A survey of natural antisense transcripts in the bacteria and archaea kingdoms

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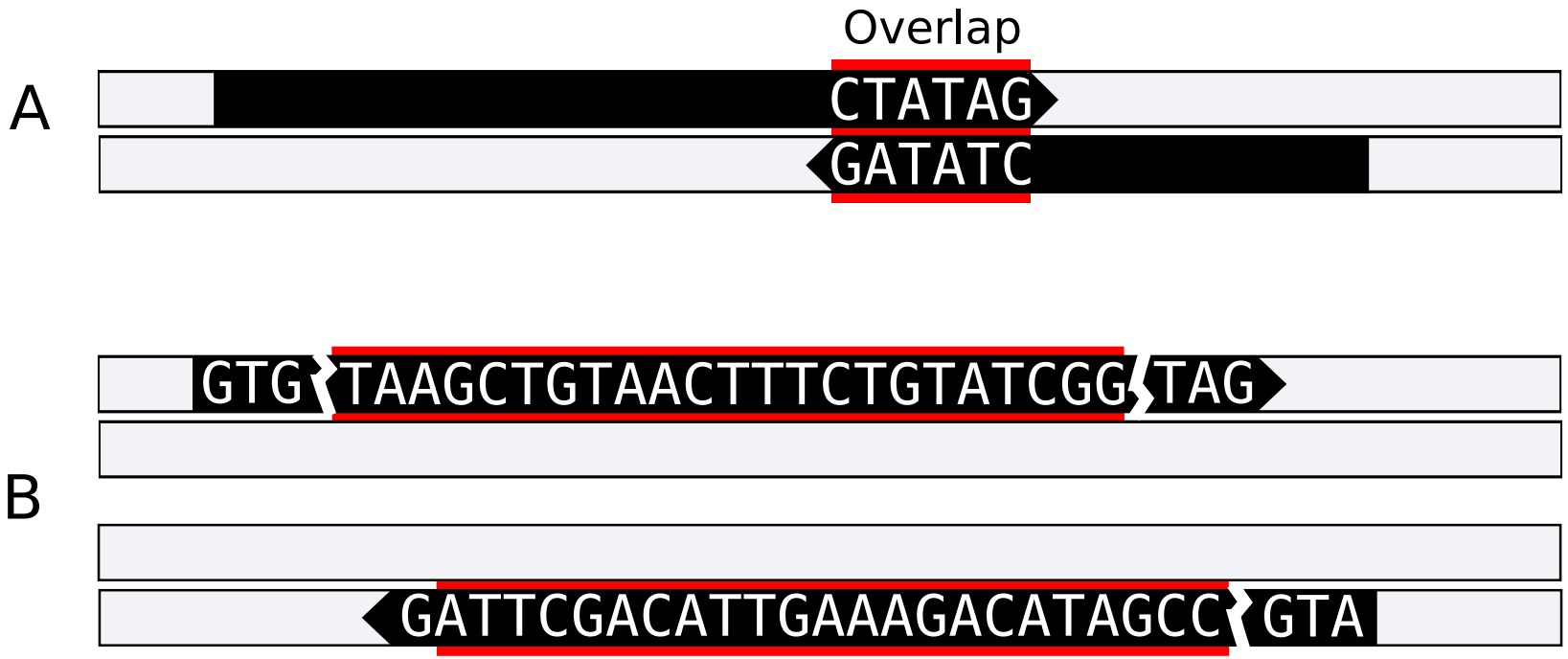
Natural Antisense Transcripts

- Natural Antisense Transcripts (NATs): transcripts with complementary sequence to another transcript
- play a role in diverse prokaryotic processes (plasmid replication, flagella synthesis,. . .)
- diverse regulatory mechanisms:
  - altering of the secondary structure of the sense partner
  - blocking or creating of protein binding sites
  - . . .

