

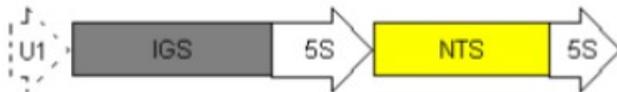
# **Evolutionary analysis of 5S ribosomal DNA in metazoans (first results)**

by Joaquín Vierna, Stefanie Wehner, and Manja Marz  
(Universidade da Coruña, Spain; Philipps Universität Marburg,  
Germany)





# Background



*Siliqua patula*



*Ensiculus cultellus*



Heredity (2011), 1–16  
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[www.nature.com/hdy](http://www.nature.com/hdy)



## ORIGINAL ARTICLE

# The linked units of 5S rDNA and U1 snDNA of razor shells (Mollusca: Bivalvia: Pharidae)

J Vierna<sup>1</sup>, KT Jensen<sup>2</sup>, A Martínez-Lage<sup>1</sup> and AM González-Tizón<sup>1</sup>

# Background: linkage with other non-coding RNAs

5S ribosomal DNA – found linked to:

SL1

U1 snDNA

U2 snDNA

U5 snDNA

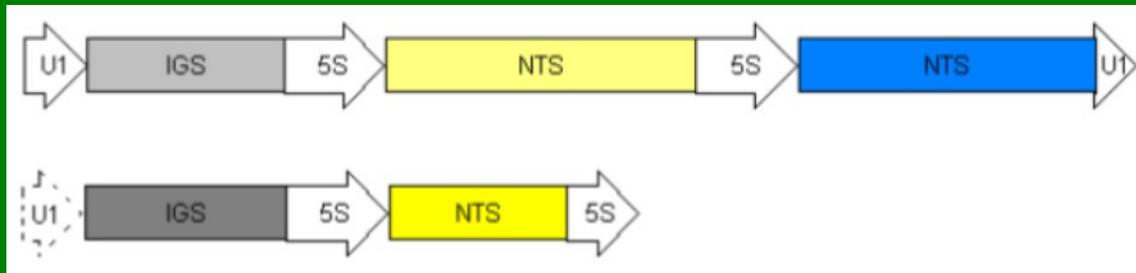
tRNAs

major ribosomal genes

# Goals

Study 5S in metazoans using genome-project data

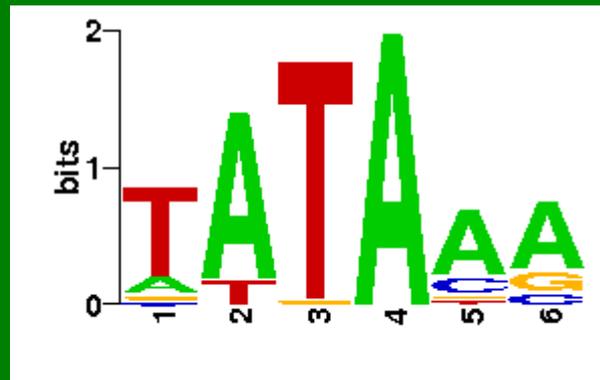
- 1 – linkage between 5S copies?
- 2 – linkage between 5S and U1 in other metazoans?
- 3 – linkage between 5S with other non-coding RNAs



# Goals

## Study 5S in metazoans using genome-project data

- 1 – linkage between 5S copies?
- 2 – linkage between 5S and U1 in other metazoans?
- 3 – linkage between 5S with other non-coding RNAs
- 4 – conservation of the upstream region
- 5 – conservation of the RNA coding region



# Methods

For both 5S and U1:

1- **blasted** using Rfam “seed alignments” and own queries (e-value:  $10e-4$ )

