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Reconstituting the genus *Mycobacterium*

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Reconstituting the genus *Mycobacterium*

Conor J. Meehan[1,2,*], Roman A. Barco[3], Yong-Hwee E. Loh[4], Sari Cogneau[1,5] and Leen Rigouts[1,5,6]

Abstract

The definition of a genus has wide-ranging implications both in terms of binomial species names and also evolutionary relationships. In recent years, the definition of the genus *Mycobacterium* has been debated due to the proposed split of this genus into five new genera (*Mycolicibacterium*, *Mycolicibacter*, *Mycolicibacillus*, *Mycobacteroides* and an emended *Mycobacterium*). Since this group of species contains many important obligate and opportunistic pathogens, it is important that any renaming of species does not cause confusion in clinical treatment as outlined by the *nomen periculosum* rule (56a) of the Prokaryotic Code. In this study, we evaluated the proposed and original genus boundaries for the mycobacteria, to determine if the split into five genera was warranted. By combining multiple approaches for defining genus boundaries (16S rRNA gene similarity, amino acid identity index, average nucleotide identity, alignment fraction and percentage of conserved proteins) we show that the original genus *Mycobacterium* is strongly supported over the proposed five-way split. Thus, we propose that the original genus label be reapplied to all species within this group, with the proposed five genera potentially used as sub-genus complex names.

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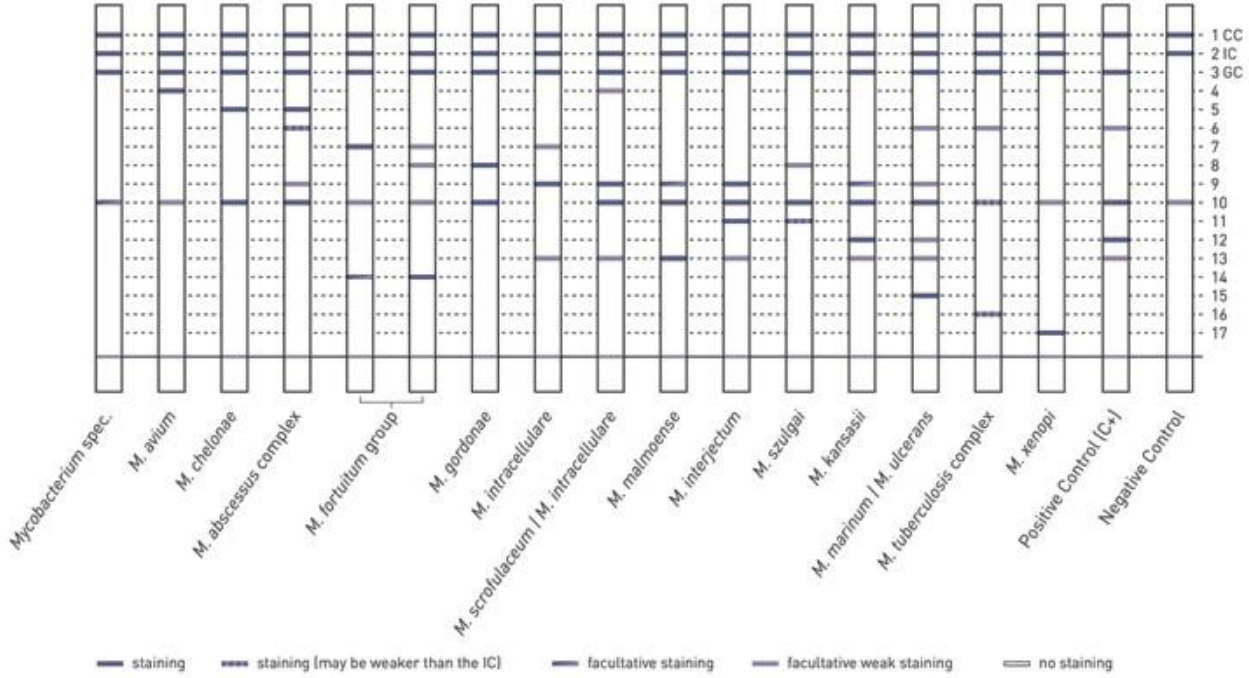
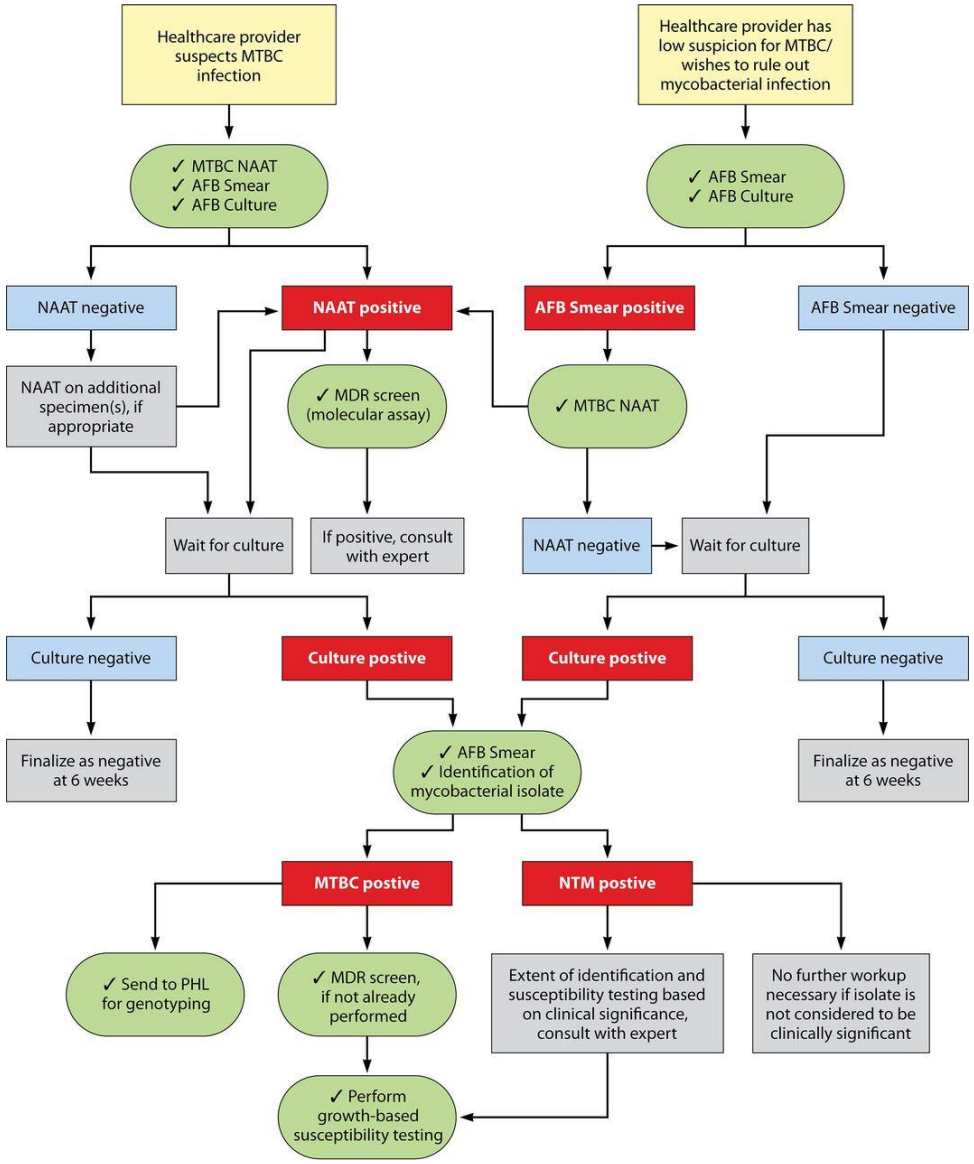
Relevance of taxonomic definitions