cis and trans NATs



Dataset

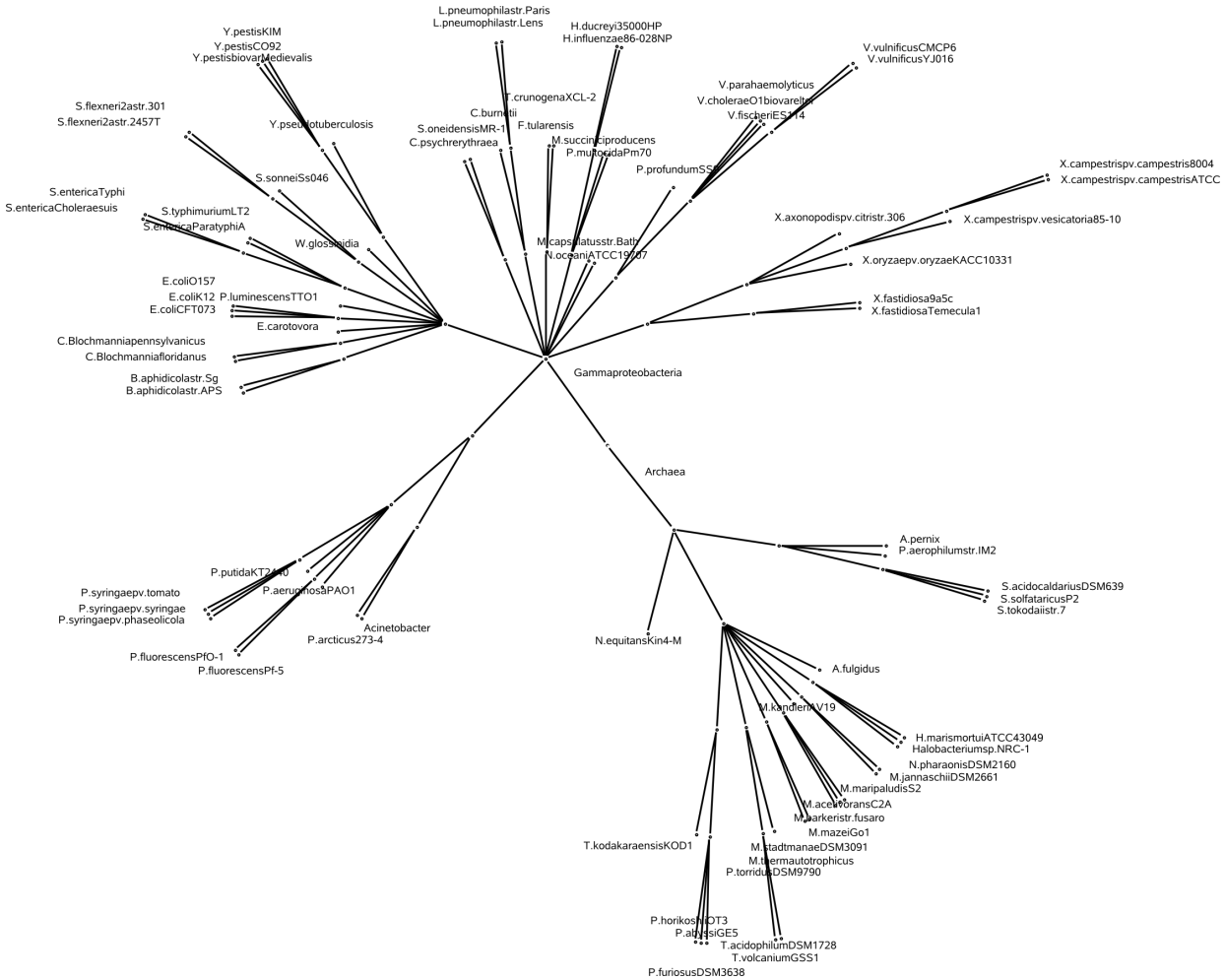
