

# Is Auchenorrhyncha REALLY Paraphyletic?

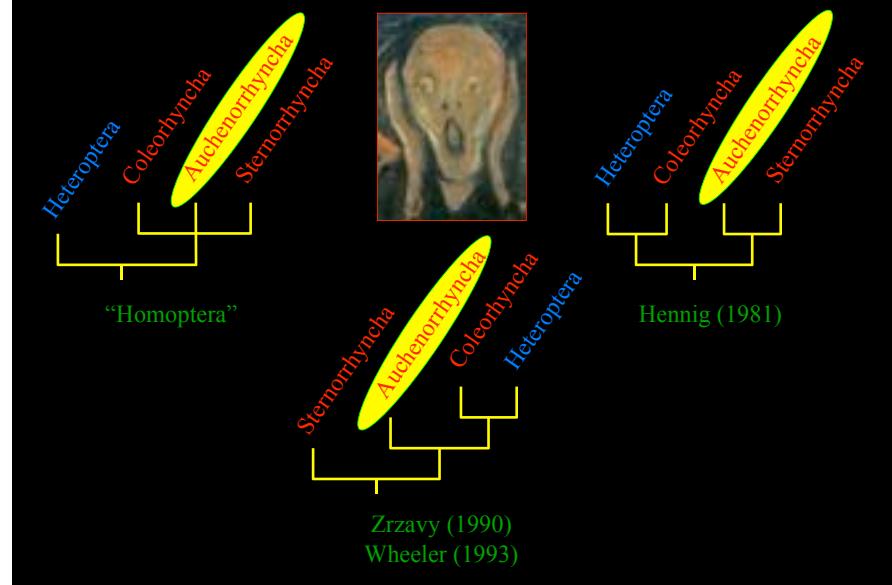


NEW YORK State  
Museum

Jason Cryan  
Laboratory for Conservation  
And Evolutionary Genetics



## Phylogenetic Hypotheses of Major Hemipteran Lineages



Fulgoromorpha:

**P  
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## Cicadomorpha 1: Cicadoidea

**C  
i  
c  
a  
d  
a**

Cicadidae  
Tettigarctidae



**Cicadomorpha 2:  
Cercopoidea**



## Spittlebugs & Froghoppers

Cercopidae  
Clastopteridae

Aphrophoridae  
Machaerotidae

Epipygidae



**Cicadomorpha 3:  
Membracoidea**

## Leafhoppers



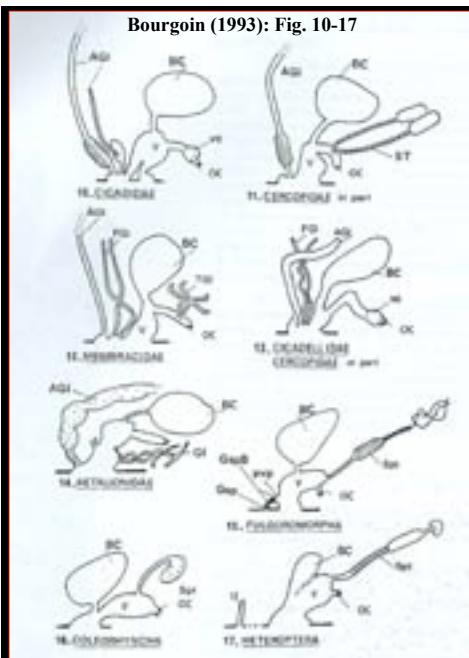
Cicadellidae

Myerslopiidae



## Treehoppers

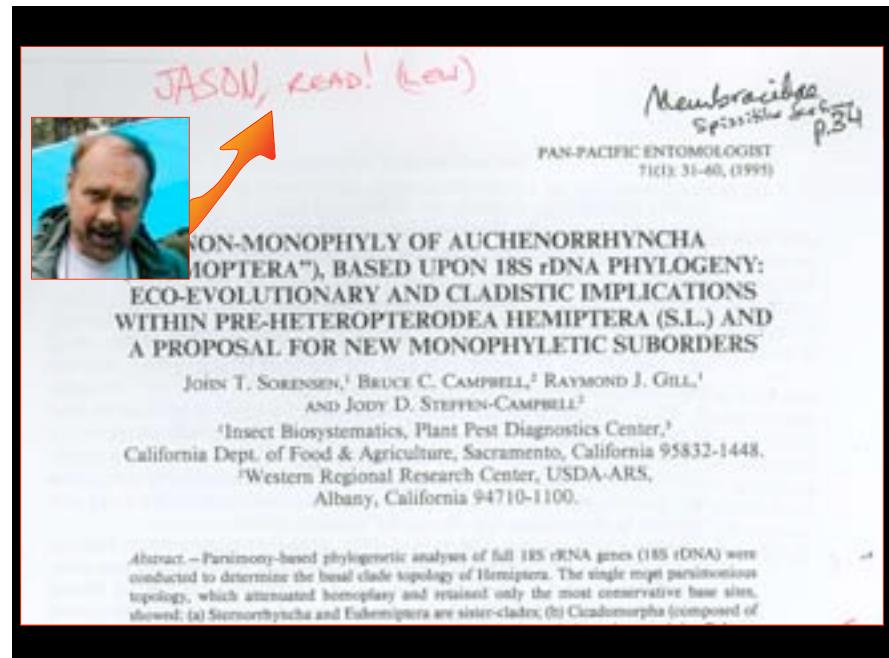
Membracidae  
Aetalionidae  
Melizoderidae

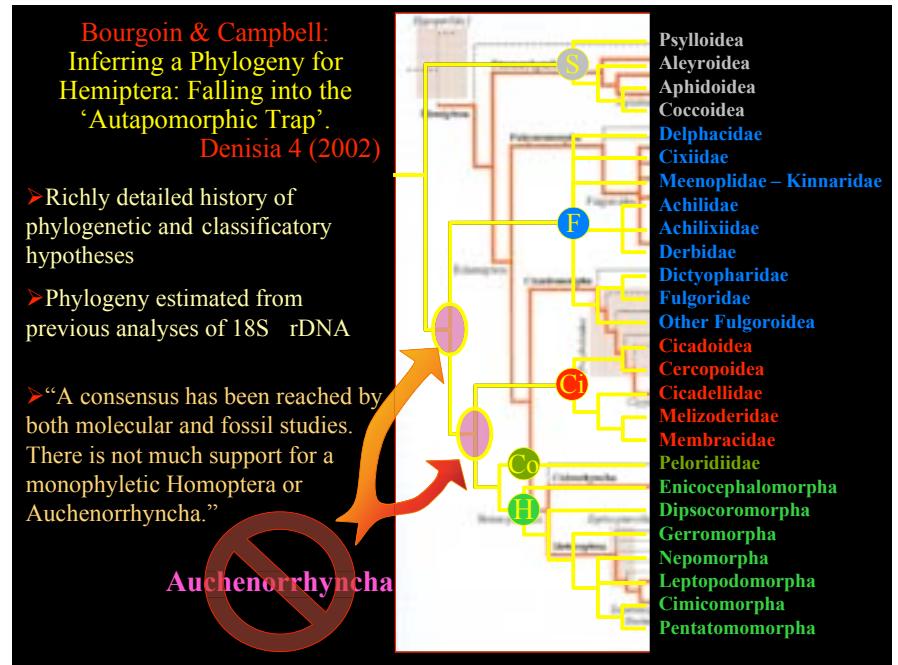
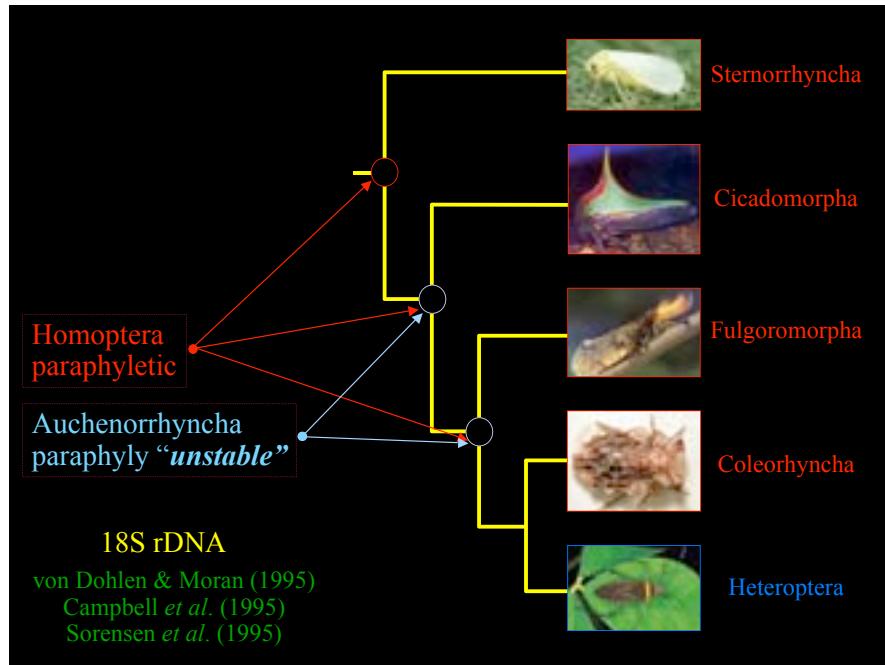