Clinical relevance of taxonomic definitions



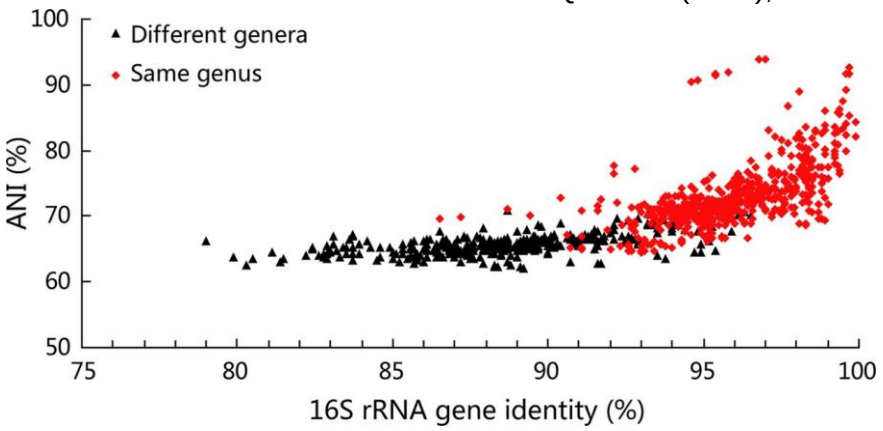


https://www.hain-lifescience.de/en/products/microbiology/mycobacteria/ntm/genotype-cmdirect.html