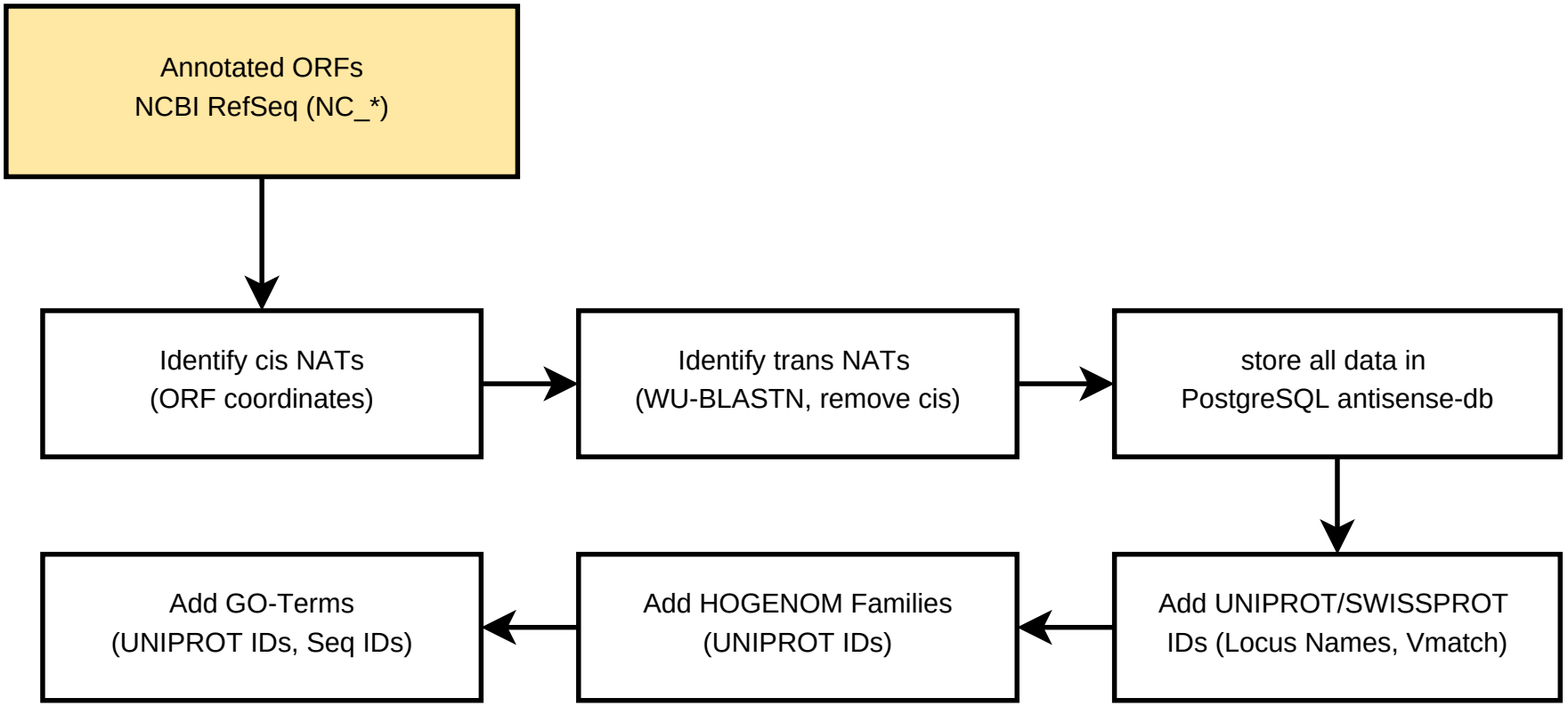
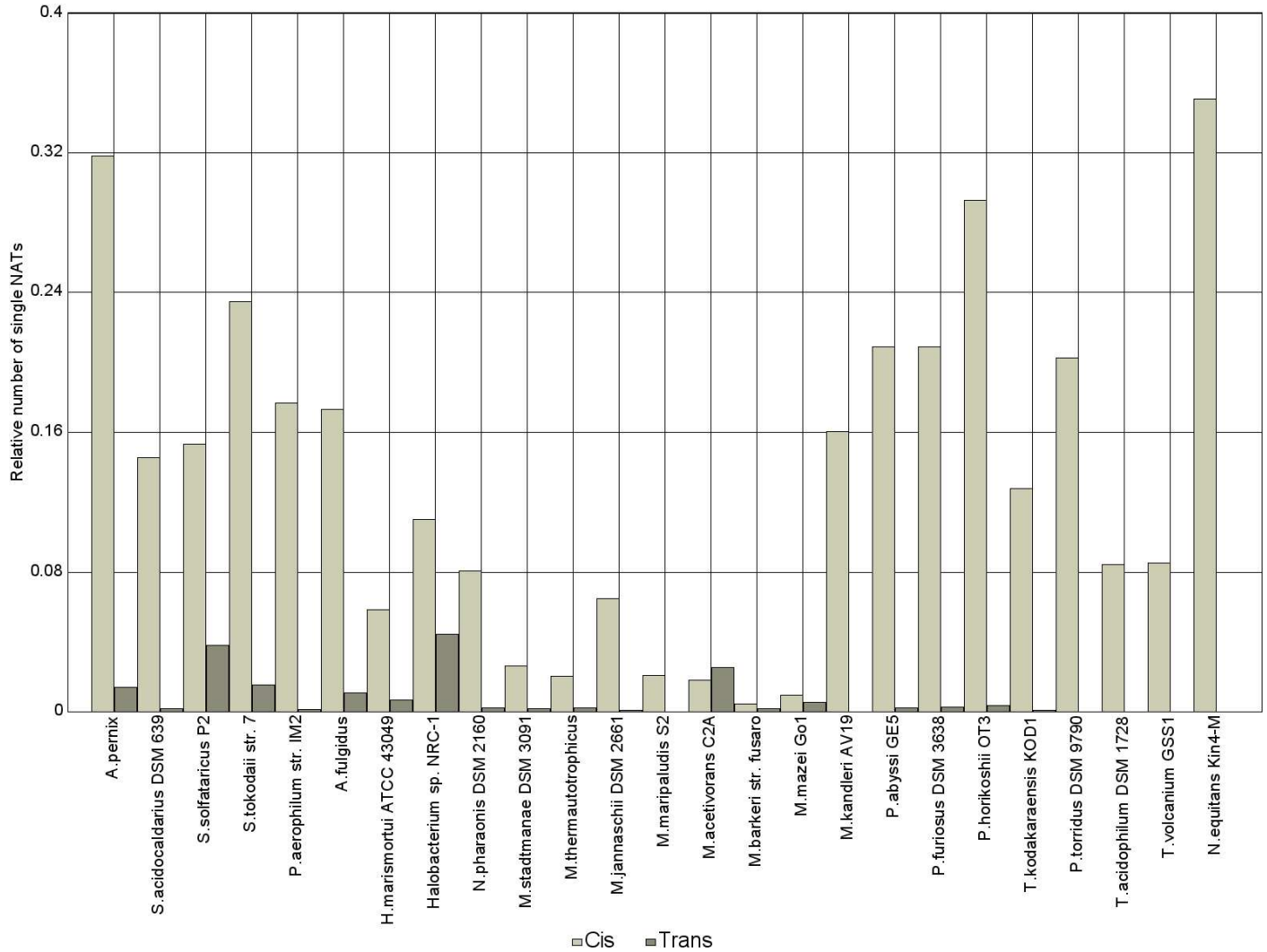


