

Novel bioinformatics tools for microbial monitoring and clinical diagnostics.

Mohamed Mysara^{1,2*}, Britto B. Xavier², Pieter Monsieurs¹, Surbhi Malhotra-Kumar², Natalie Leys¹



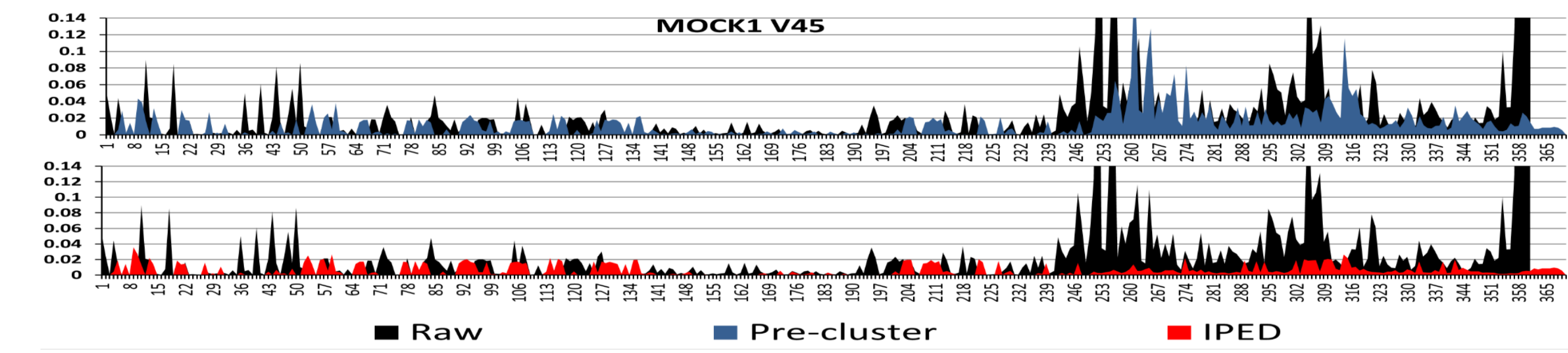
¹ Unit of Microbiology, Belgian Nuclear Research Centre (SCK-CEN), Mol, Belgium.
² Laboratory of Medical Microbiology, University of Antwerp, Wilrijk, Belgium.

OCToPUS pipeline

Mysara M. et al. (2017) *Gigascience*

IPED

- IPED algorithm developed for correcting sequencing errors in Illumina MiSeq paired-end reads
- It is able to predict positions in the sequencing reads potentially containing errors.
- IPED detects double the amount of errors compared with the second best algorithm.