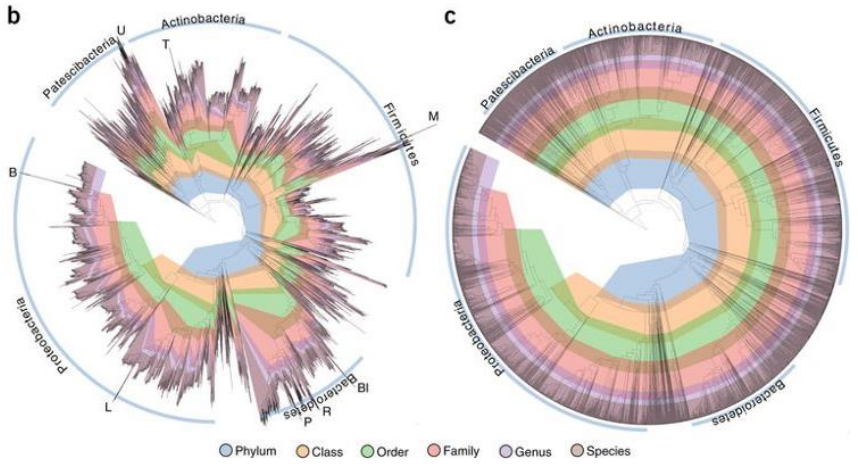
Forbes et al (2018); CMR

Defining a genus

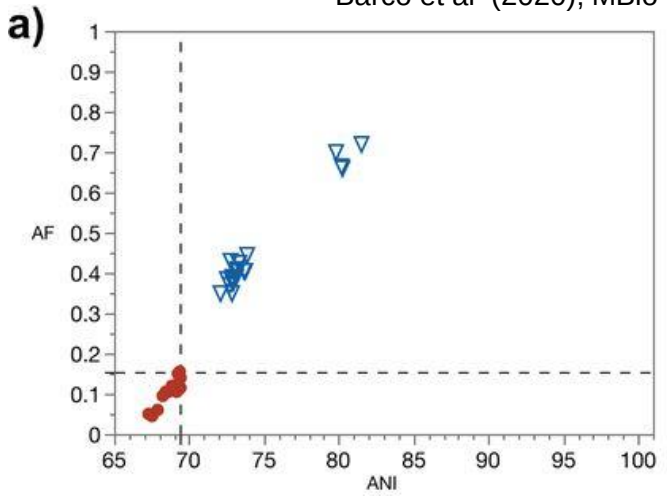
Qin et al (2014); J. Bact



