

Russ Doolittle

3.12.97

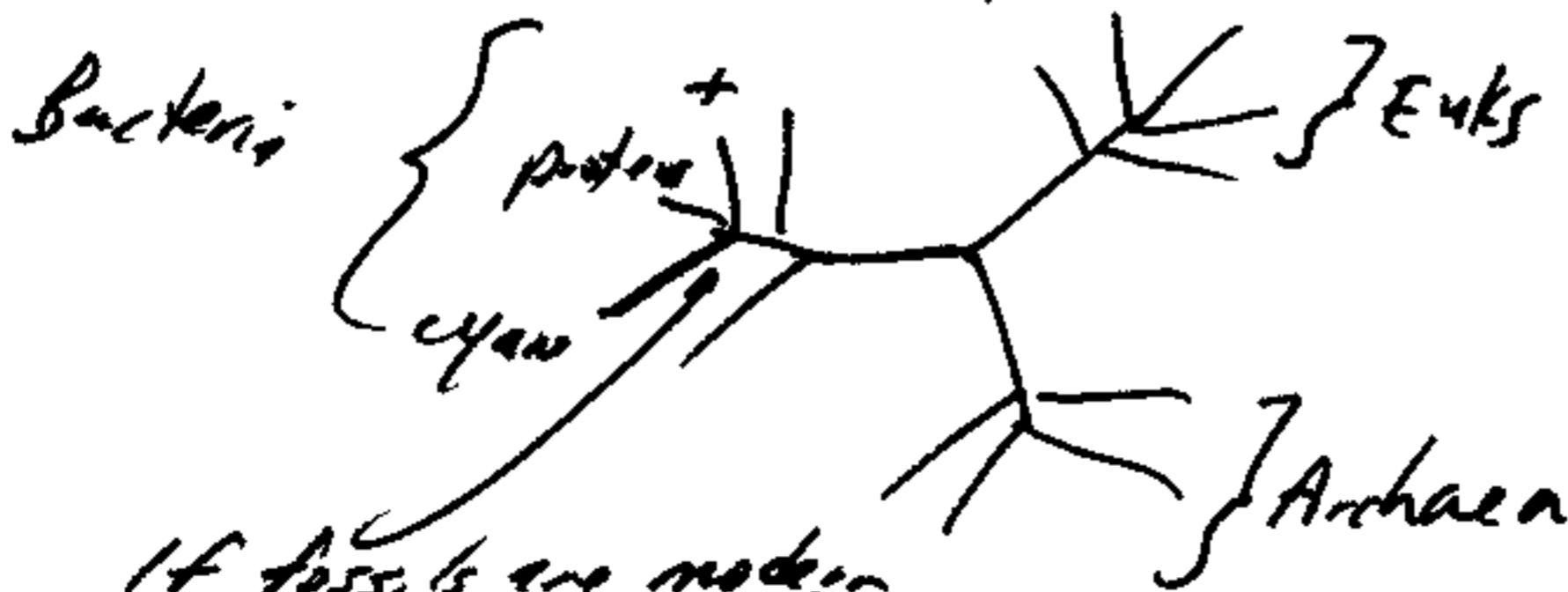
see Urts + Orts

Origin of universe = -15 bya
Self replicating = -3.5 bya
Prok-Euk Div = -2.0 bya
Plant Animal = -1.0 bya
Inv-ver diverg = -0.5 bya