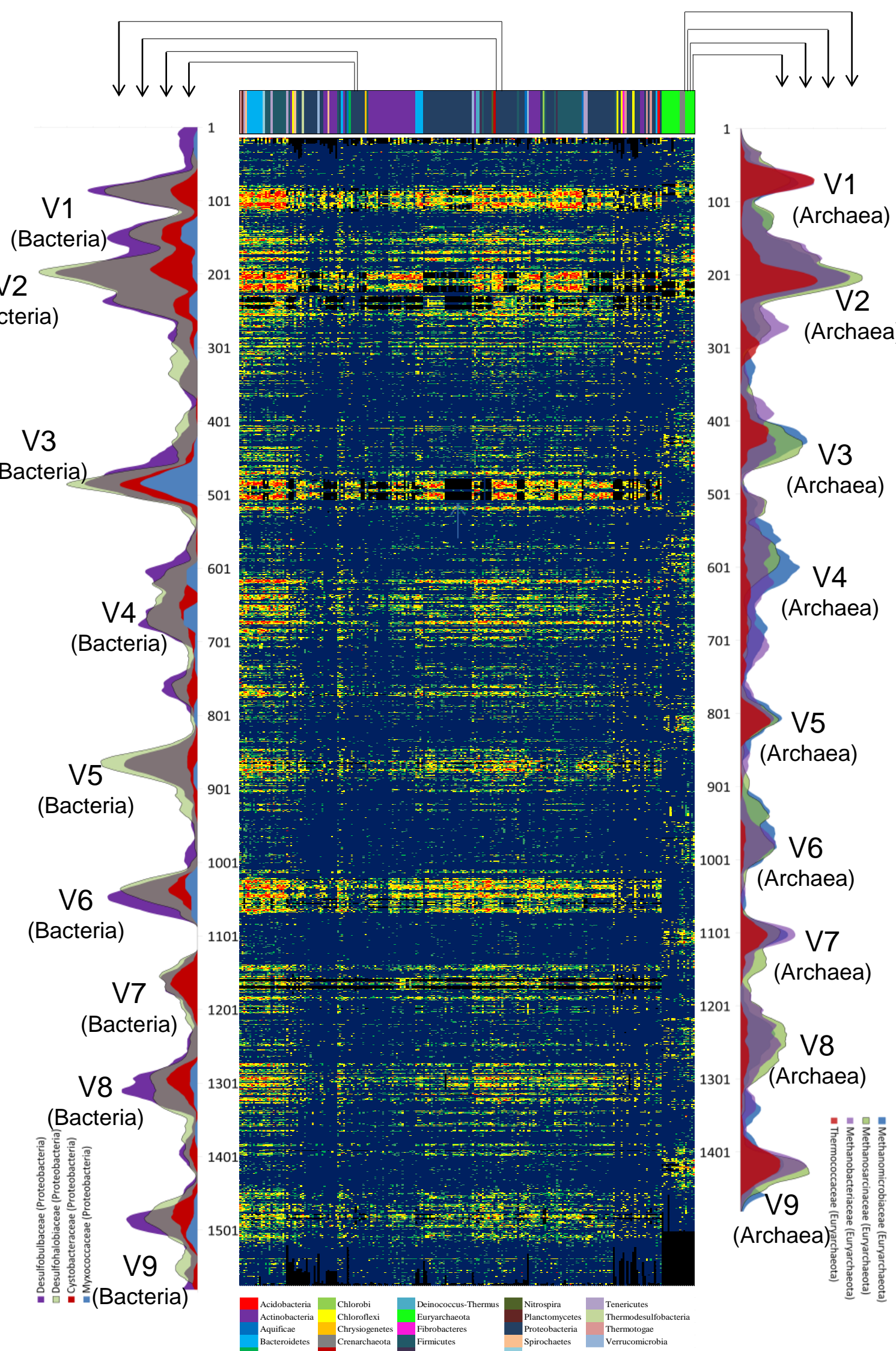
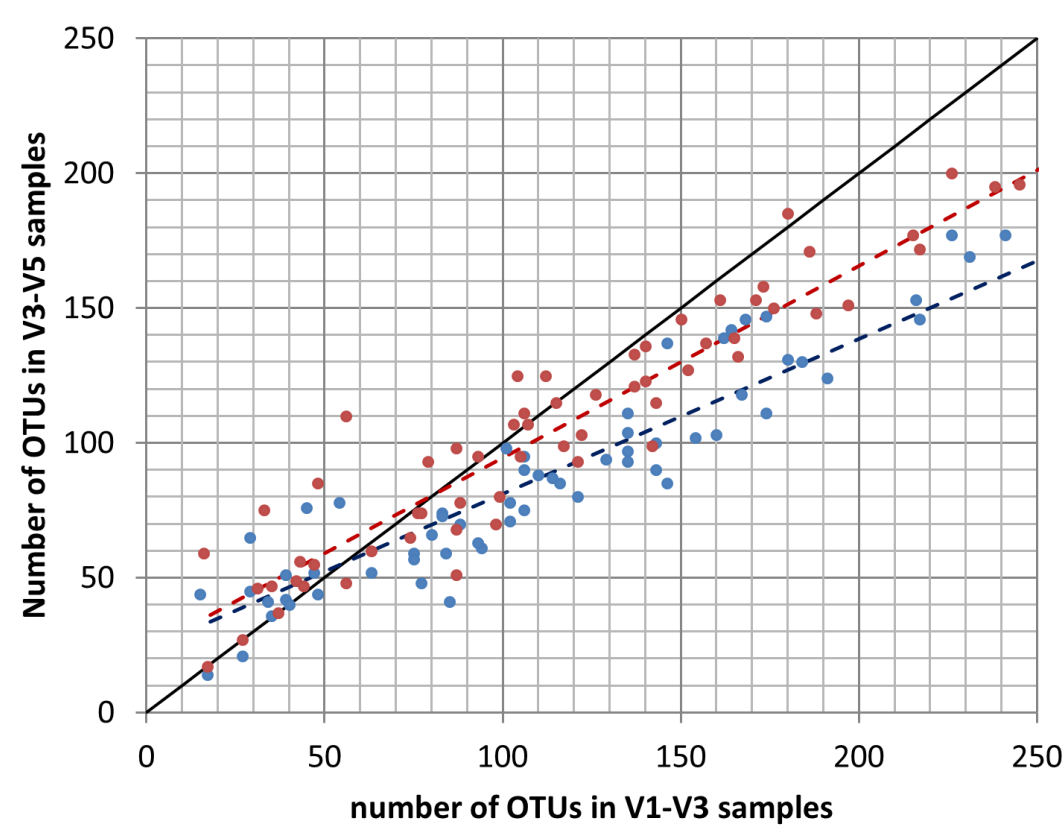


Mysara, M., et al. (2016) *BMC Bioinformatics*.