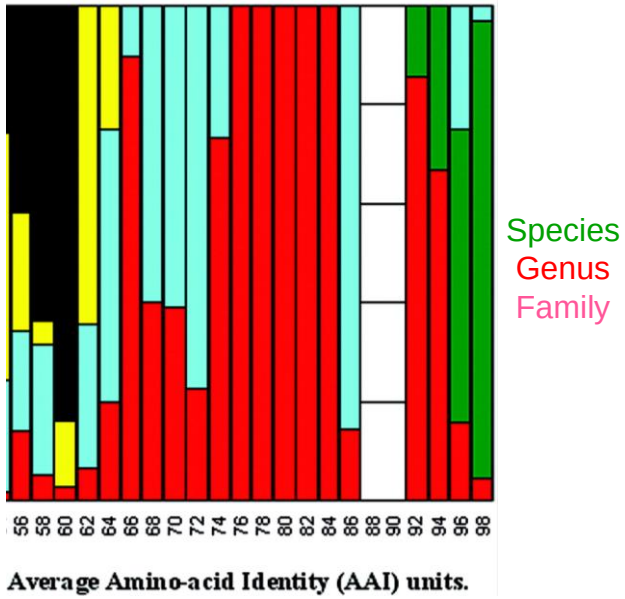
Parks et al (2018); Nature Biotech



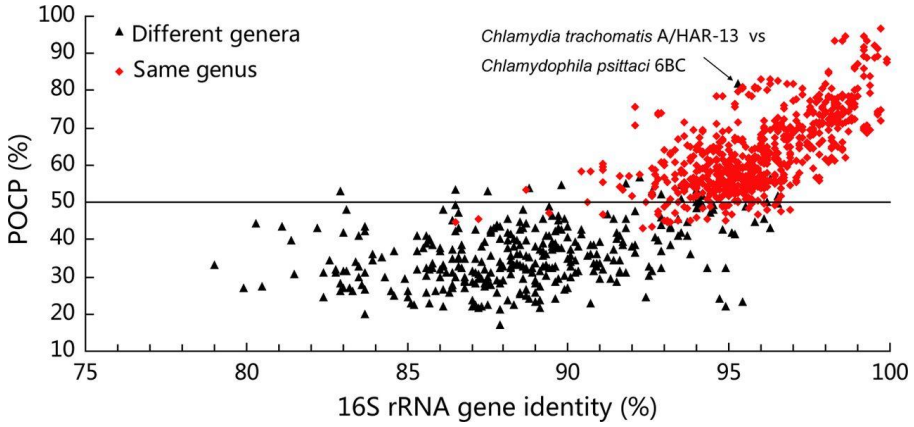
Barco et al (2020); MBio



