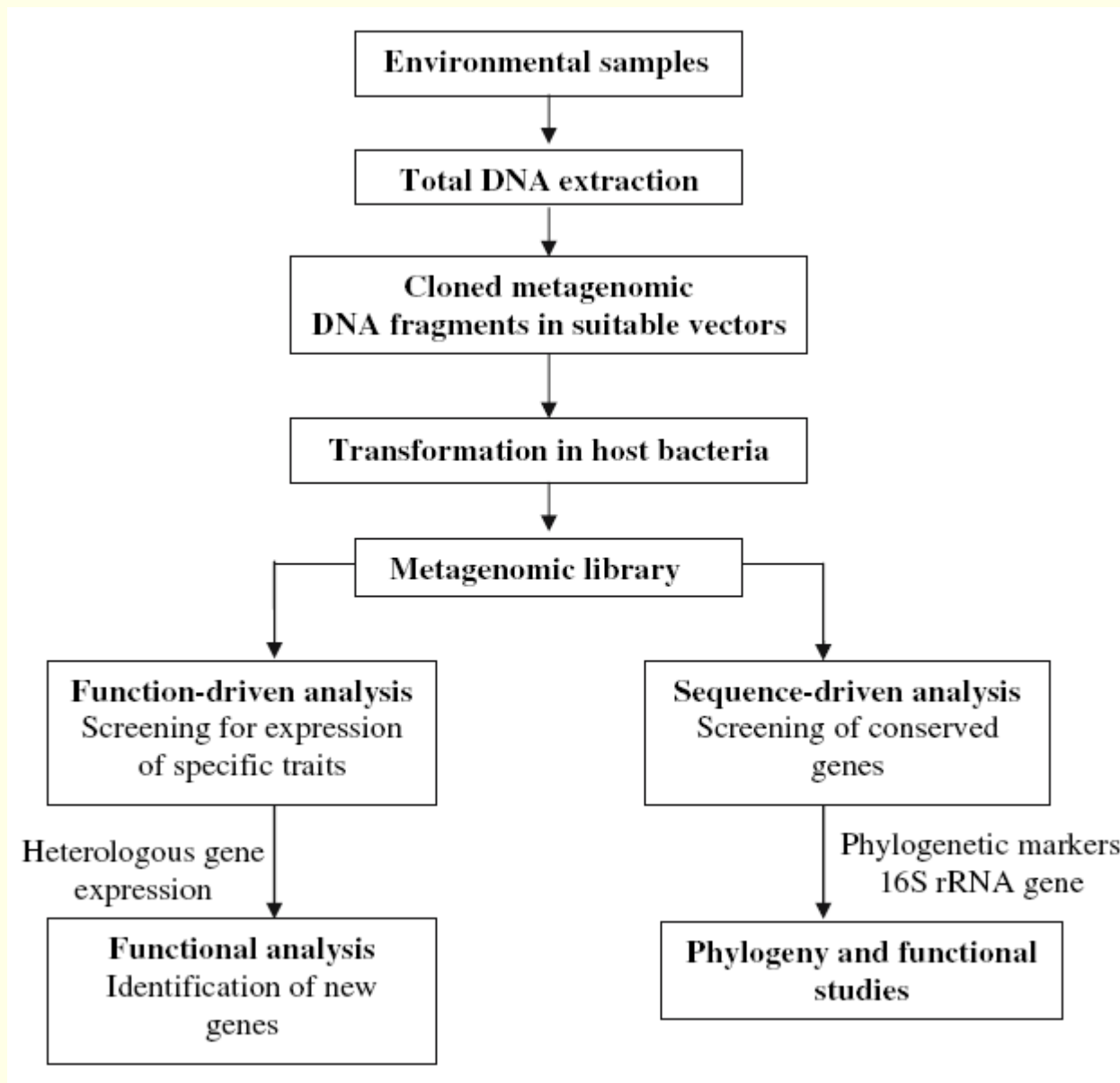
D
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Useful culture dependent and culture independent methods.

- RFLP restriction fragment length polymorphism
- DGGE denaturing gradient gel electrophoresis
- SSCP single-stranded conformation polymorphism
- ARDRA amplified rDNA restriction analysis,
- TGGE temperature gradient gel electrophoresis,
- FISH Fluorescence in situ hybridization