Figure: 25 Archaea, 56 Gammaproteobacteria (E.coli, Legionella,. . .)

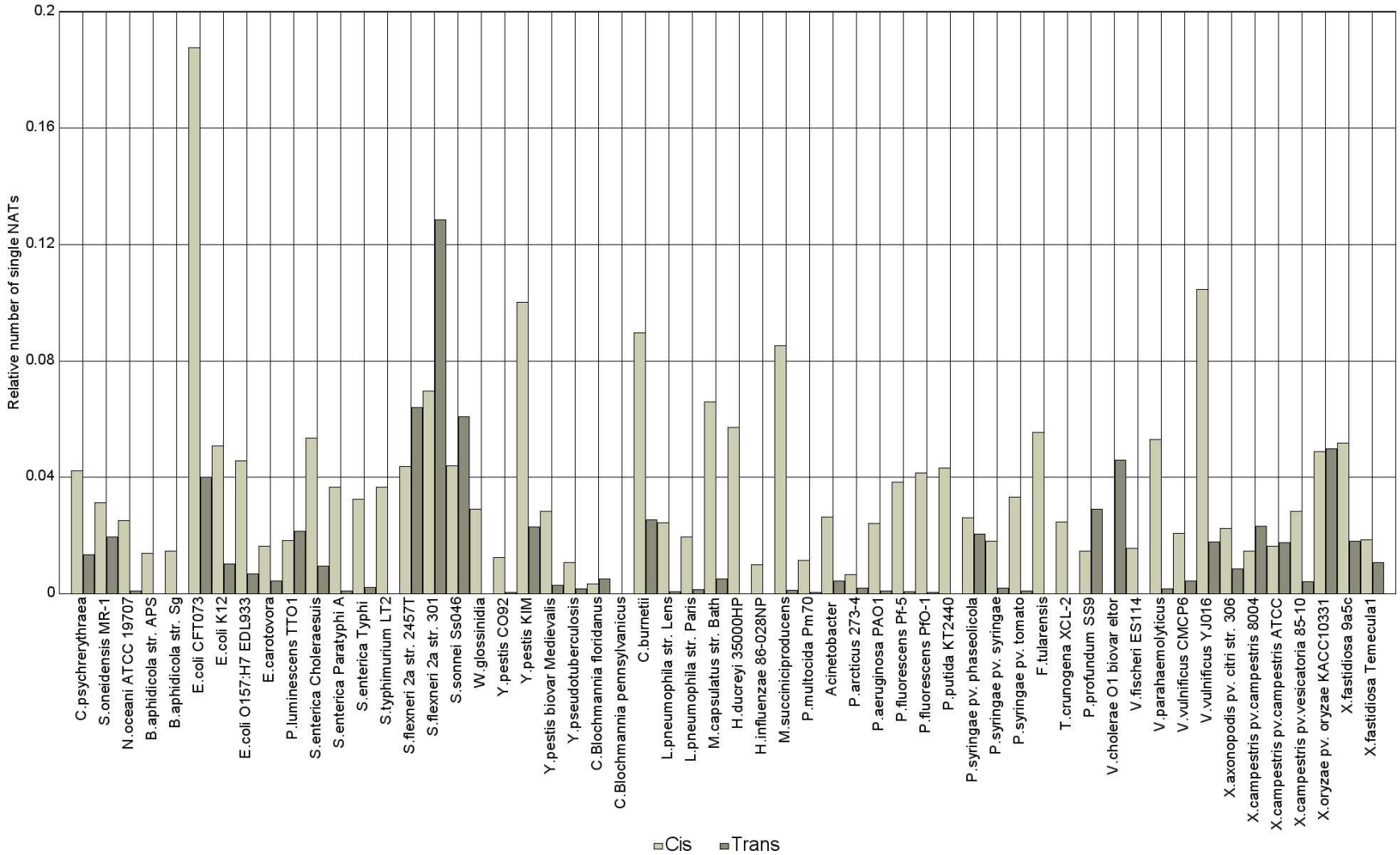
Pipeline


Annotated ORFs
NCBI RefSeq (NC_*)
Identify cis NATs
(ORF coordinates)
Identify trans NATs
(WU-BLASTN, remove cis)
store all data in
PostgreSQL antisense-db
Add UNIPROT/SWISSPROT
IDs (Locus Names, Vmatch)
Add HOGENOM Families
(UNIPROT IDs)
Add GO-Terms
(UNIPROT IDs, Seq IDs)