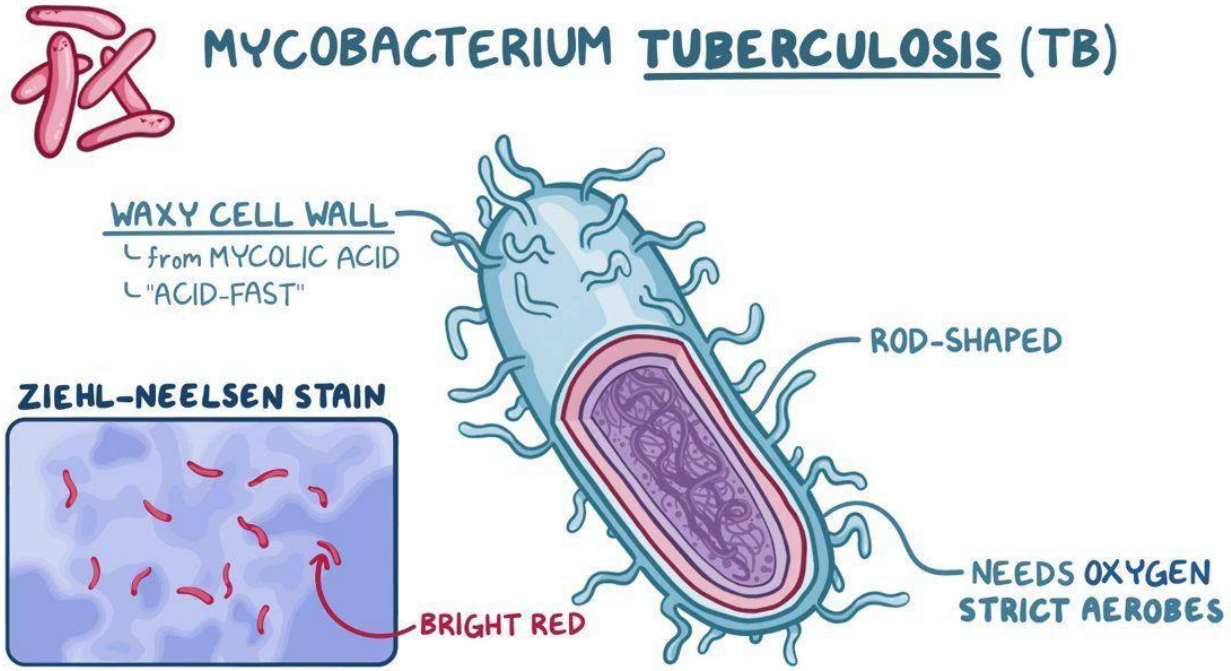
Konstantinidis et al (2005); J. Bact

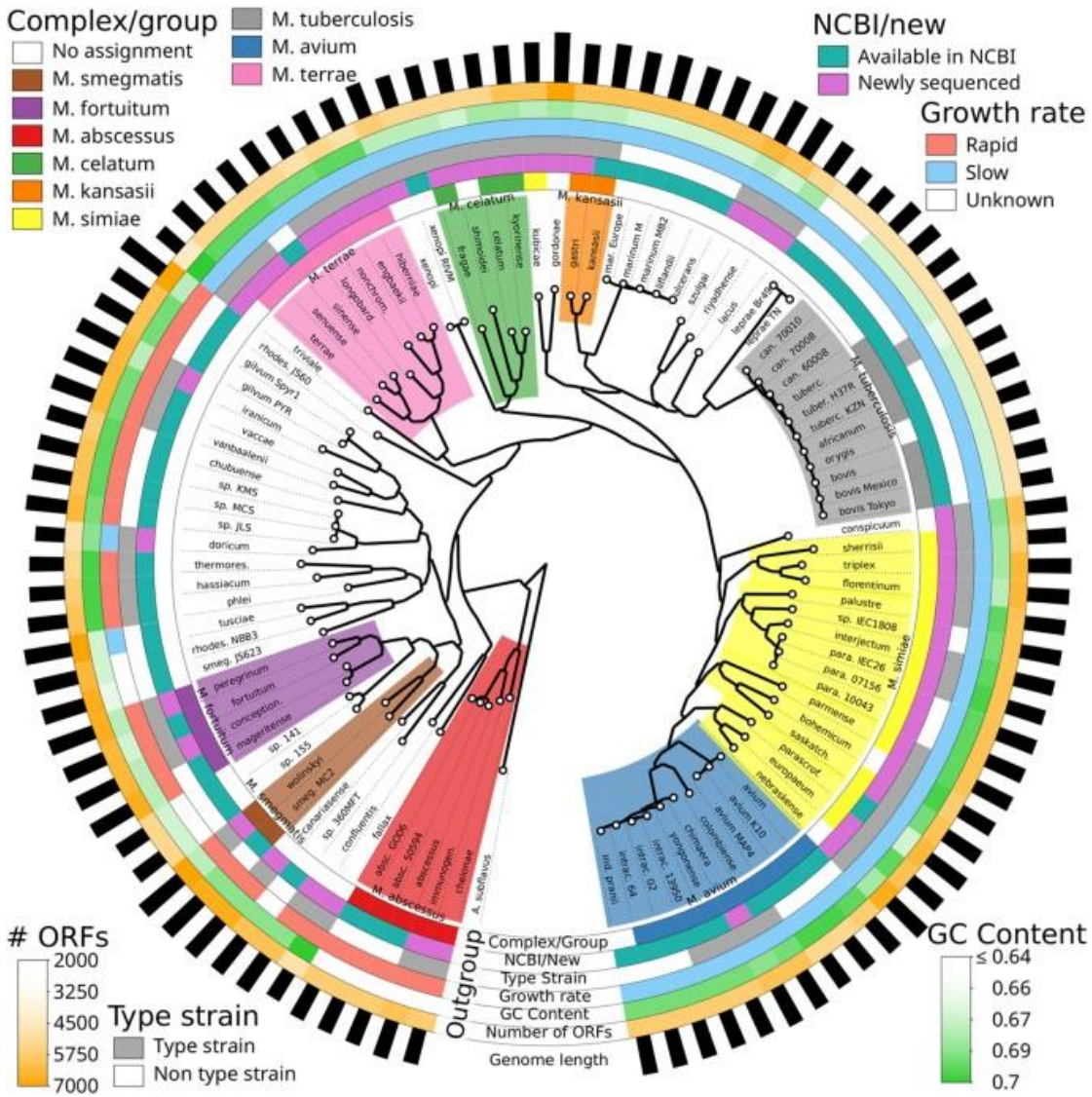


Qin et al (2014); J. Bact



Mycobacterium genus