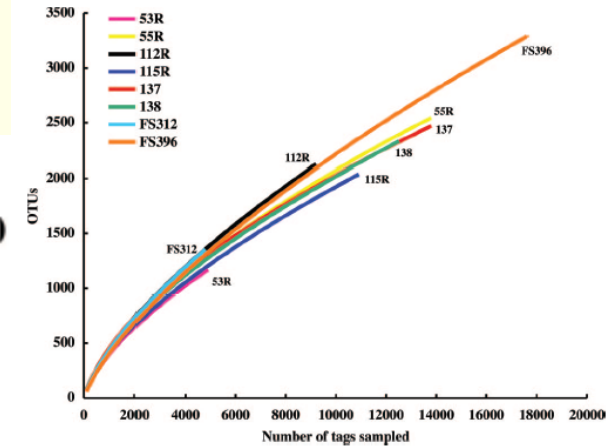
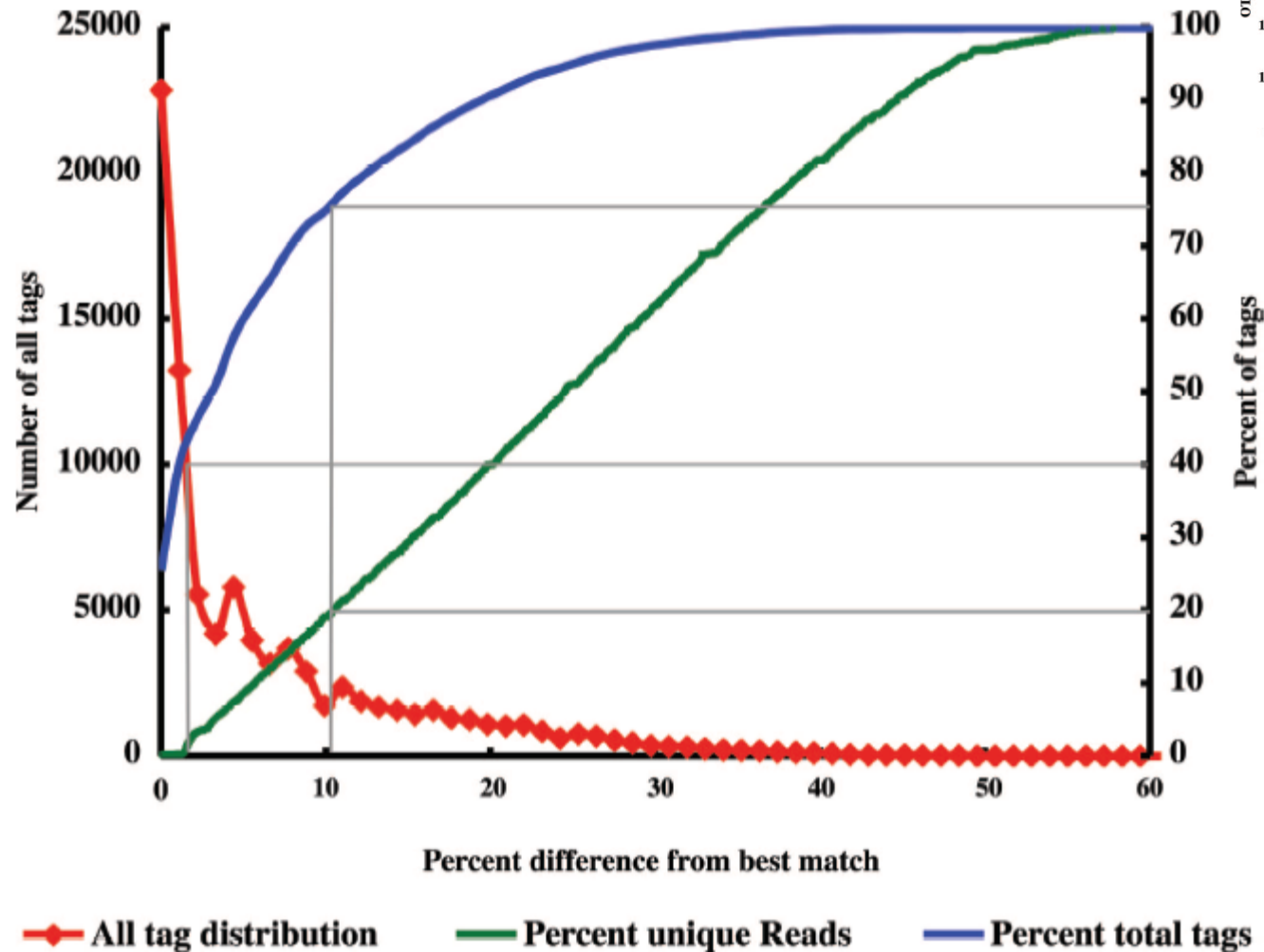