DynamicC

- Novel family-specific region depend approach to dynamically defines the cut-offs clustering step
- 46% reduction in the erroneous merging of different species.
- Fast and accurate estimation to the microbial diversity when applying 35 mock samples.

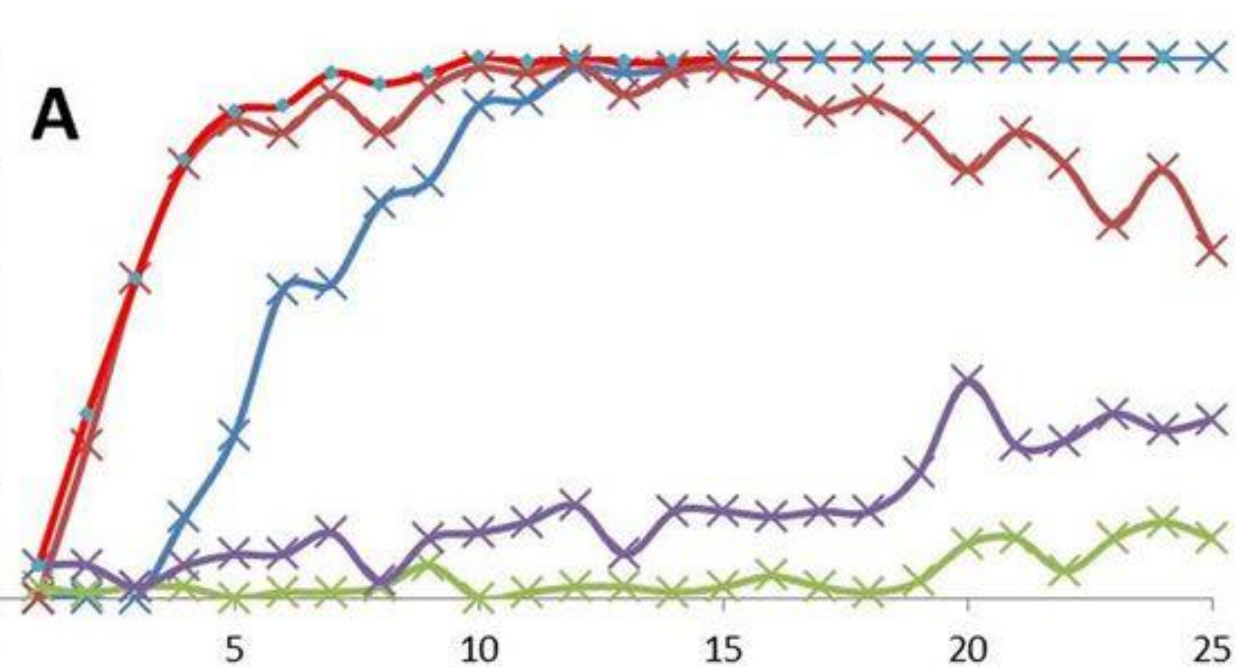
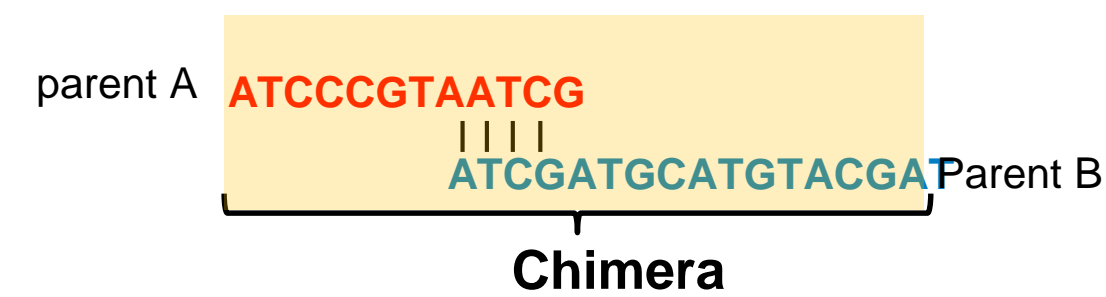
Mysara, M., et al. (2017) *FEMS Microbiology Ecology*.