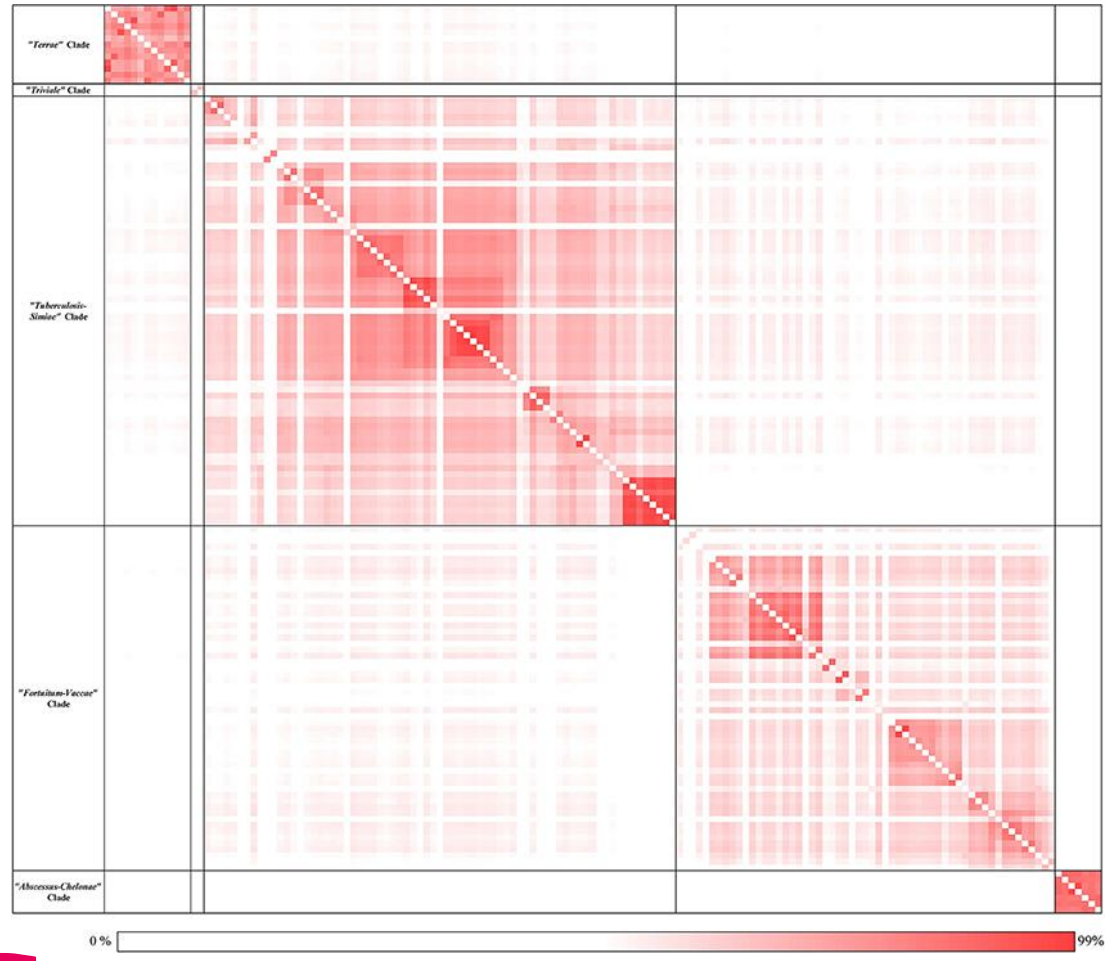




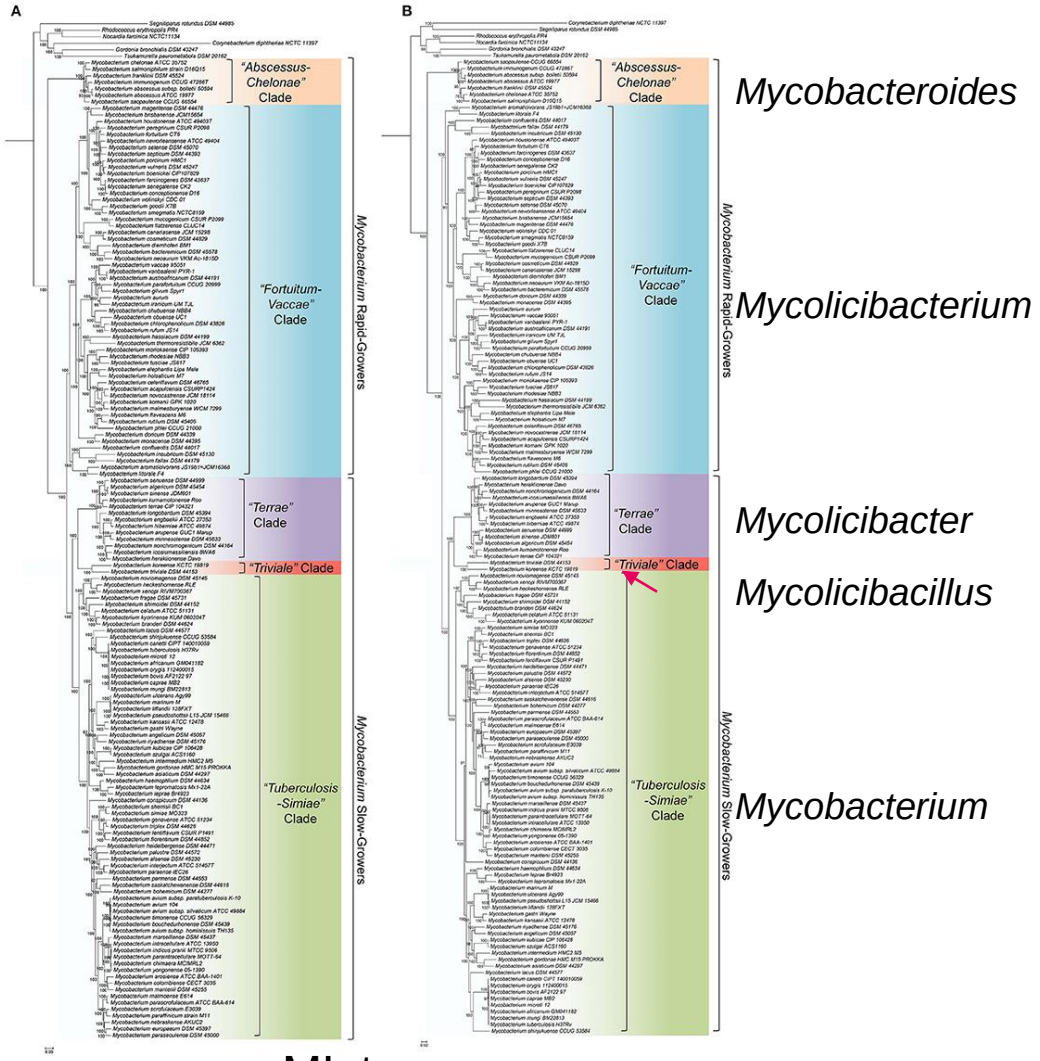
https://www.osmosis.org/learn/Mycobacterium_tuberculosis_(Tuberculosis)