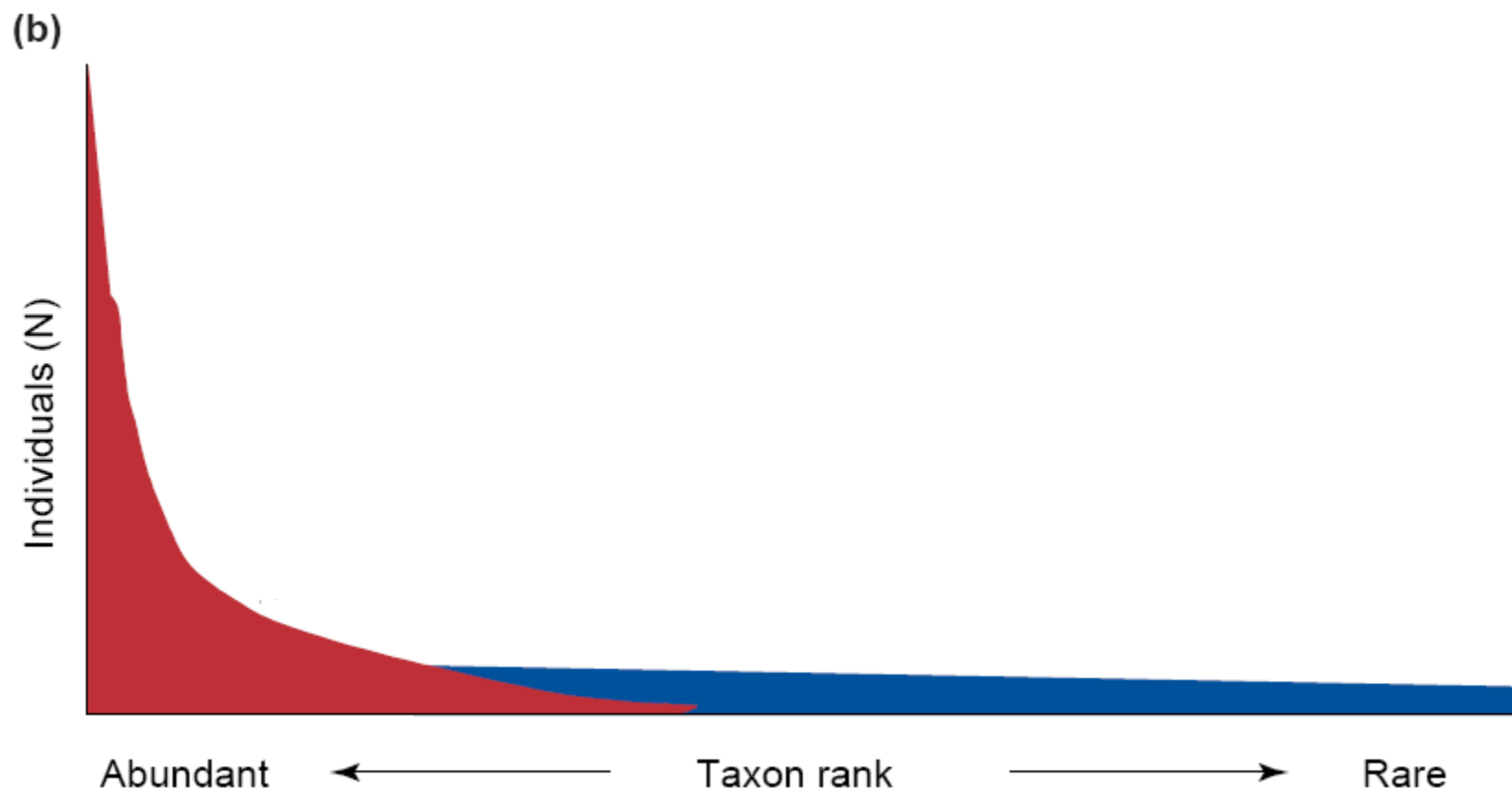
Scheme of construction and screening of environmental metagenomic libraries



Microbial diversity in the deep sea and the underexplored “rare biosphere”

Sogin et al., PNAS, 2006, 103(32): 12115-12120.





TRENDS in Microbiology



Tree: Tree Of Life V1.0

Current view: 191 species

Update tree
Reset tree Export tree

Basic controls Mode: Circular 0 * rotation 350 * arc Inverted
Advanced controls Ignore branch lengths Align leaf labels

Quick help
• Mouseover branches/leaves to show name/bootstrap
• Click on a branch/leaf to show available functions
• Click 'Update tree' to redraw the tree