“....Fulgoromorpha appear very different from Cicadomorpha....the fulgoromorph scheme is closer to the Heteropteran one.”

“....[one interpretation] would lead us to question the monophyly of the Auchenorrhyncha ...and to group together Heteroptera + Fulgoromorpha...one the basis of several synapomorphies such as 1) “loss of accessory glands”, 2) “spermatheca structure”, 3) “male genitalia conformation”..., and 4) “tentorial construction”....”

“....convincing autapomorphies for the Auchenorrhyncha are yet to be found.”





## Potential Synapomorphies of Auchenorrhyncha 2

### Auchenorrhyncha

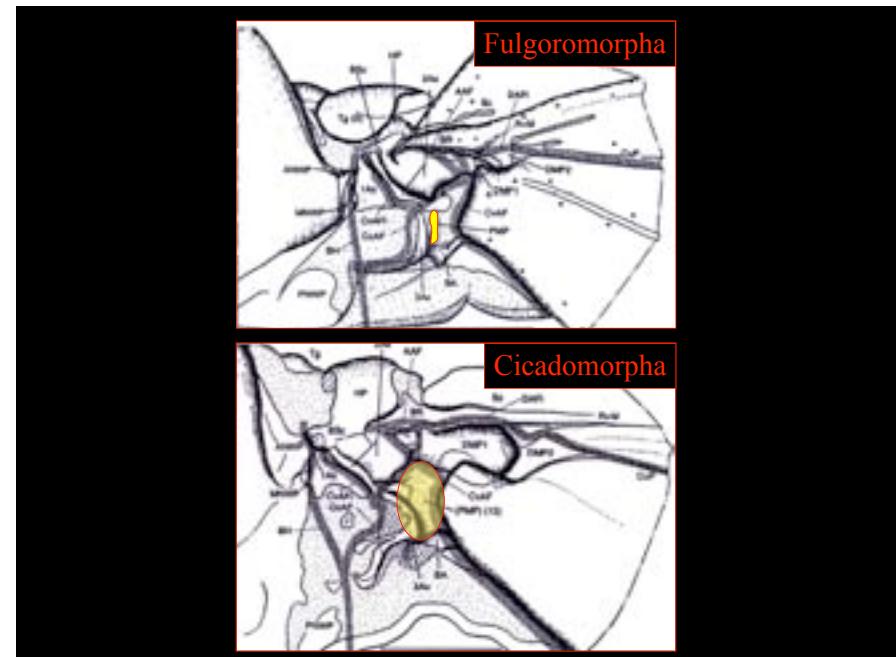
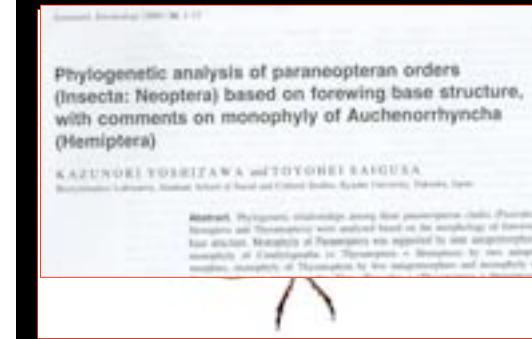
= throat = beak