Fedrizzi, Meehan et al (2017); SciRep

Splitting into 5 genera



AAI

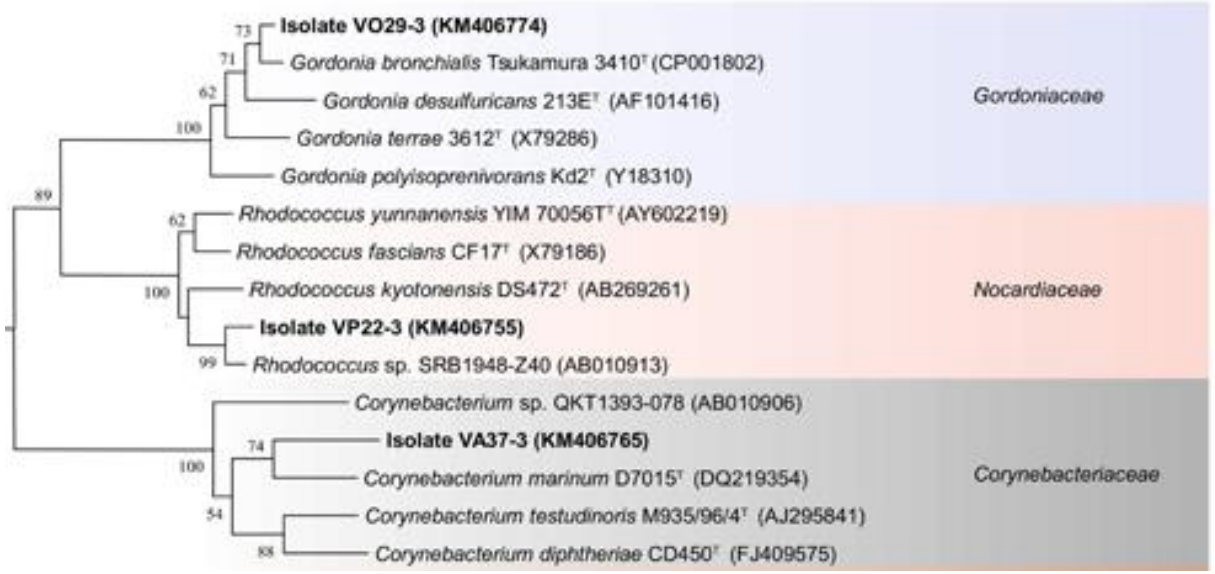


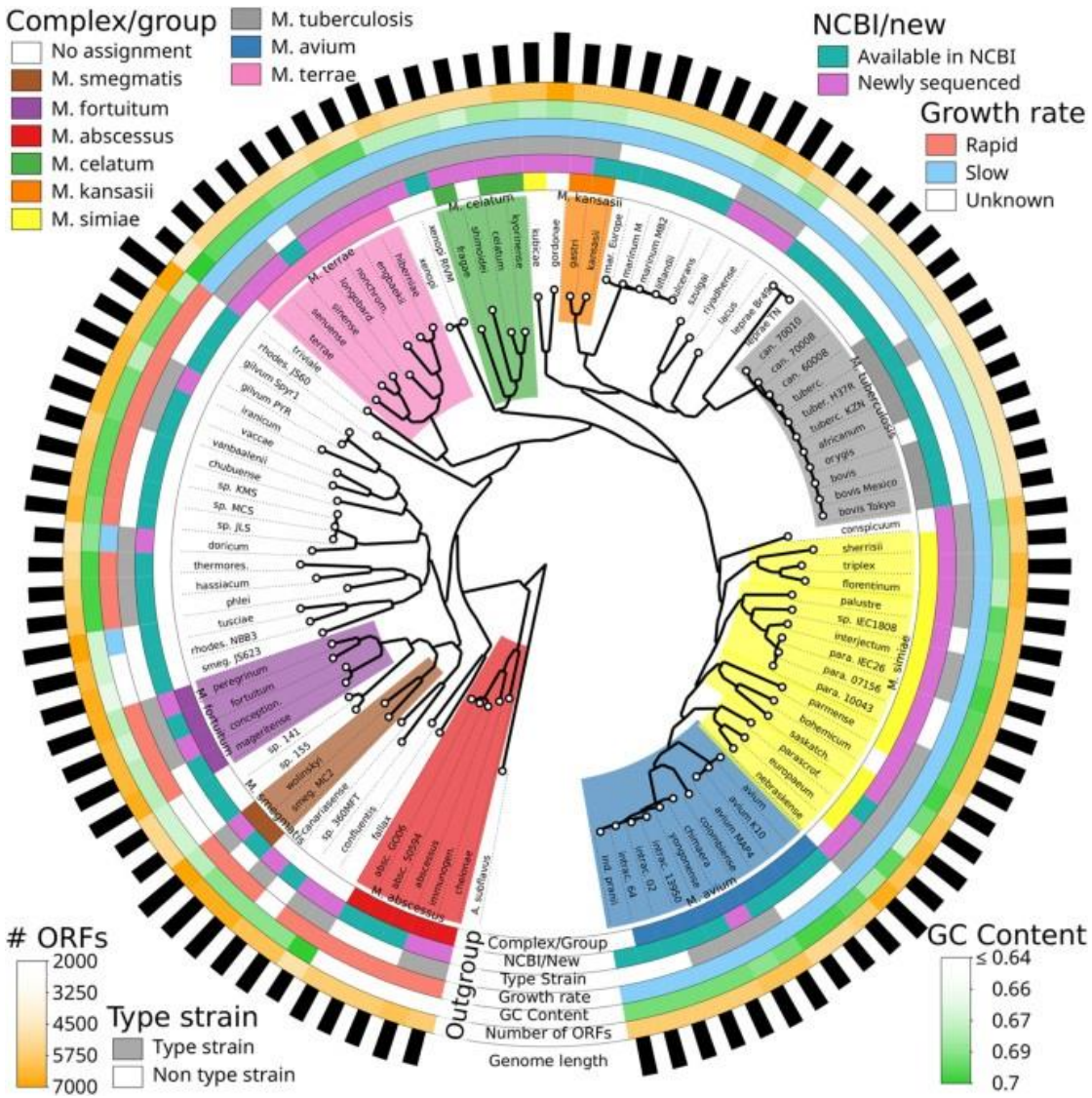