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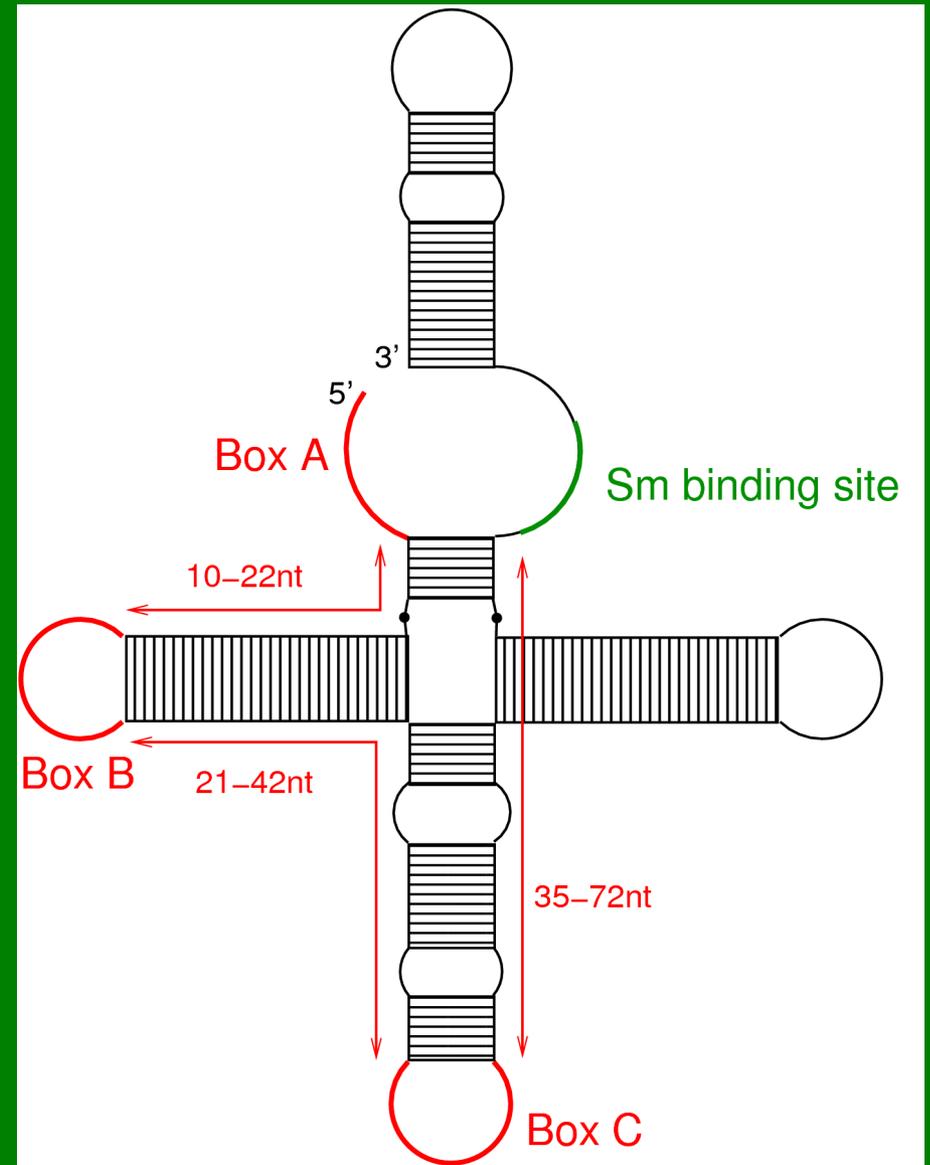
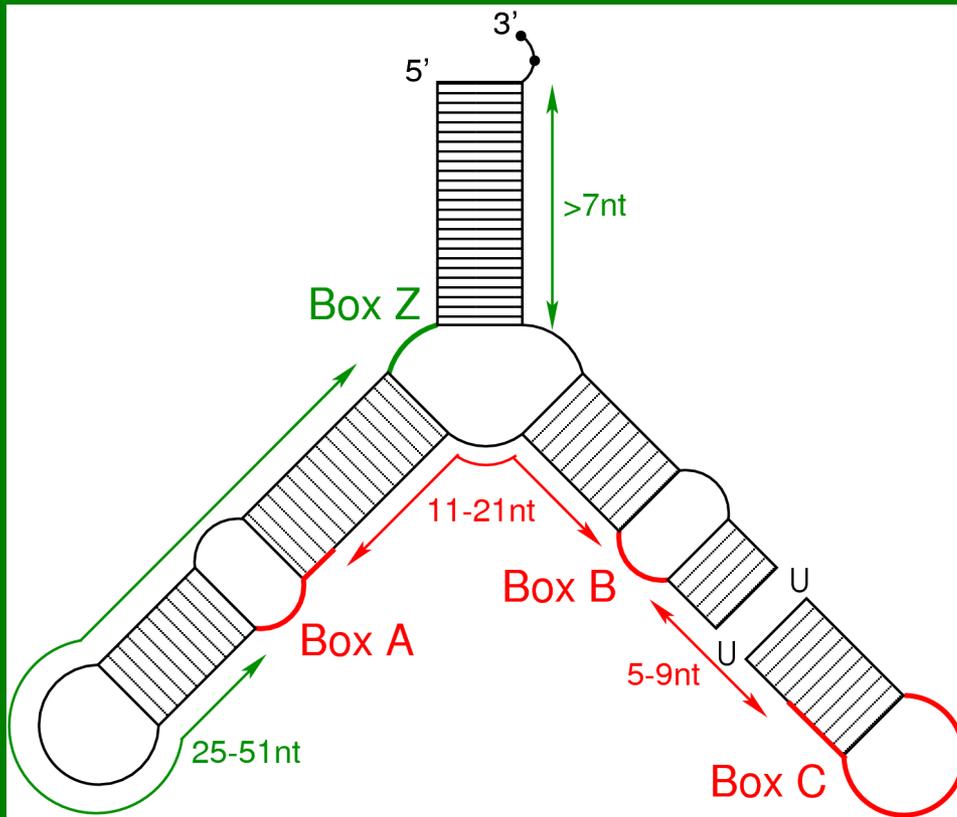
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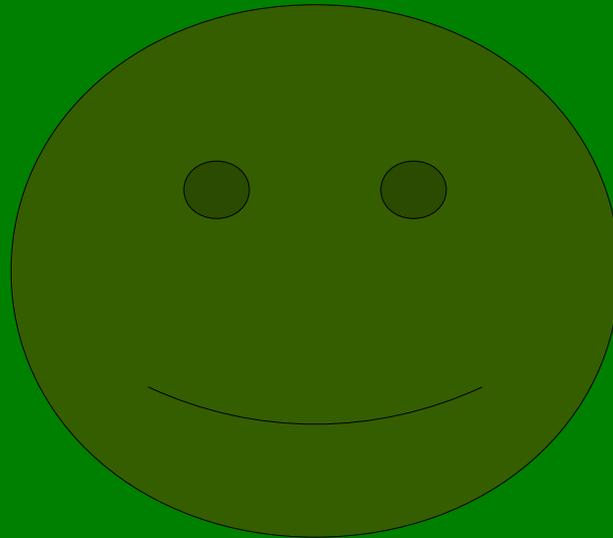