CATCh

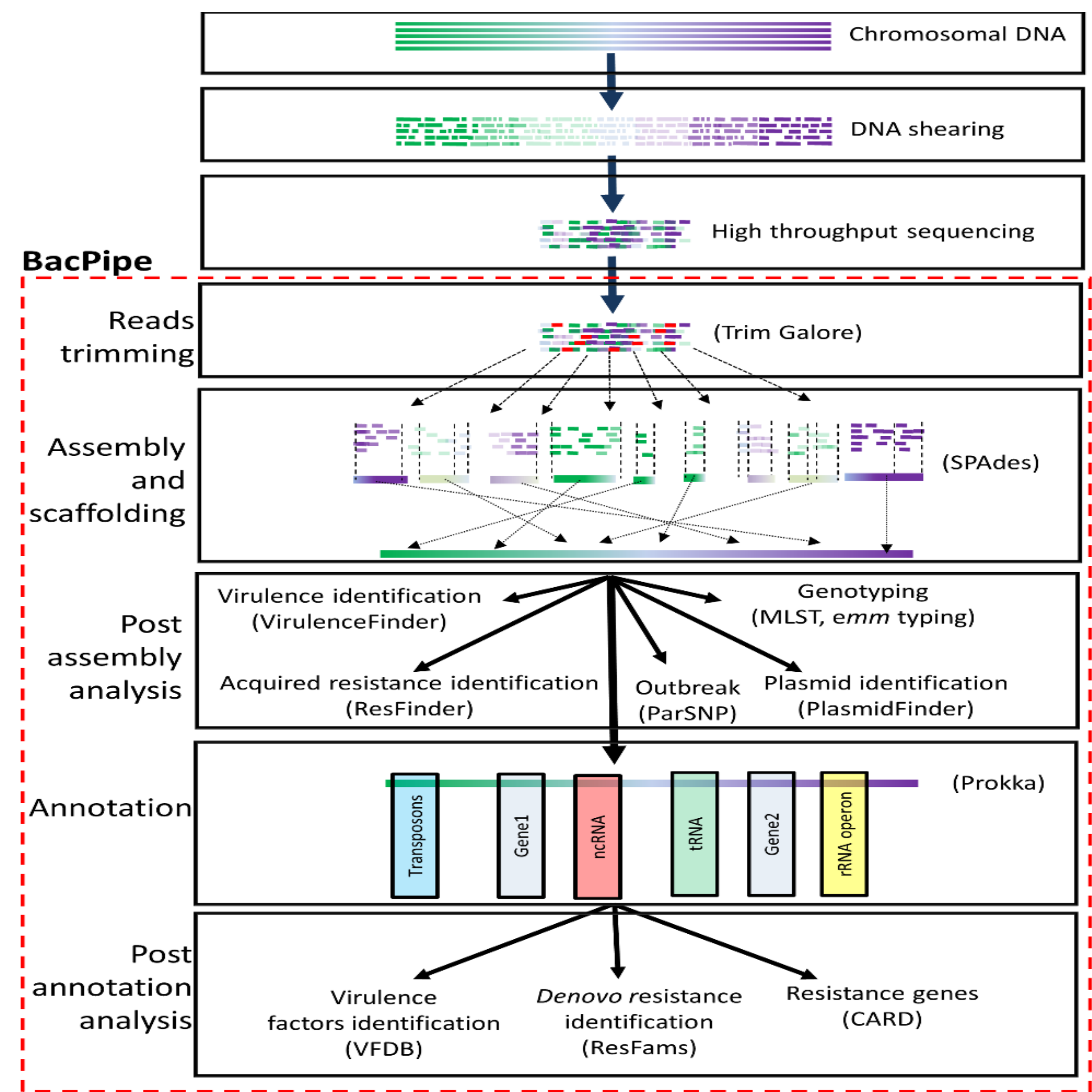
- PCR amplification produces a significant amount of chimeras.
- CATCh integrates other existing chimera detection tools into a new, more powerful method.

Mysara, M., et al. (2015) *Applied and environmental microbiology*.