- Articulation of rostrum on posterior of head



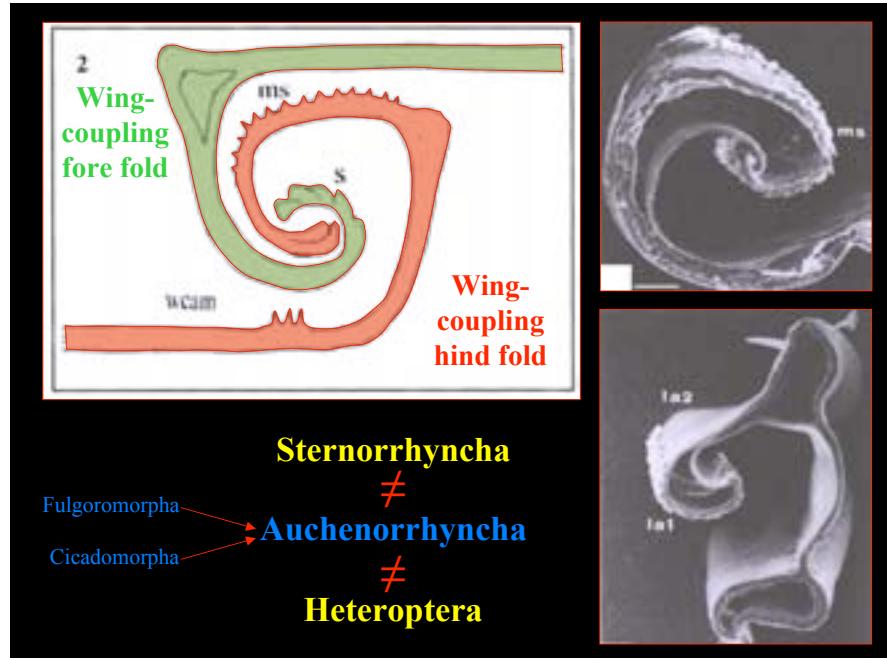
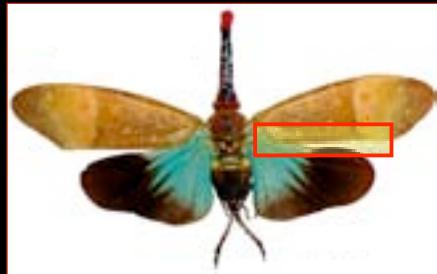
## Potential Synapomorphies of Auchenorrhyncha 3

- Aristoid antennal flagellum
- Forewing Base Structure
  - Yoshizawa & Saigusa (2001)
  - PMP: proximal median plate

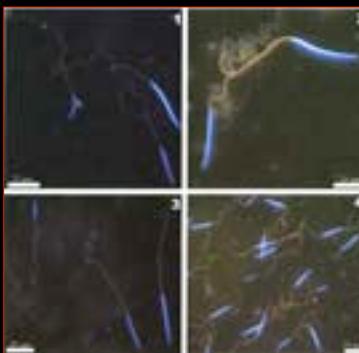


## Potential Synapomorphies of Auchenorrhyncha 4

- Wing-Coupling Mechanism
- D'Urso (2002)



## Potential Synapomorphies of Auchenorrhyncha 5

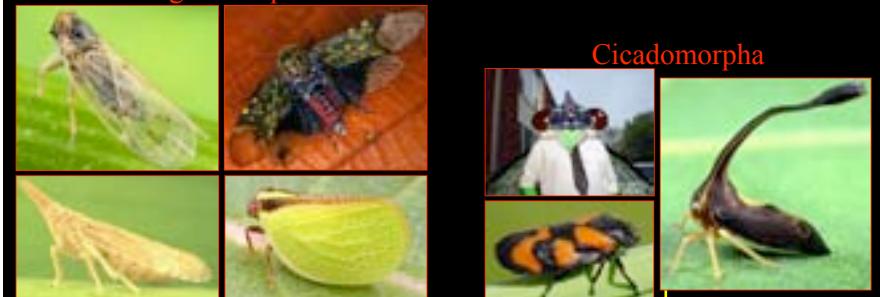


"[Cicada sperm] have a number of morphological features that are similar to the Cicadomorpha...and Fulgoromorpha described to date."