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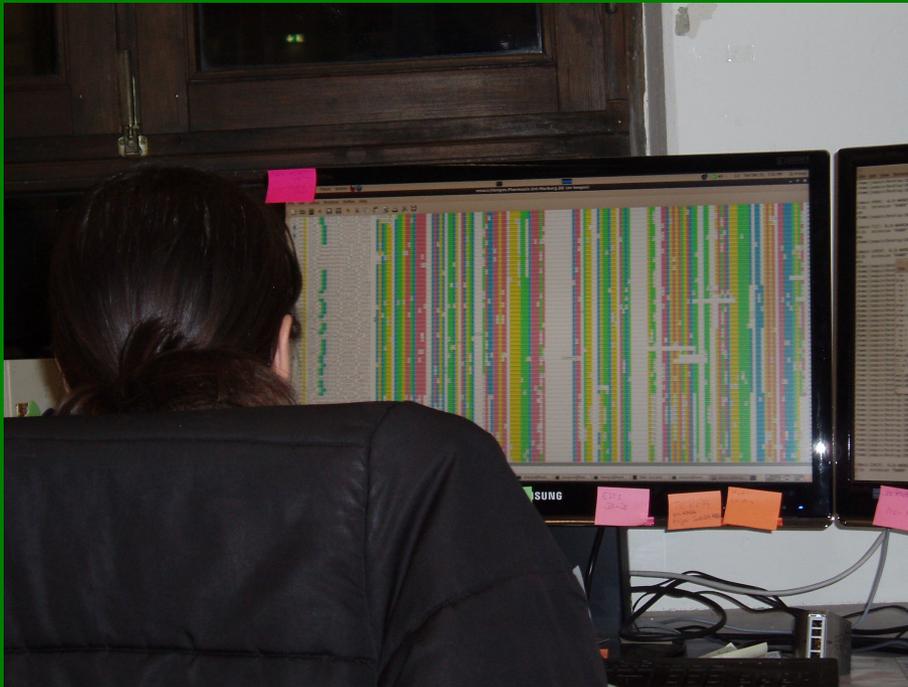
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- 2- **re-blasted** using initial query + “first Blast” output + consensus sequence for each species
- 3- **extended** the sequences
- 4- **filtered** the Blast results using conserved motifs from the literature
- 5- **folded and scored** all candidate sequences and **cleaned** alignments according to secondary structures / scores

