

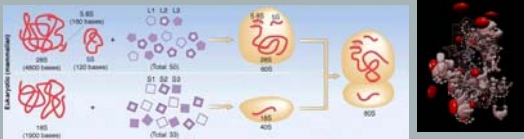
Ribosomal RNA

Prokaryotic

- 23S, 16S, & 5S rRNAs + ribosomal proteins

Eukaryotic Cytoplasmic ribosomes

- 18S rRNA + ~ 30 different protein molecules = small subunit
- 28S, 5.8S, and 5S rRNA. + ~ some 45 different proteins = large subunit
- S reflects size
- mitochondria and chloroplasts have ribosomes with 16S-like rRNA
- why?




<http://universe-review.ca/I11-21-rRNA2.jpg> Slide 4 (of 15)

endosymbiosis

Mereschkowsky, 1910 Lynn Margulis (1970).

- Symbiosis = stable association
- lichens (algae and fungi) and coral reefs (coelenterates and algae).
- important in euk. evol.
- close proximity → coevolution, lateral transfer of genetic information between compartments or between evolutionary lineages.



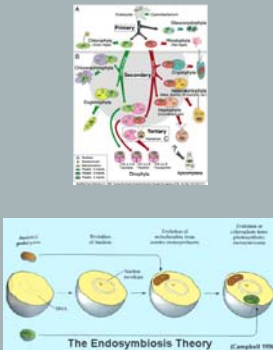
Photograph copyright © 2000 Mitchell L. Sogin Slide 5 (of 15)

Endosymbiosis

Intracellular symbiosis = endosymbiosis

mitochondria and chloroplasts

- ancestors of these organelles were bacteria
- mitochondria, ultrastructure and molecular data indicate they are derived alpha-proteo bacteria (Yang et al., 1985).
- enabled aerobic respiration
- chloroplast = cyanobacterium



The Endosymbiosis Theory (Campbell 1996)

Slide 6 (of 15)

16s/18s RNA phylogenetic analysis

16S rRNA - ca. 1500 nt, widely used, pioneered by Carl Woese 1970s

>110,000 sequences in databases

Analysis by Carl Woese led to the 3 domain tree

- Bacteria, Archaea, Eukarya
- Has highly conserved and highly variable regions, allowing for identification to different levels
- Signature sequences
 - oligonucleotides unique to certain groups of organisms

```

CAA-AGGAAG CACCGGCTAA CTC CGTGCCA GCAGCCGGG TAATAAAAACGGAG
CAA-AGGAAG CACCGGCTAA CTC CGTGCCA GCAGCCGGG TAATAAAAACGGAG
CAATAGGAAG CACCGGCTAA CTC CGTGCCA GCAGCCGGG TAATAAAAACGGAG
TAG- AGGAAG CACCGGCTAA CTC CGTGCCA GCAGCCGGG TAATAAAAACGGAG
CAA-AGGAAC CACCGGCTAA CTC CGTGCCA GCAGCCGGG TAATAAAAACGGGG
CGA-AGGAAG CACCGGCTAA CTC CGTGCCA GCAGCCGGG TAGTAAAAACGGCG
YRR-AGGAAS CACCGGCTAA CTC CGTGCCA GCAGCCGGG TARTAAAAASGGRG
    
```

Slide 7 (of 15)

16s/18s RNA phylogenetic analysis

Testing of the RNA- based hypotheses

- (i) Multiple gene phylogenies
- (ii) individual phylogenies converging on the same relationships
- (iii) discrete characters
- (iv) morphological and ultrastructural data

Slide 8 (of 15)

A Phylogeny is a hypothesis

monophyly of Archaea is uncertain

lateral transfer – life is not exactly a tree

Endosymbiosis

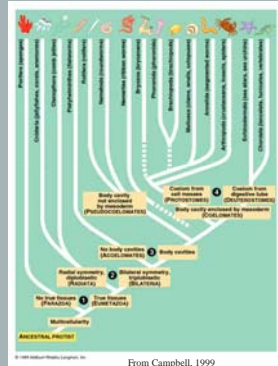
23s unit: more info, evolves more rapidly, more difficult to sequence

Whole-genome data

Slide 9 (of 15)

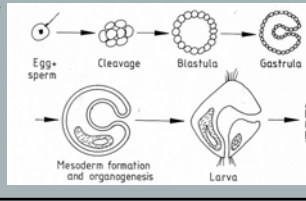
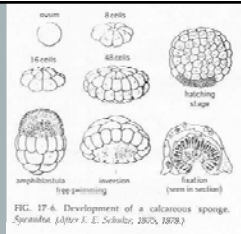
Kingdom Animalia

Multicellular
 -requires cellular adhesion, communication, altruism
 heterotrophic
 lack rigid cell walls that characterize plant cells
 all except sponges: tissues



Kingdom Animalia

development of most animals is characterized by distinctive stages,
 •zygote, formed by the product of the first few division of cells following fertilization;
 •blastula, which is a hollow ball of cells formed by the developing zygote;
 •gastrula, which is formed when the blastula folds in on itself to form a double-walled structure with an opening to the outside, the blastopore.



Kingdom Animalia

~ 9 or 10 million species of animals
 By far most species of animals are insects, with groups such as mollusks and nematodes also being especially diverse.
 By this measure, our own group, the vertebrates, is relatively inconsequential.