Divergence Critics

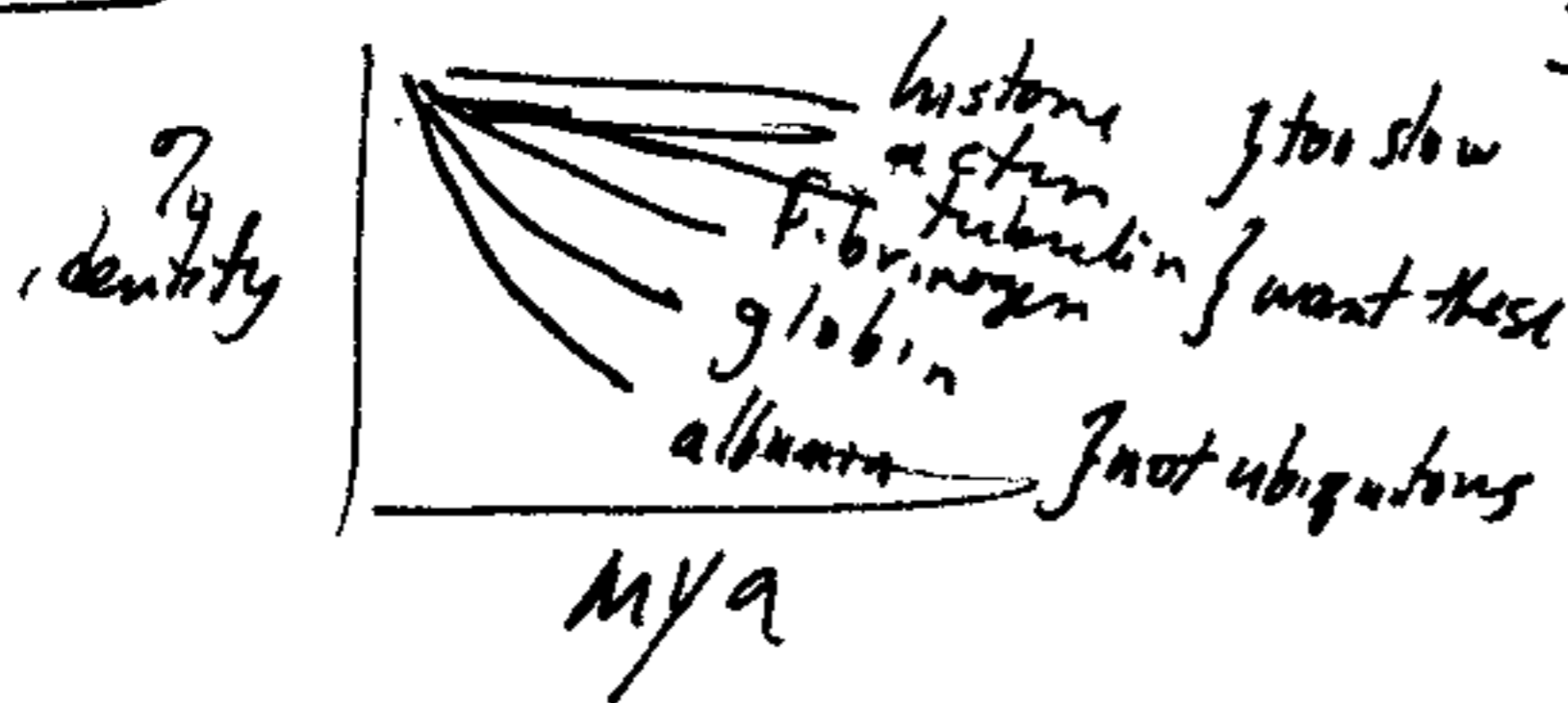
- snortan Norman - if cyanobacteria were there then other groups must have been there ^{3.5 bya}
- Bill Schopf

found lots of "microfossils" of things like cyanobacteria



If fossils are modern cyanos then a lot of evolution must have happened before 3.5 bya

Clocks

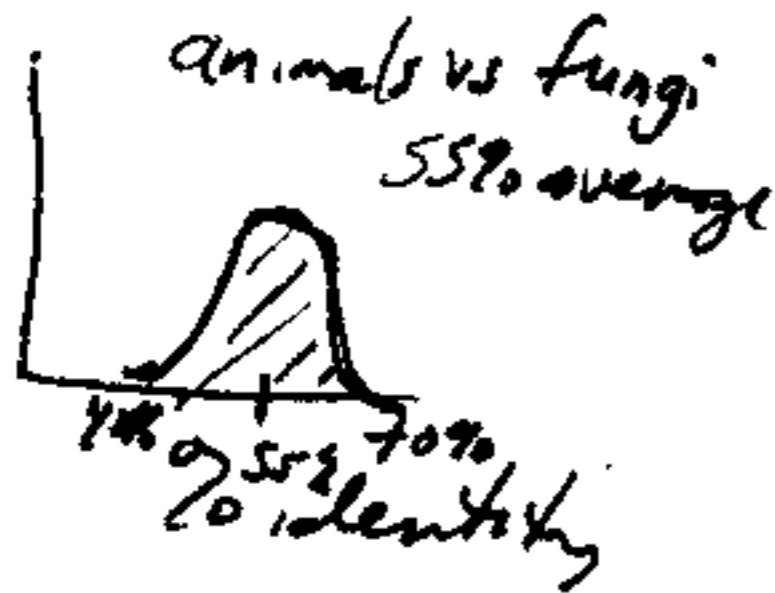


Problems w/ rRNA

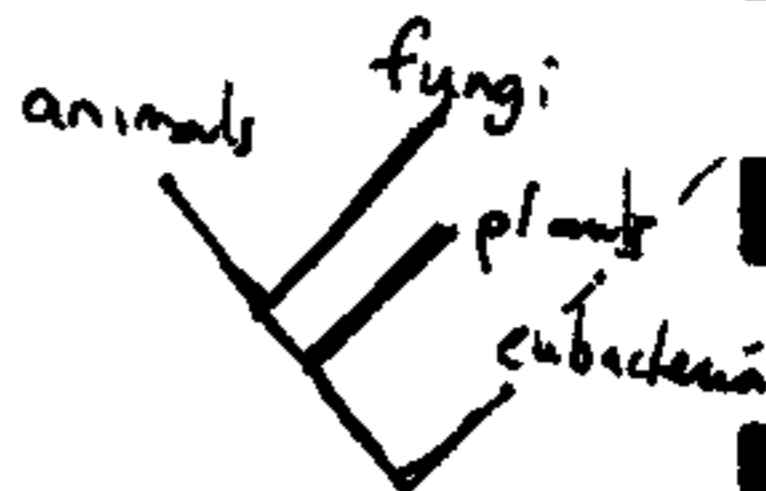
- need independent marker
- GC bias may be problem

Which proteins?