**NOW WE HAVE THE 5S (AND  
U1) ALIGNMENTS FOR 104  
METAZOANS!**  
**(putative functional  
sequences)**



# Methods

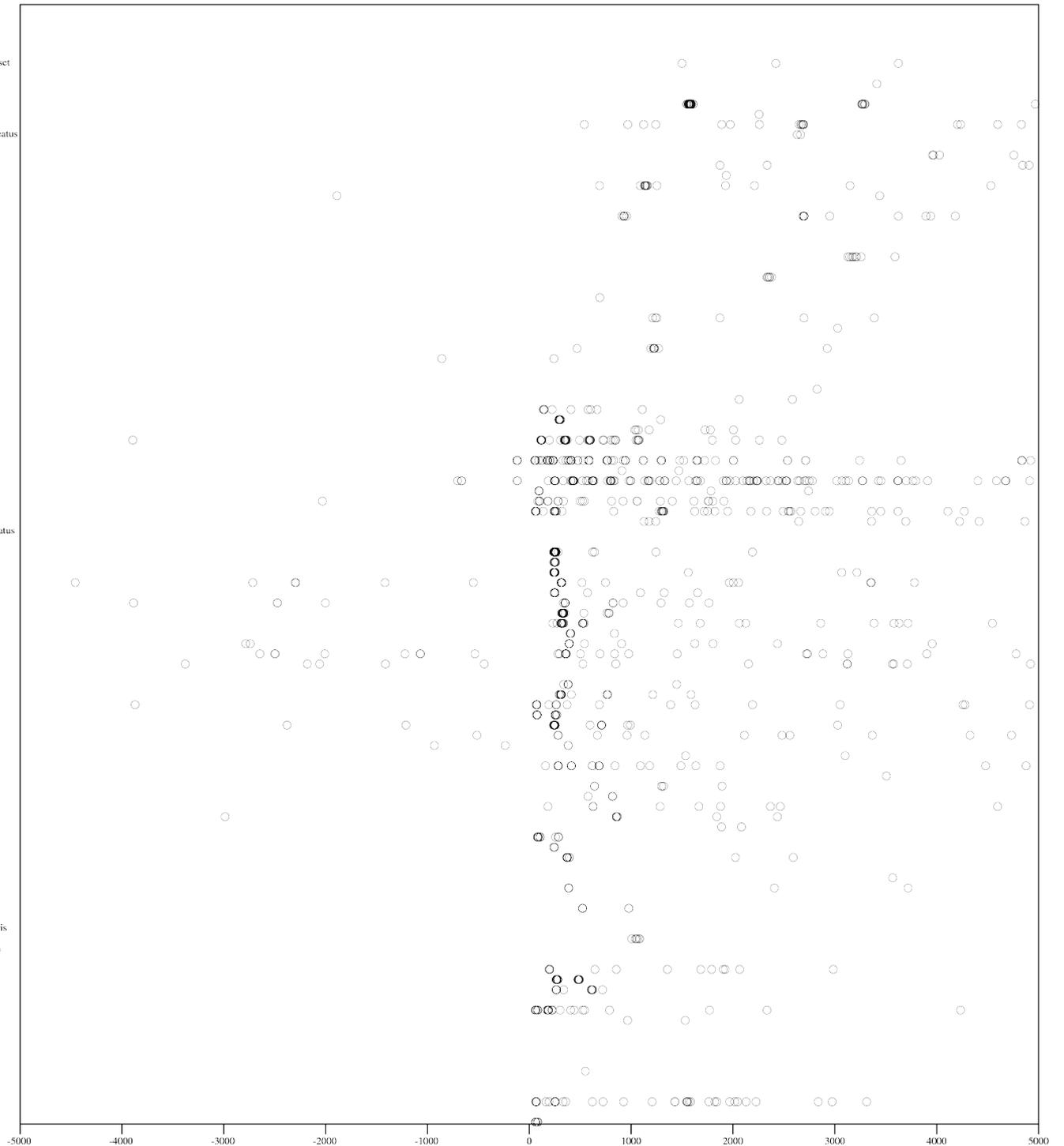
Once we had our alignments ready...



We looked for our goals...