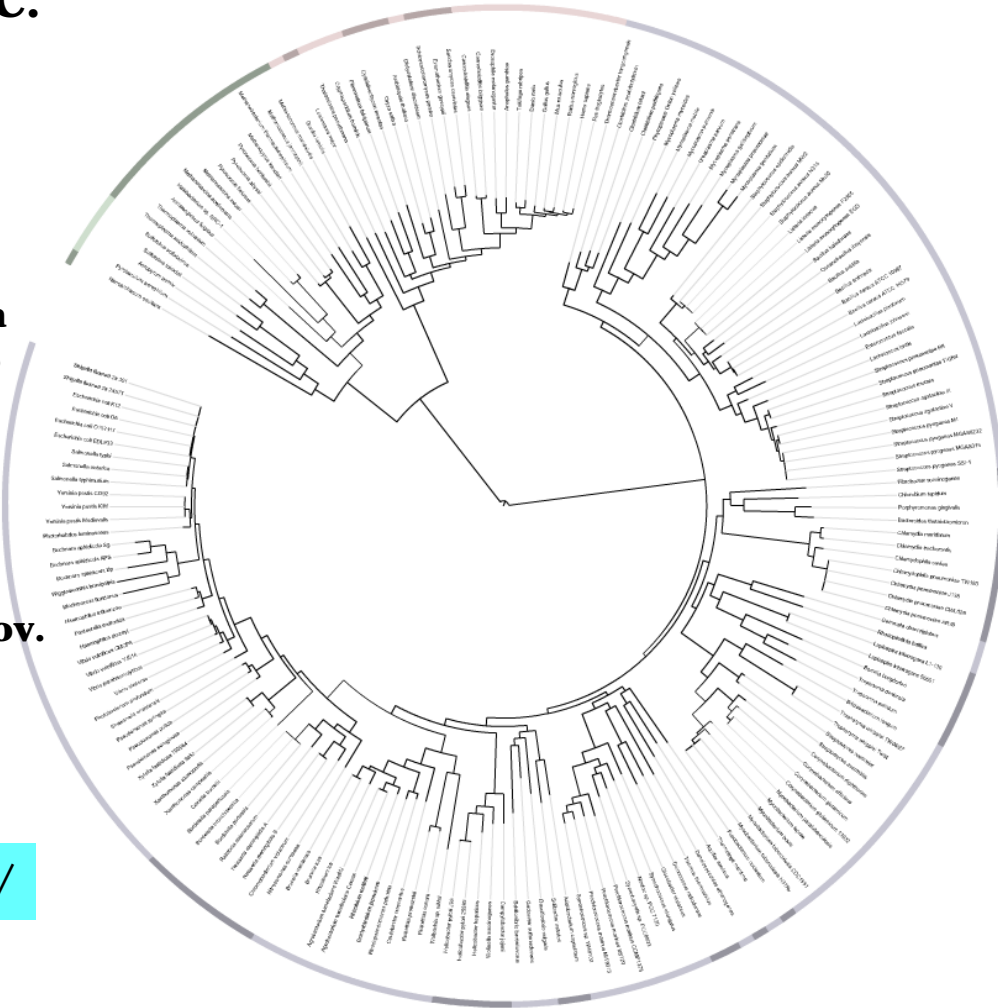
Save current tree view
Label:
Note:

Tree scale: 0.1
Search

Datasets
 Genome size
 Publication date
 Domains per genome

Colored ranges
 Archaea
 Bacteria
 Eukaryota
Cover: Full clades
Labels only

C.



C: drevo življenja, kot ga prikazuje specializirano spletno orodje iTOL, ki vključuje tudi sekvence, pridobljene neposredno iz okoljskih vzorcev, torej brez osamitve in gojenja mikroorganizmov.

<http://itol.embl.de/>



Tree: *Tree Of Life V1.0*

Current view: 191 species

[Update tree](#)
[Reset tree](#) [Export tree](#)

Basic controls Mode: **Circular** ° rotation ° arc Inverted
Advanced controls Ignore branch lengths Align leaf labels

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[Search](#)

Datasets

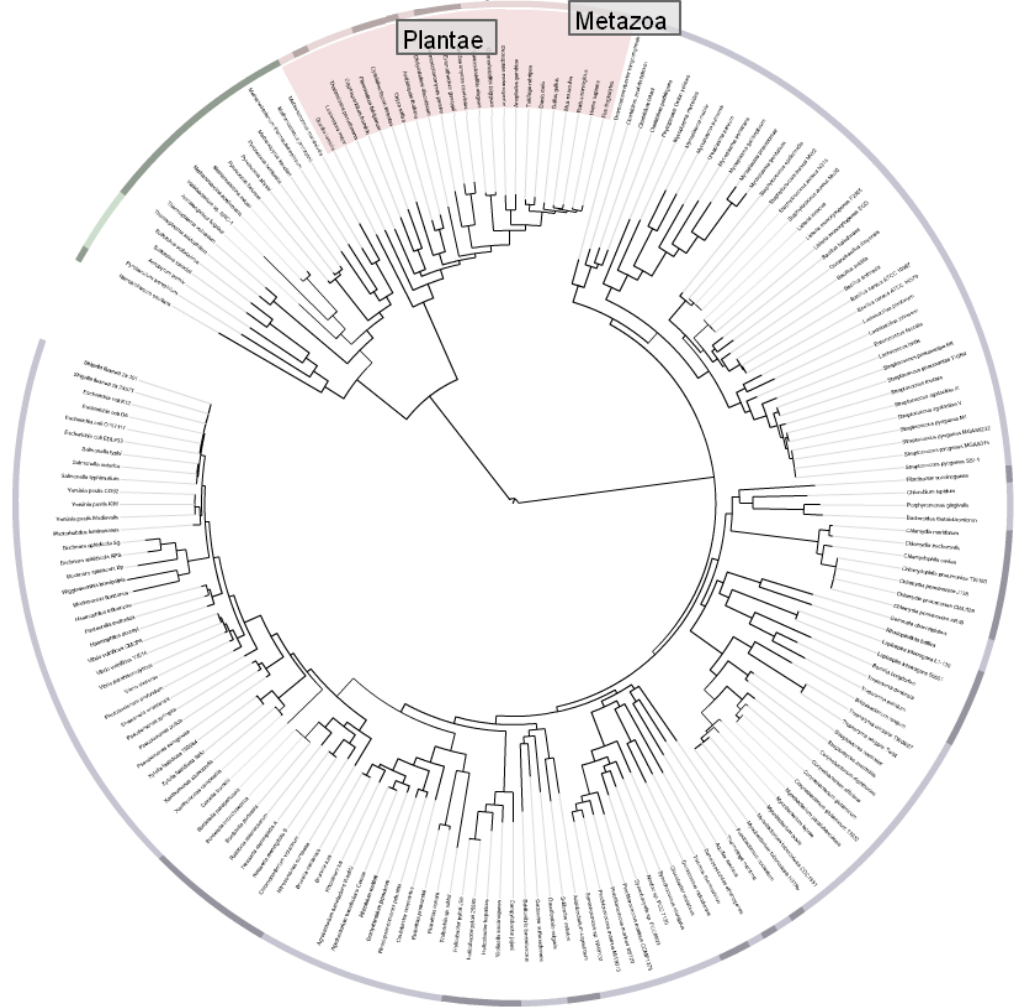
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- Domains per genome