Relative Number of NATs in Archaea



Relative Number of NATs in Bacteria



cis NATs

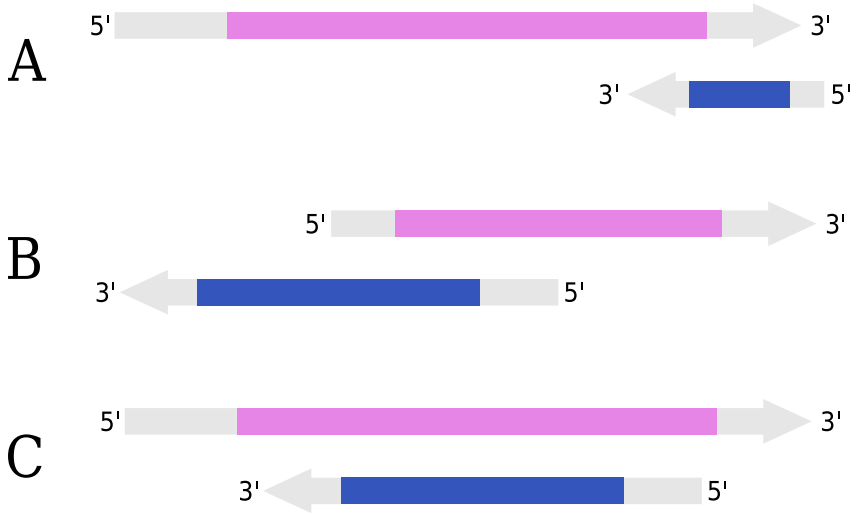
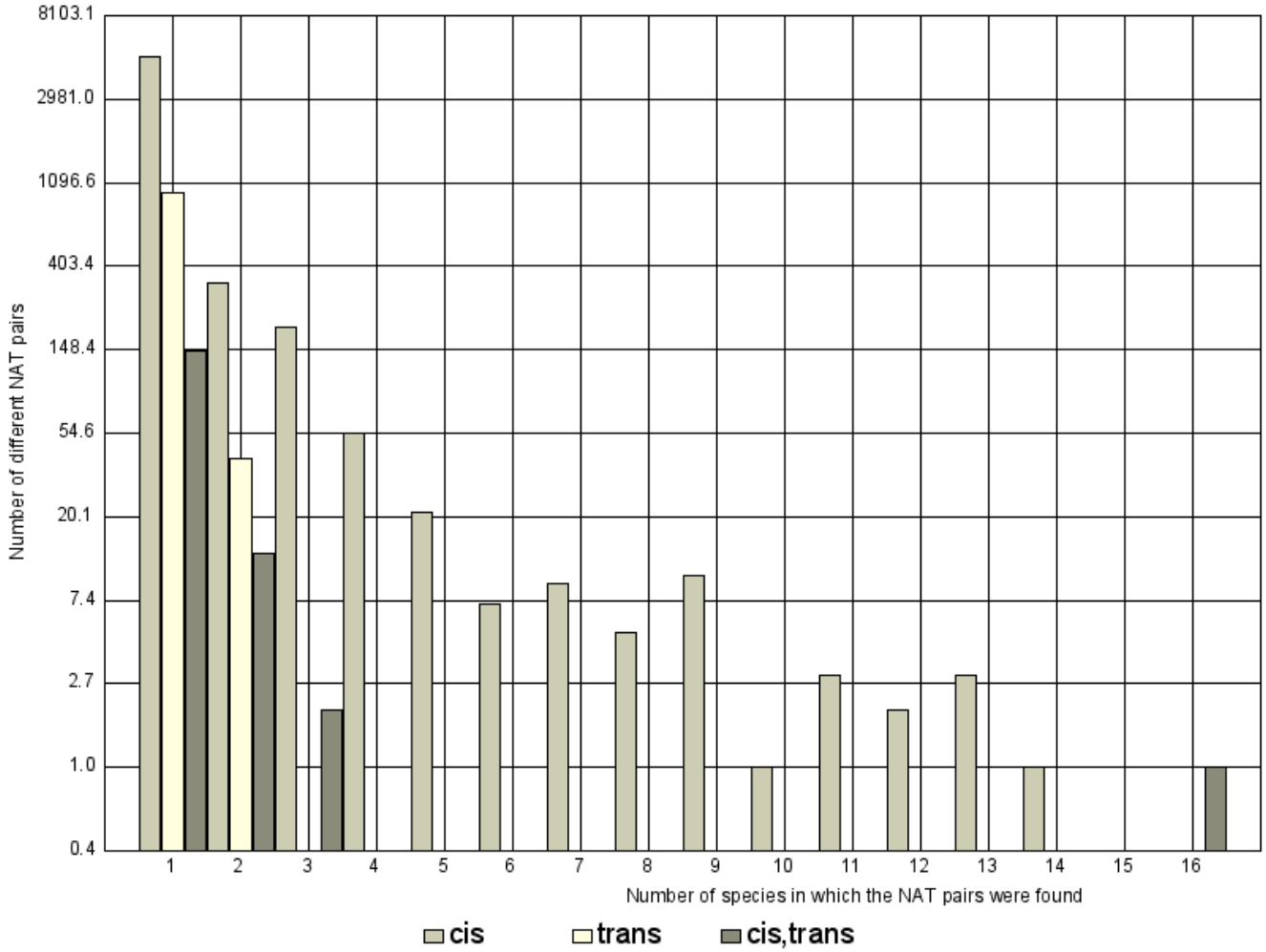


Figure: A. tail-to-tail, B. head-to-head, C. inside

- A. ($\rightarrow\leftarrow$): 68.3%
- B. ($\leftarrow\rightarrow$): 19.3%
- 20% are tail-to-tail overlaps of size 4b.