# Results: 5S-5S linkage

Homo\_sapiens  
 Pan\_troglodytes  
 Pongo\_pygmaeus  
 Macaca\_mulata  
 Callithrix\_jacchus\_Marmoset  
 Tarsius\_syrichta  
 Otlemur\_garnettii  
 Microcebus\_murinus  
 Mus\_musculus  
 Rattus\_norvegicus  
 Dipodomys\_ordii  
 Spermophilus\_tridecemlineatus  
 Cavia\_porcellus  
 Ochotona\_princeps  
 Oryctolagus\_cuniculus  
 Tupaia\_belangeri  
 Felis\_catus  
 Canis\_familiaris  
 Vicugna\_pacos  
 Tursiops\_truncatus  
 Bos\_taurus  
 Sus\_scrofa  
 Equus\_caballus  
 Myotis\_lucifugus  
 Pteropus\_vampyrus  
 Erinaceus\_europaeus  
 Sorex\_araneus  
 Loxodonta\_africana  
 Echinops\_telfairi  
 Procavia\_capensis  
 Dasypus\_noveboracensis  
 Choloepus\_hoffmanni  
 Monodelphis\_domestica  
 Macropus\_eugenii  
 Ornithorhynchus\_anatinus  
 Anolis\_carolinensis\_T  
 Taeniopygia\_guttata  
 Gallus\_gallus  
 Xenopus\_tropicalis  
 Tetraodon\_nigroviridis  
 Takifugu\_rubripes  
 Gasterosteus\_aculeatus  
 Oryzias\_latipes  
 Danio\_rerio  
 Callorhynchus\_mili  
 Petromyzon\_marinus  
 Branchiostoma\_floridae  
 Ciona\_intestinalis  
 Ciona\_savignyi  
 Oikopleura\_dioica  
 Strongylocentrotus\_purpuratus  
 Saccoglossus\_kowalevskii  
 Drosophila\_melanogaster  
 Drosophila\_simulans  
 Drosophila\_sechellia  
 Drosophila\_erecta  
 Drosophila\_yakuba  
 Drosophila\_amanassae  
 Drosophila\_pseudoobscura  
 Drosophila\_persimilis  
 Drosophila\_willistoni  
 Drosophila\_virtilis  
 Drosophila\_mojavensis  
 Drosophila\_grönshawi  
 Phlebotomus\_papatasi  
 Anopheles\_gambiae  
 Aedes\_aegypti  
 Bombyx\_mori  
 Tribolium\_castaneum  
 Apis\_mellifera  
 Nasonia\_vitripennis  
 Pediculus\_humanus  
 Acyrthosiphon\_pisum  
 Daphnia\_pulex  
 Ixodes\_scapularis  
 Caenorhabditis\_remanei  
 Caenorhabditis\_briggsae  
 Caenorhabditis\_brenneri  
 Caenorhabditis\_elegans  
 Caenorhabditis\_japonica  
 Haemonchus\_contortus  
 Ancylostoma\_canium  
 Pristionchus\_pacificus  
 Strongyloides\_rati  
 Meloidogyne\_incognita  
 Meloidogyne\_hapla  
 Ascaris\_lumbricoideus  
 Brugia\_malayi  
 Trichinella\_spiralis  
 Echinococcus\_multilocularis  
 Schistosoma\_mansoni  
 Schistosoma\_haematobium  
 Schistosoma\_japonicum  
 Schmiebia\_mediterranea  
 Helobdella\_robusta  
 Capitella\_sp  
 Alvinella\_pompejana  
 Lottia\_gigantea  
 Aplysia\_californica  
 Biomphalaria\_glabrata  
 Euprymna\_scolopes  
 Carinoma\_mutabilis  
 Cerebratulus\_lacertus  
 Acropora\_palmata  
 Acropora\_millepora  
 Porites\_lobata  
 Nematostella\_vectensis  
 Hydra\_magnipapillata  
 Reniera\_spez