Colored ranges

- Archaea
- Bacteria
- Eukaryota

Cover: [Full clades](#)
[Labels only](#)

Eukaryota





- HOME
- TREE OF LIFE
- OTHER TREES
- SHARED PROJECTS
- DATA UPLOAD
- SAVED VIEWS
- HELP
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Login

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Datasets

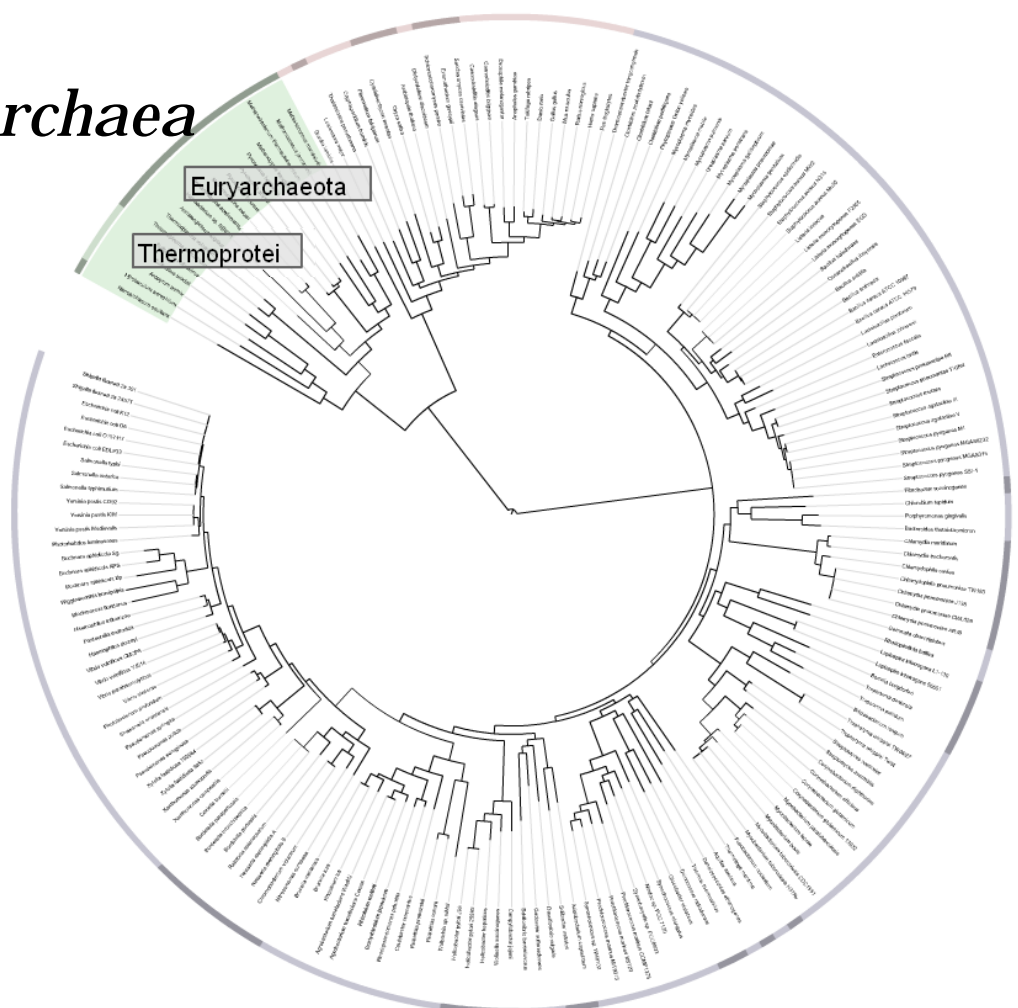
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- Domains per genome