BacPipe pipeline

- open-access tools were screened to select the appropriate tools for each stage of analyses. Within BacPipe, including tools for: quality control check, assembly, as well as specialized tools for bacterial and plasmid typing, and for resistance and virulence gene predictions.
- As some of these specialized tools required annotation, these were divided within BacPipe into those that required assembly (post-assembly tools) or annotation (post-annotation analysis)
- BacPipe is designed to run multiple tools simultaneously which considerably reduces the time-to-result.
- To increase the user-friendliness of the pipeline, we also integrated a graphical user interface (GUI)



Britto B. Xavier et al. (2020) *iScience*

Patient care

Clinical sample monitoring (Blood, urine, mucosal, fecal)

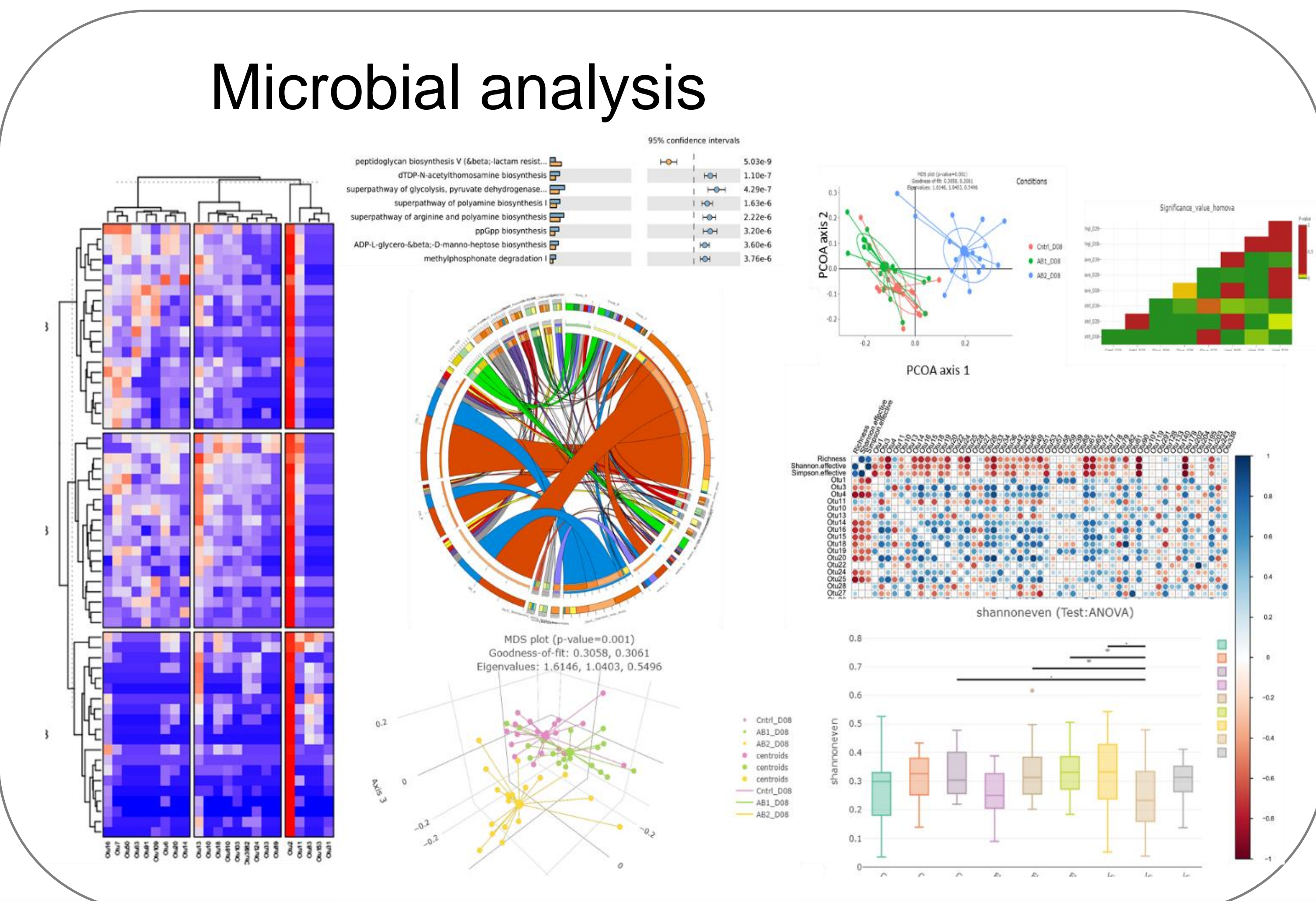
Bioreactors

Bioreactor compositional stability

Monitoring

Water samples monitoring and biofilm formation

Microbial analysis



Novelty

- × New level of accuracy
- × Unseen depth of microbial analysis
- × Identification and monitoring of microbial composition

Clinical application

- × Antibiotic effect on microbiome
- × Artificial ventilation microbiome
- × Digestive disorder
- × Urinary track infection

Industrial application

- × Fermentation and bioreactors
- × Reactor cooling water
- × Drinking water purification
- × Waste disposal
- × Rhizosphere agricultural application