## Research Questions

Is Auchenorrhyncha Monophyletic?

Fulgoromorpha



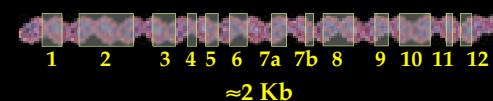
## Taxonomic Sampling

<i>Pectinariophyes reticulata</i>	Machaerotidae	Cercopoidea
<i>Lepyronia quadrangularis</i>	Aphrophoridae	
<i>Philaenus spumarius</i>	Aphrophoridae	
<i>Mahanarva costaricensis</i>	Cercopidae	
<i>Flexamia areolata</i>	Cicadellidae	Membracoidea
<i>Aetalion reticulata</i>	Aetalionidae	
<i>Ophiderma definita</i>	Membracidae	
<i>Tettigarcta crinita</i>	Tettigarctidae	Cicadoidea
<i>Pauropsalta corticinus</i>	Cicadidae	
<i>Froggatoides typicus</i>	Cicadidae	
<i>Nothodelphax gillettei</i>	Delphacidae	Fulgoroidea
<i>Neoliefkneckana</i> sp.	Fulgoridae	
<i>Tangia viridis</i>	Tropiduchidae	
<i>Aonidiella aurantii</i>	Diaspididae	Sternorrhyncha
<i>Triozza eugeniae</i>	Triozidae	
<i>Phylloxera notabilis</i>	Phylloxeridae	
<i>Adelges</i> sp.	Adelgidae	
<i>Hackeriella veitchi</i> 1	Peloriidae	Coleorrhyncha
<i>Hackeriella veitchi</i> 2	Peloriidae	
<i>Hemiowoodwardia wilsoni</i>	Peloriidae	
<i>Henicocoris montheithi</i>	Enicocephalidae	Heteroptera
<i>Brochymena</i> sp.	Pentatomidae	
Undet.	Pentatomidae	
<i>Triatoma dimidiata</i>	Reduviidae	
Undet.	Reduviidae	
<i>Lethocerus</i> sp.	Belostomatidae	
Undet.	Miridae	
Undet.	Mantodea	
Undet.	Phasmida	
		Outgroups