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- Archaea
- Bacteria
- Eukaryota

Cover: Full clades
 Labels only

Archaea





ITOL INTERACTIVE TREE OF LIFE



BIOLOŠKA
ZNANOST
IN DRUŽBA

HOME TREE OF LIFE OTHER TREES SHARED PROJECTS DATA UPLOAD SAVED VIEWS HELP ABOUT & CONTACT [Login](#)

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 Search

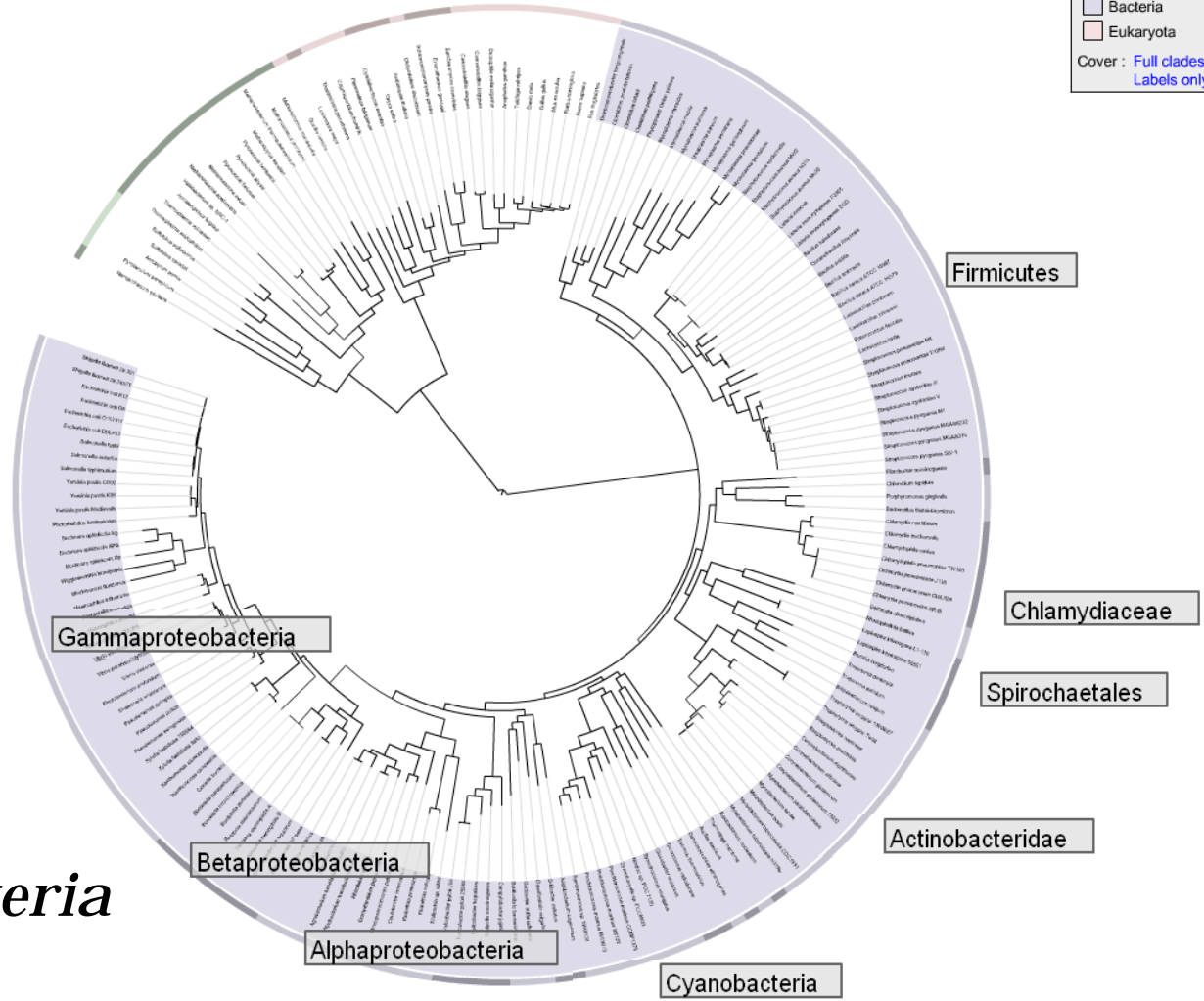
Datasets

- Genome size
- Publication date
- Domains per genome

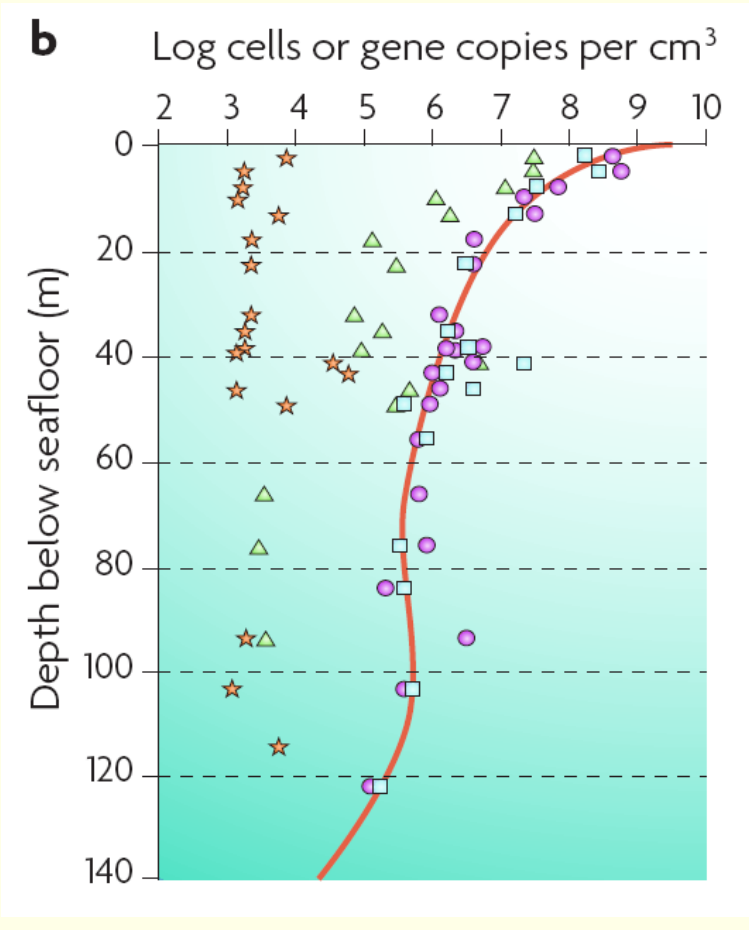
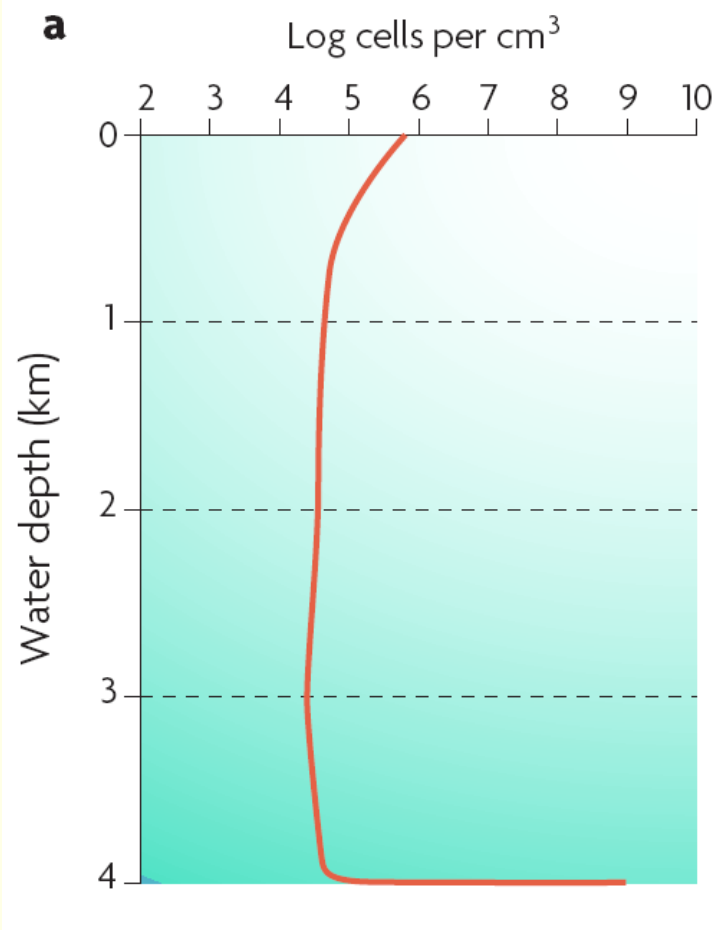
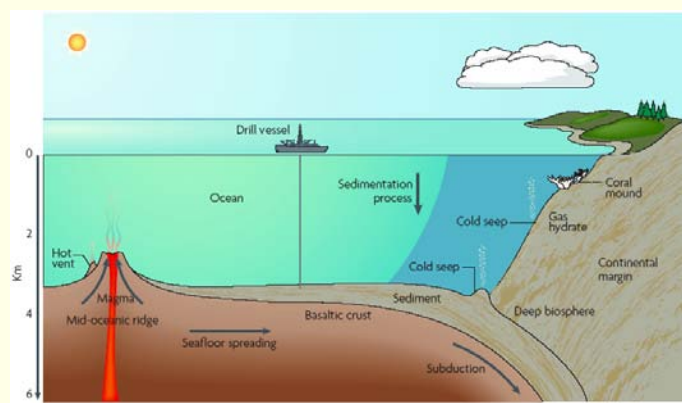
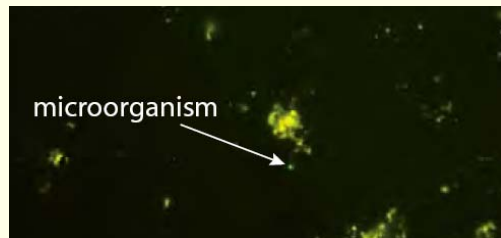
Colored ranges