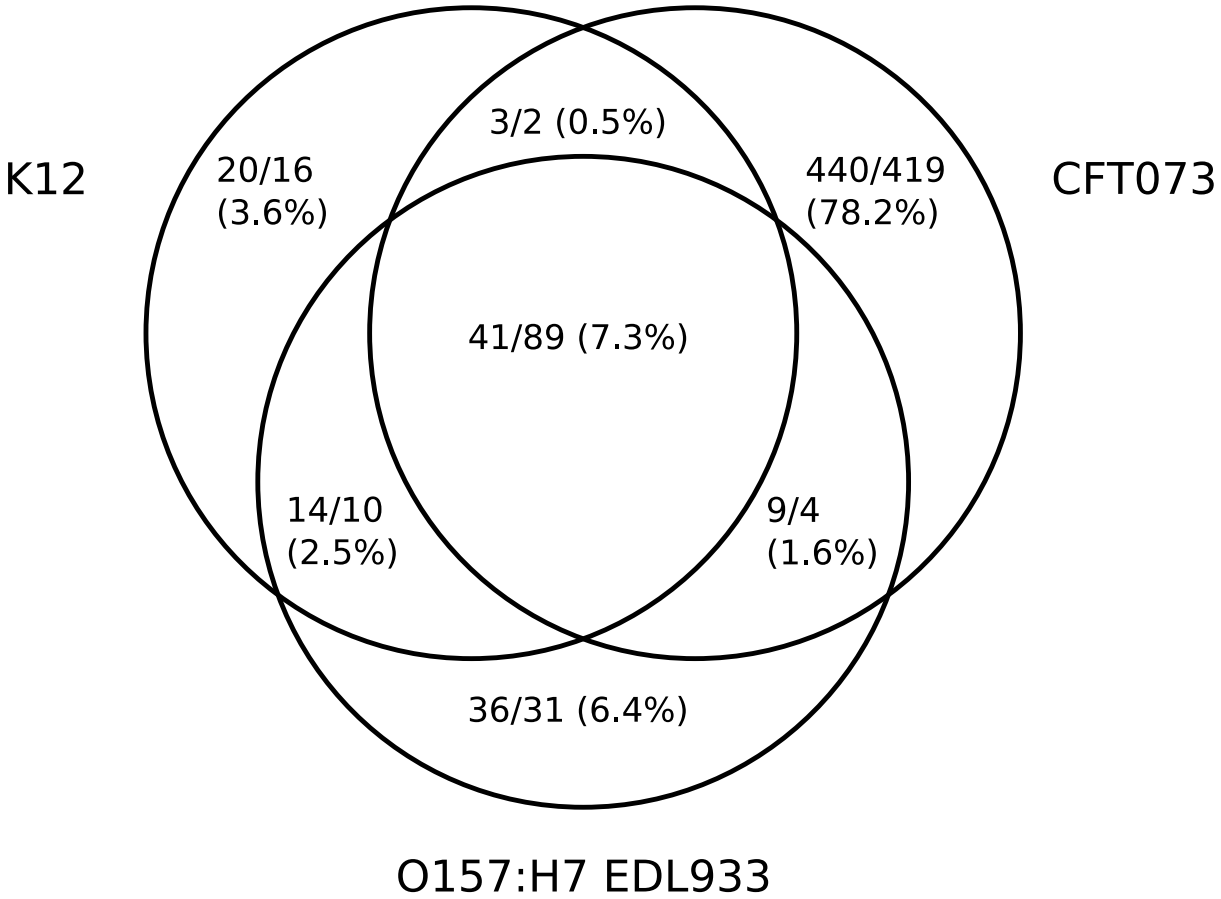
Conserved NAT Pairs



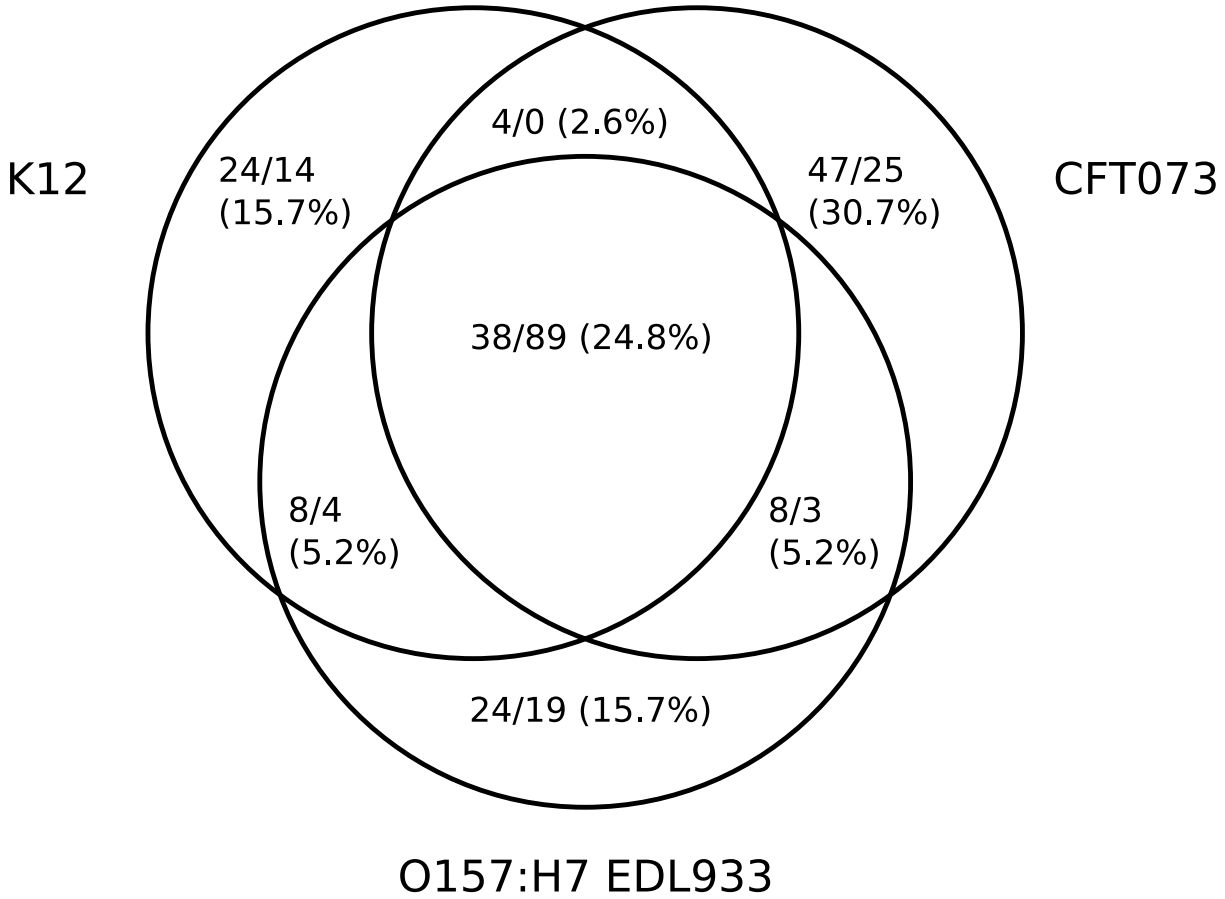
NATs

- 17620 (6% of all analyzed ORFs) potential NATs in 81 Species
- 9614 annotated as "'hypothetical proteins"' $\Rightarrow$
  - wrongly annotated
  - interesting because unknown function?

cis NATs in Ecoli



cis NATs Ecoli, Genemark.hmm



GO-Terms, Function

Species	Aspect	GO ID	Term
20	F	GO:0005488	binding
17	F	GO:0003824	catalytic activity
11	F	GO:0030528	transcription regulator activity
8	F	GO:0016787	hydrolase activity
4	F	GO:0016740	transferase activity
3	F	GO:0015075	ion transporter activity
3	F	GO:0005554	molecular function unknown
3	F	GO:0005386	carrier activity
3	F	GO:0004871	signal transducer activity
3	F	GO:0005215	transporter activity
2	F	GO:0005489	electron transporter activity
2	F	GO:0016491	oxidoreductase activity
1	F	GO:0016853	isomerase activity
1	F	GO:0016874	ligase activity
1	F	GO:0016829	lyase activity
1	F	GO:0005198	structural molecule activity