- ① use enzymes
- ② > 4 organisms
- ③ 1 animal, 1 fungi or plant, bacteria
- ④ not organellar coded, not viral

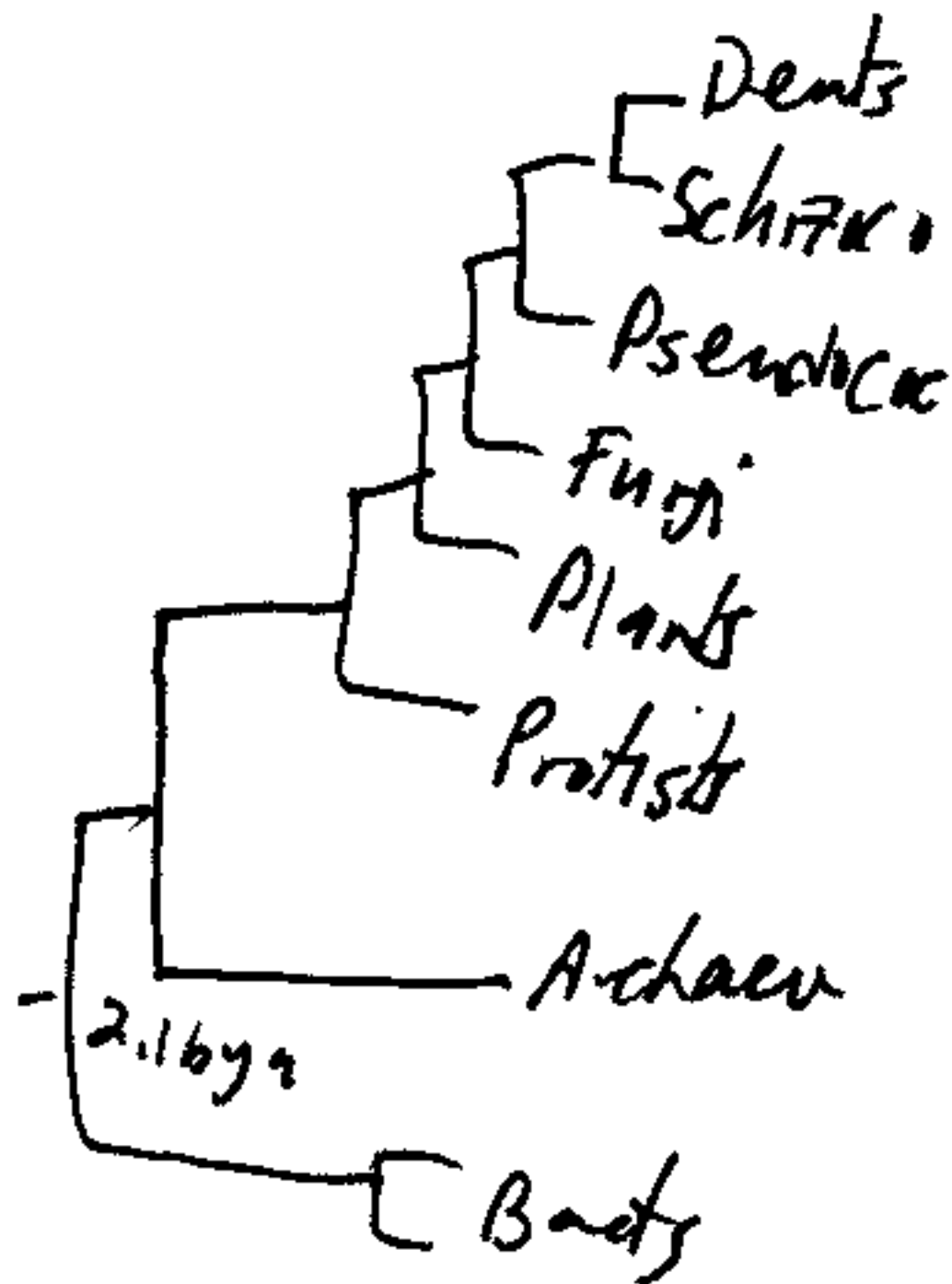


animals/plants
- 59% average



Fossil Record

Tree from paper



Problems

- ① longer distances underestimated bec. poisson and other corrections inadequate
- ② bacteria may have gone more slowly
- ③ endosymbiotic events may complicate history

$$D = -\ln \frac{(S_{\text{real}} - S_{\text{rand}})}{(S_{\text{ident}} - S_{\text{rand}})} \times 100$$

- corrects for nature of aa
- corrects for diff. mutation rates (in part)

Genes Duplicated Before Divergence
sugg. bacterial genes
evolve at normal rates

Suggests genes w/ A + B most similar
are due to lat. transfers + that
A are ancient.

FINAL #

~ 3 bya