# Results: 5S-U1 linkage

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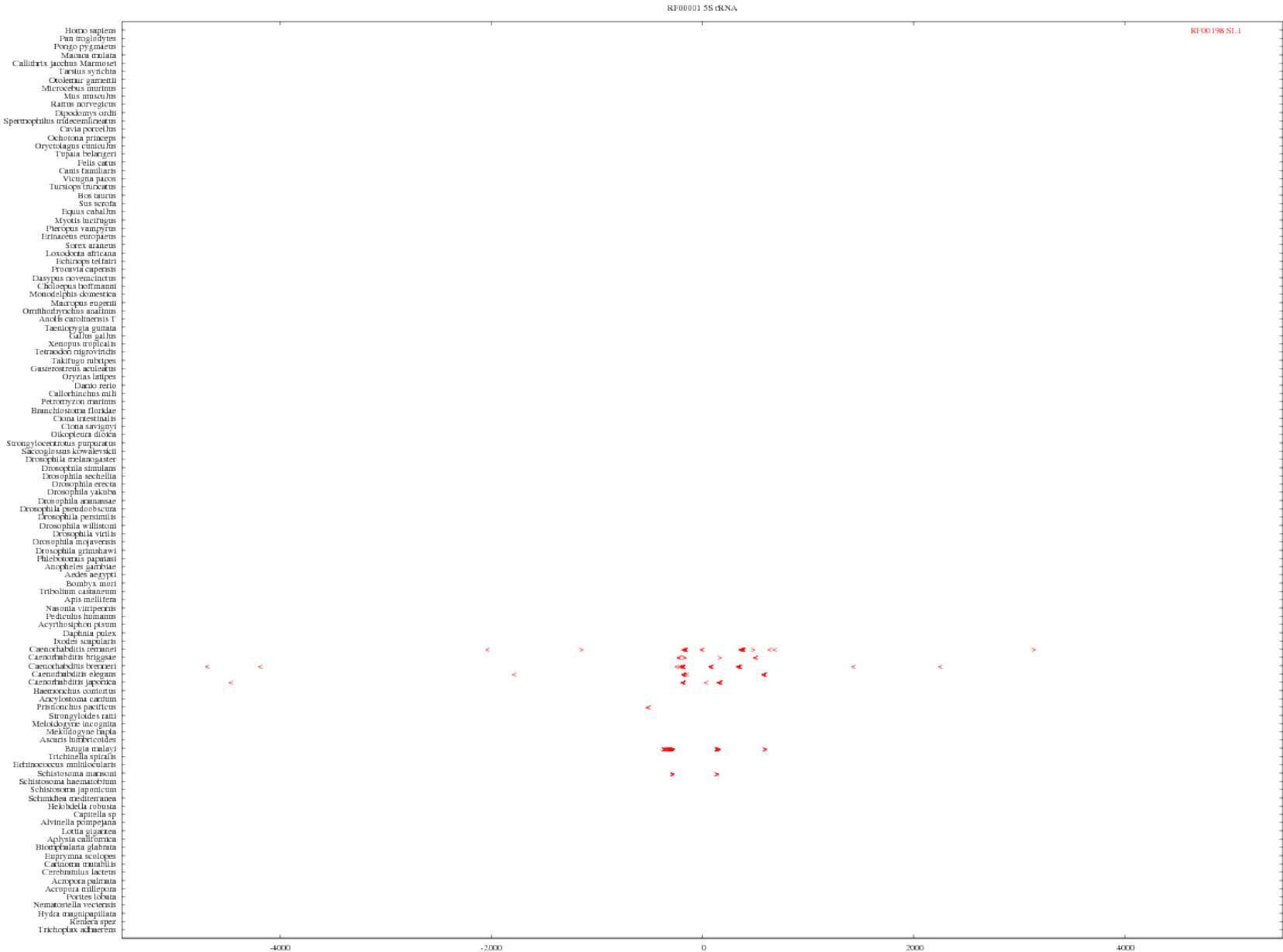