- Archaea
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Cover: Full clades Labels only



Bacteria



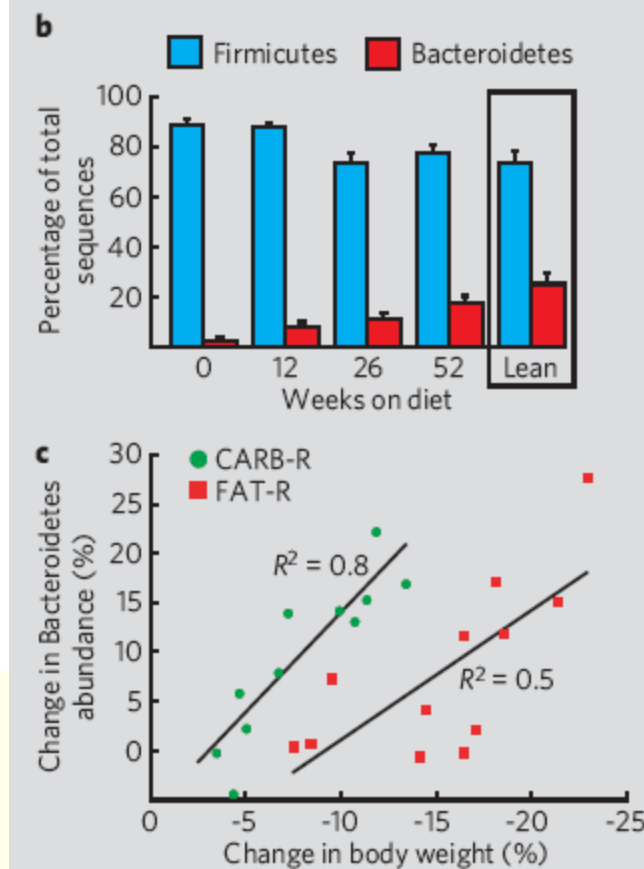
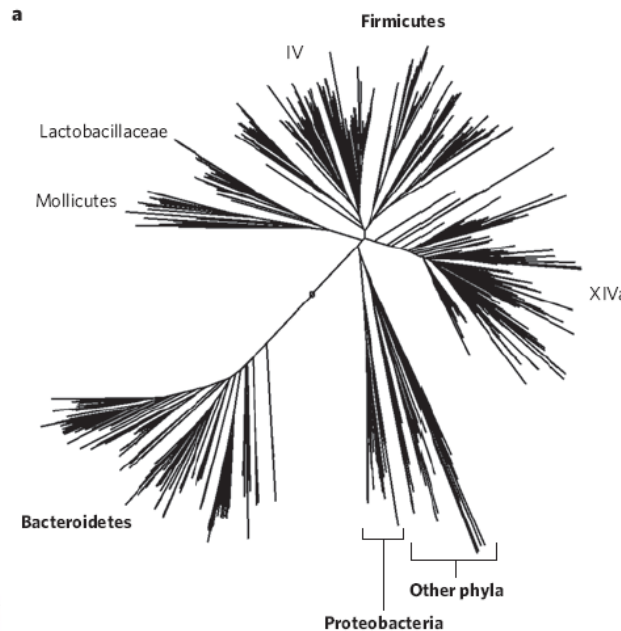


An ecological and evolutionary perspective on human-microbe mutualism and disease

Les Dethlefsen¹, Margaret McFall-Ngai² & David A. Relman^{1,3,4}

NATURE | Vol 449 | 18 October 2007 | doi:10.1038/nature06245

INSIGHT REVIEW



Ruth E. Ley, Peter J. Turnbaugh, Samuel Klein, Jeffrey I. Gordon

Washington University School of Medicine,
St Louis, Missouri 63108, USA

NATURE | Vol 444 | 21/28 December 2006