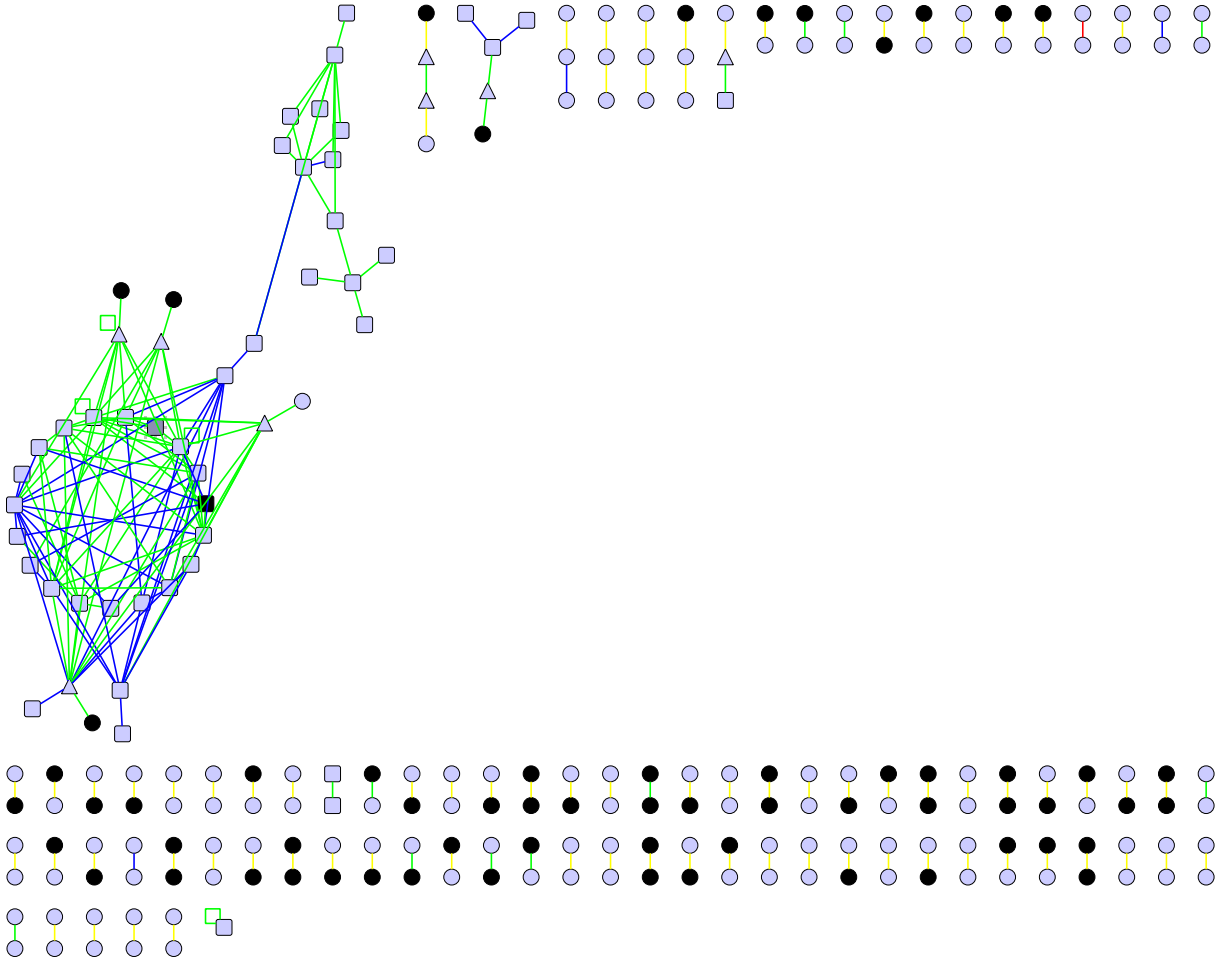
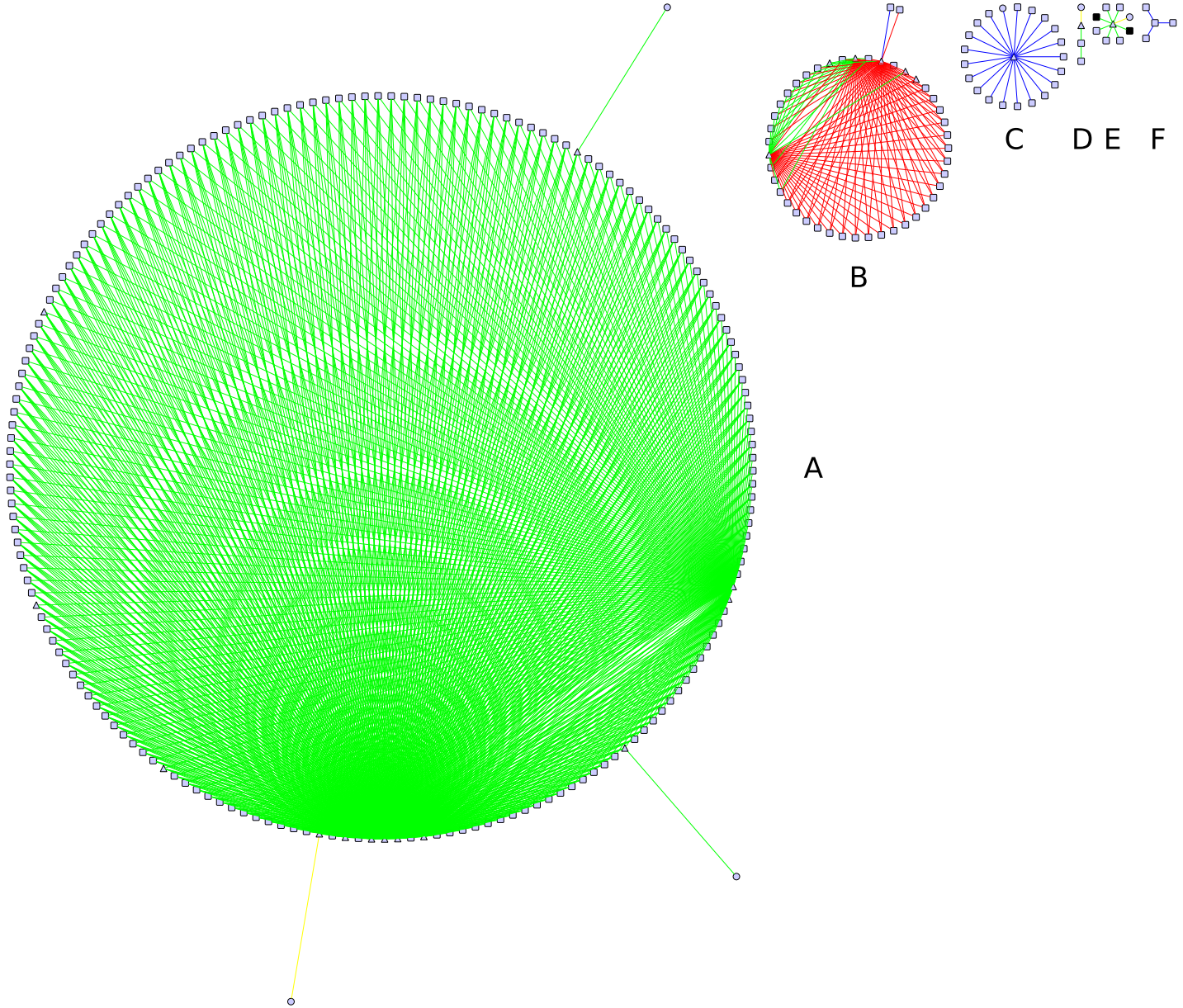
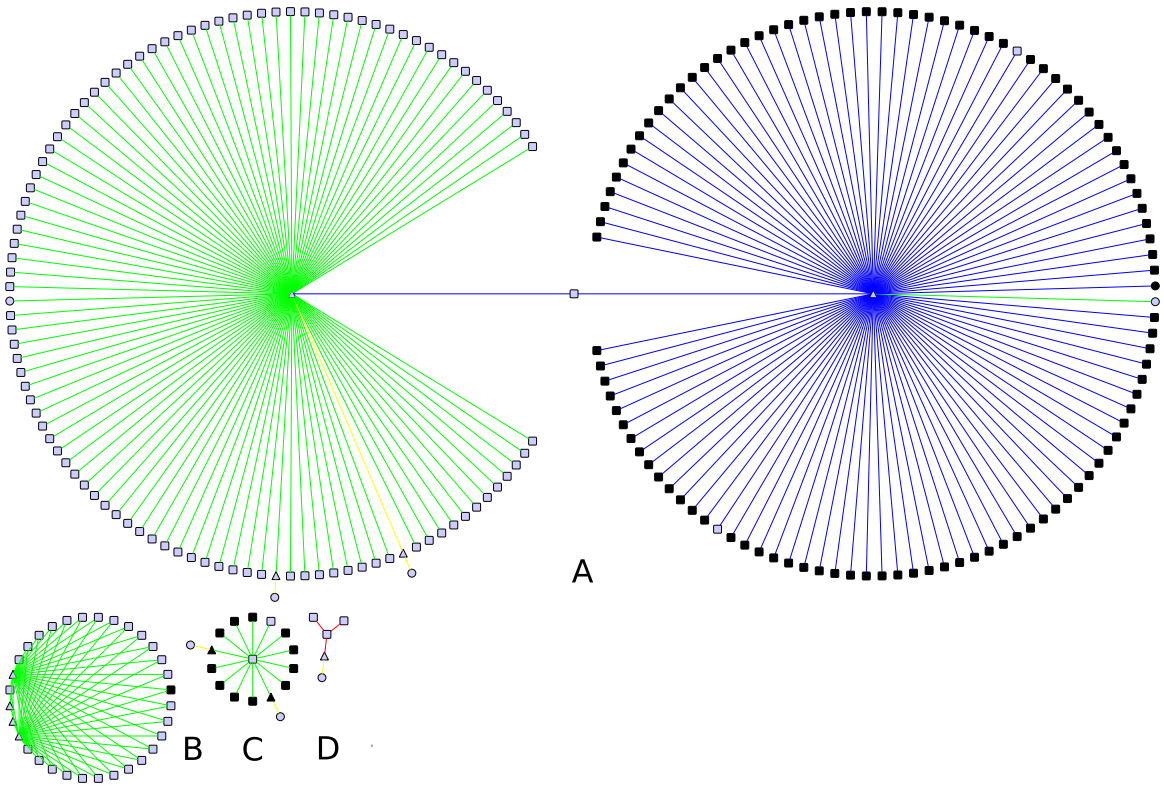


Figure: Network of *cis* and *trans* NATs in *Coxiella burnetii RSA 493*.


A
B
C
D E
F


A
B
C
D

Acknowledgments

Stephan Steigele, Kay Nieselt