**Results:  
linkage**

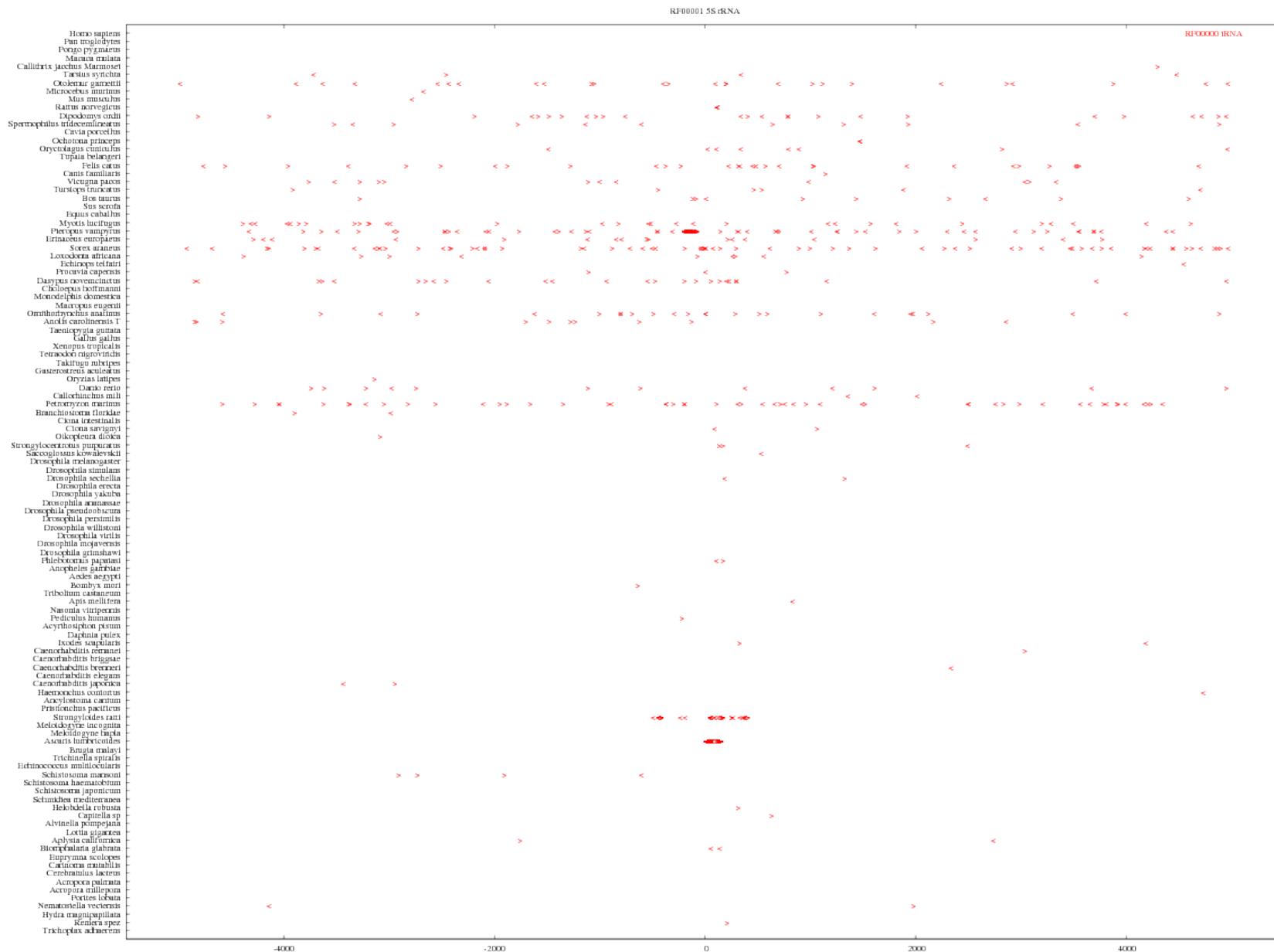
**Rfam --> 1025 non-coding RNA classes**

