



# SILVA - a comprehensive online resource for high-quality ribosomal RNA sequence data

## REFERENCE DATABASES - SERVICES - TOOLS

Christian Quast<sup>1</sup>, Jan Gerken<sup>2</sup>, Alan Beccati<sup>1</sup>, Amandine Nunes-Jorge<sup>1</sup>, Maksym Pyatygorskyy<sup>1</sup>, Markus Klimmek<sup>1</sup>, Pablo Yarza<sup>5</sup>, Ralph Florent<sup>2</sup>, Jörg Peplies<sup>5</sup>, Frank Oliver Glöckner<sup>1,3,4</sup>

<sup>1</sup> Department of Life Sciences and Chemistry, Jacobs University gGmbH, Bremen

<sup>2</sup> Microbial Genomics and Bioinformatics Research Group, Max Planck Institute for Marine Microbiology, Bremen

<sup>3</sup> Computing and Data Center, Alfred Wegener Institute - Helmholtz Center for Polar- and Marine Research, Bremerhaven

<sup>4</sup> MARUM - Center for Marine Environmental Sciences, University of Bremen, Bremen

<sup>5</sup> Ribocon GmbH, Bremen

Fkz: 031A539A

## SILVA rRNA Databases

SILVA is a comprehensive web resource for up-to-date, quality-controlled databases of aligned ribosomal RNA (rRNA) gene sequences from the *Bacteria*, *Archaea* and *Eukaryota* domains and supplementary online services. All sequences are checked for anomalies, carry a rich set of sequence associated contextual information, multiple taxonomic classifications and the latest validly described nomenclature.

SILVA provides: a) curated guide trees with the latest taxonomy and nomenclature, b) consistent naming of clades of uncultivated (environmental) sequences, c) a complete eukaryotic taxonomy, ranging from insects to ciliates.

## de.NBI Training and Education

Regular workshops are provided on database resources, marker gene sequence analysis, phylogenetic inference, and large-scale processing of next generation sequencing data.

### Summer School: (Bio)Data Science

The de.NBI Bigi, BioData, BioInfra.Prot, CIBI, GCBN, SysBio centers and the German Federation for Biological Data (GFBio e.V.) held the second iteration of the summer school to support researchers in managing their scientific data.



The summer school provided a practical toolbox for the collection, maintenance, documentation, archiving and publication of research data according to the FAIR data principles (Findable, Accessible, Interoperable and Re-usable).

## General information on the project (funding)

- de.NBI (BMBF):
  - 3 full-time developers,
  - 1 full-time ELIXIR liaison / Communication Officer,
- MPG: 1 full-time and 1 part-time developer,
- Moore Foundation: 1 full-time developer,
- RiboCon GmbH: 1 part-time curator.

## Publications

- Beccati A, Gerken J, Quast C, Yilmaz P, Glöckner FO (2017) *SILVA Tree Viewer: interactive web browsing of the SILVA phylogenetic guide trees*. BMC Bioinformatics 18: 433.
- Glöckner FO, Yilmaz P, Quast C, Gerken J, Beccati A, Ciuprina A, Bruns G, Yarza P, Peplies J, Westram R, Ludwig W (2017) *25 years of serving the community with ribosomal RNA gene reference databases and tools*. J. Biotechnol. 261: 169-176.
- Quast C, Pruesse E, Yilmaz P, Gerken J, Schweer T, Yarza P, Peplies J, Glöckner FO (2013) *The SILVA ribosomal RNA gene database project: improved data processing and web-based tools*. Nucl. Acids Res. 41 (D1): D590-D596.

## de.NBI Services

### SILVA Parc:

Comprehensive quality checked SSU & LSU datasets

- SSU Parc (138): 9,469,656 +56%
- LSU Parc (132): 910,134 +24%



### SILVA Ref(erence):

High-quality SSU & LSU datasets

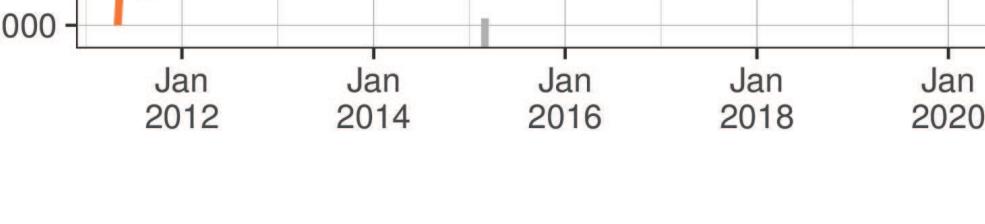
- SSU Ref (138): 2,225,272 +6%
- LSU Ref (132): 201,588 +32%



### SILVA Ref NR 99:

Non-redundant SSU Ref dataset

- SSU Ref NR (138): 510,984 -27% (new clustering)



### Online Services:

- Sequence Alignment,
- Classification & Phylogenetics,
- Probe and Primer evaluation,
- Custom-tailored Datasets,
- SILVAngs: rDNA amplicons analysis.

## Progress Report

### SILVA Taxonomy:

- Member of Bergey's Manual Trust,
- Member of the UniEuk (technology provider),
- Manually curated taxonomy and nomenclature,
- Adapted the **Genome Taxonomy**,
- Adapted the **UniEuk Taxonomy**.

### SILVA (Web) Services / Processing Pipeline:

- Ported SILVA(ngs) to the de.NBI cloud,
- Virtualised SILVA (web) services,
- Updated imports/exports to many 3rd party resources.

### Ongoing:

- Redesign of the website.