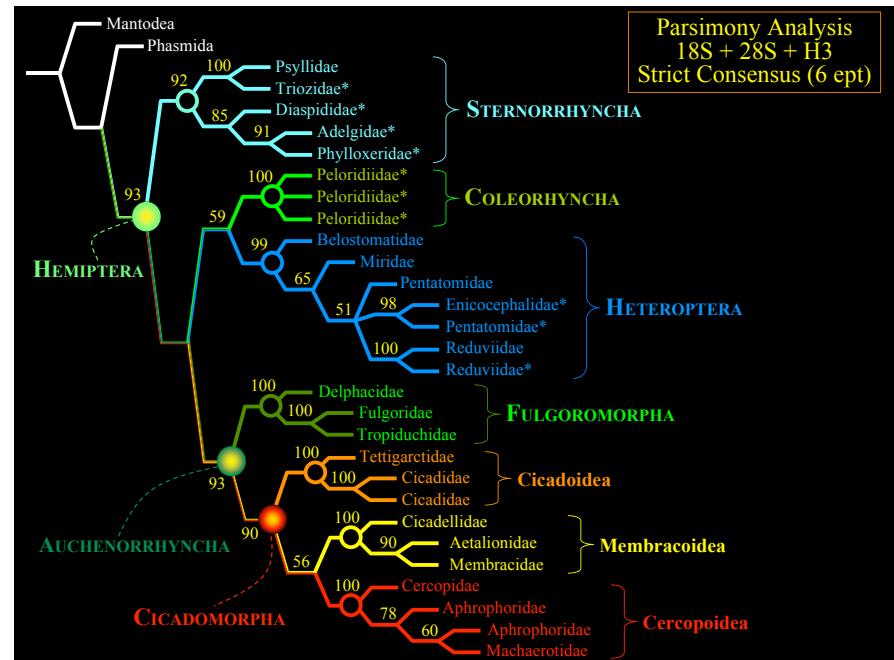
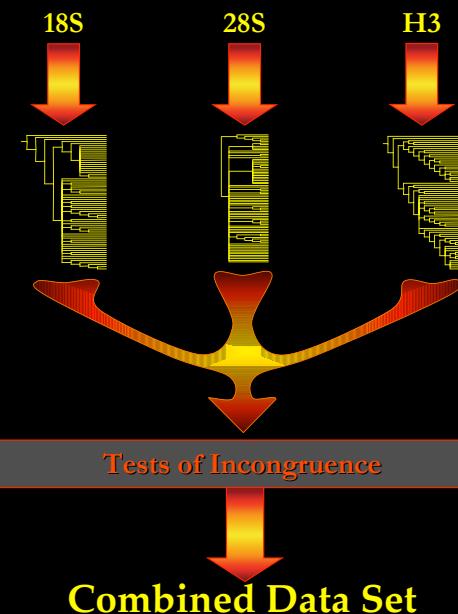
## 18S ribosomal DNA (18S rDNA)

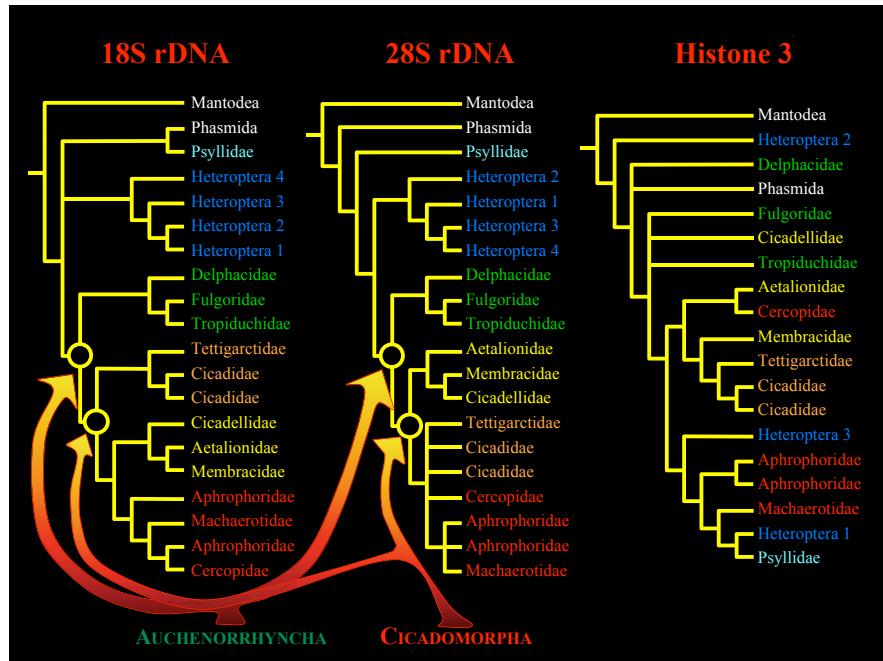


## 28S ribosomal DNA (28S rDNA)



## Histone 3 (H3)





## Is Auchenorrhyncha Really Paraphyletic?

- Morphological synapomorphies seem compelling
- Acknowledging that PMP is a “Reduction Character”
- Evaluation of Fulgoromorpha + Heteropterodea (Bourgoin 1993)?
- Some support for Auchenorrhyncha monophyly from molecular data
  - Some evidence from 18S & 28S to support monophyly of Auchenorrhyncha
  - Not limited to alignment methodology of 18S sequences

## Conclusion?

### Best Guess?

Auchenorrhyncha is probably monophyletic...  
but then again, maybe not!