**We found 23 ncRNAs that were  
linked to 5S in at least one species**

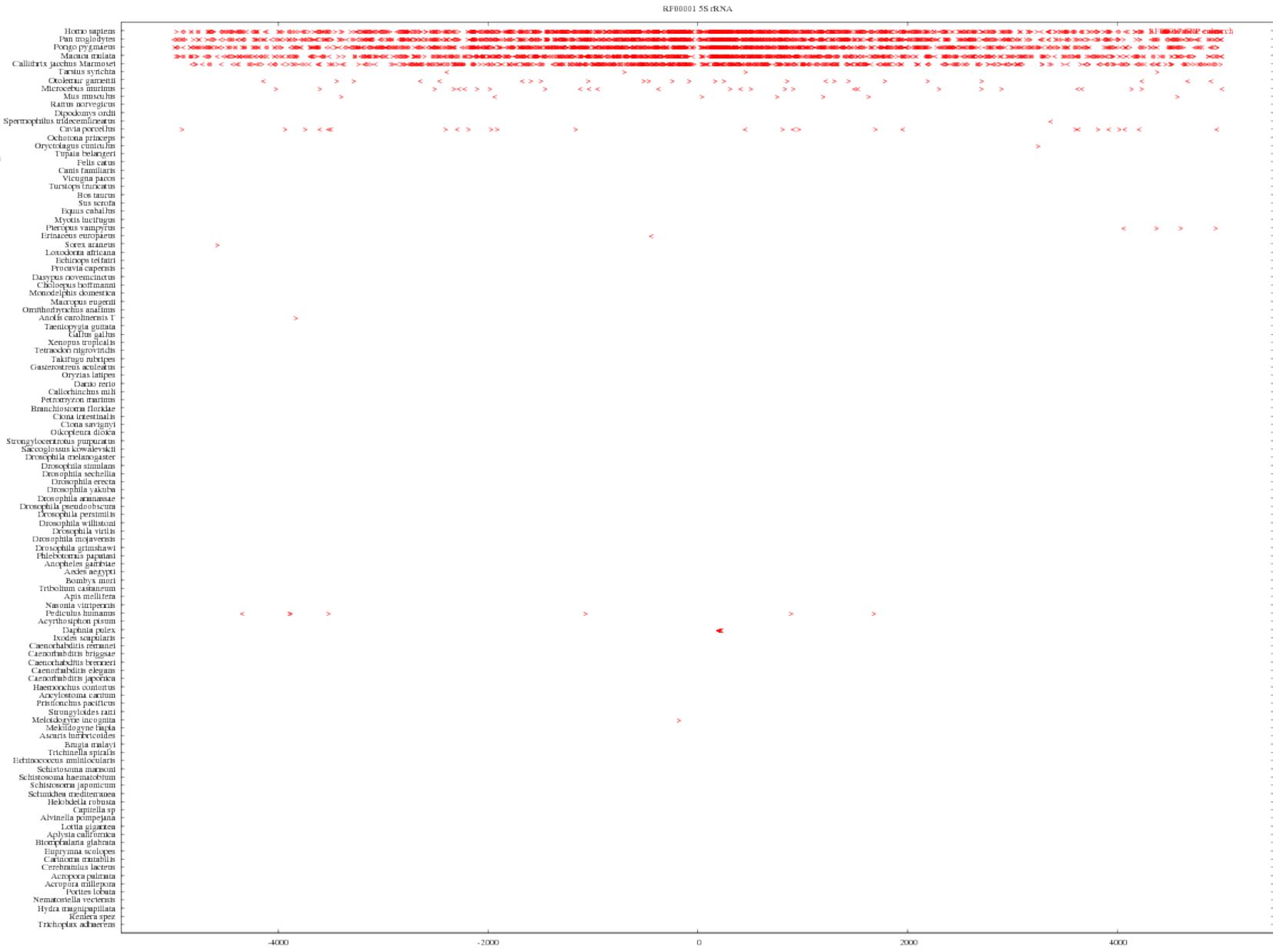
# Results: linkage SL1



# Results: linkage tRNA



# Results: linkage Signal recog. particle







# **Results: conservation of RNA coding region (120 nts)**

**We have found three main classes of RNA  
coding regions:**

- basal deuterostomes**
- protostomes**
- mammals**

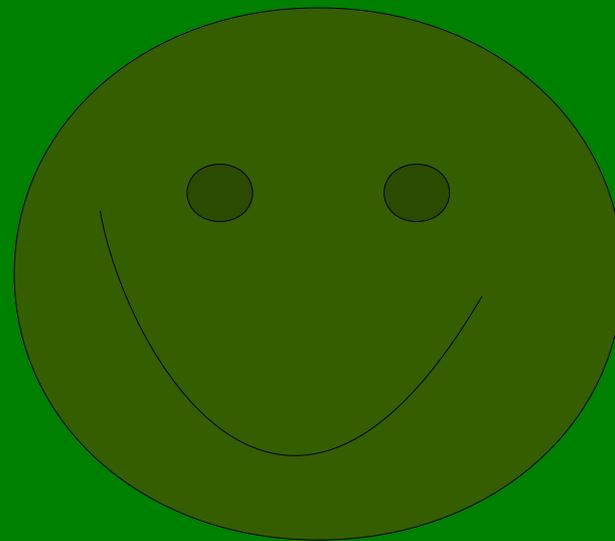
# First conclusions

5S ribosomal DNA appears to be linked to several different genes – are these linkages stochastic or do they provide any advantage?

# First conclusions

## Conservation:

- conserved upstream region in metazoans
- three main classes of RNA coding regions for basal deuterostoms, protostoms, and mammals



**THANKS!**