ML trees

Gupta et al (2018); Front Microbiol

Genomic dataset

- 137 *Mycobacterium*
- 210 *Corynebacteriaceae*

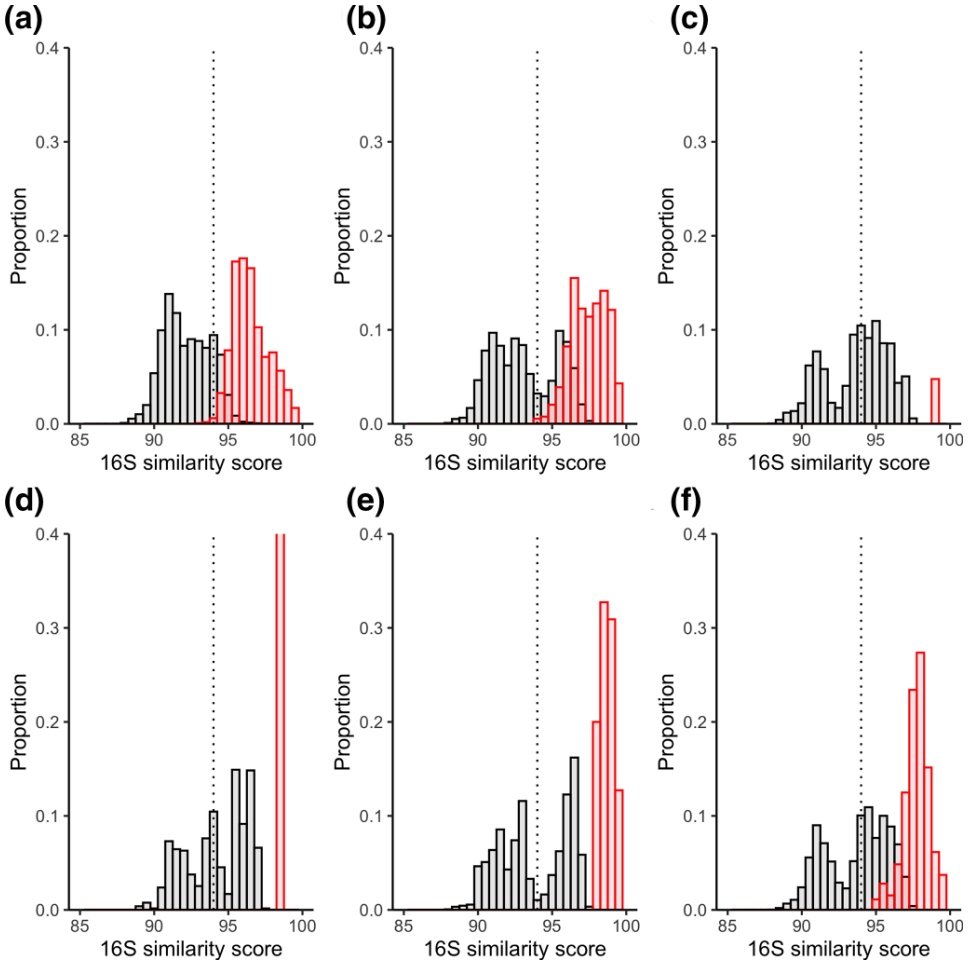


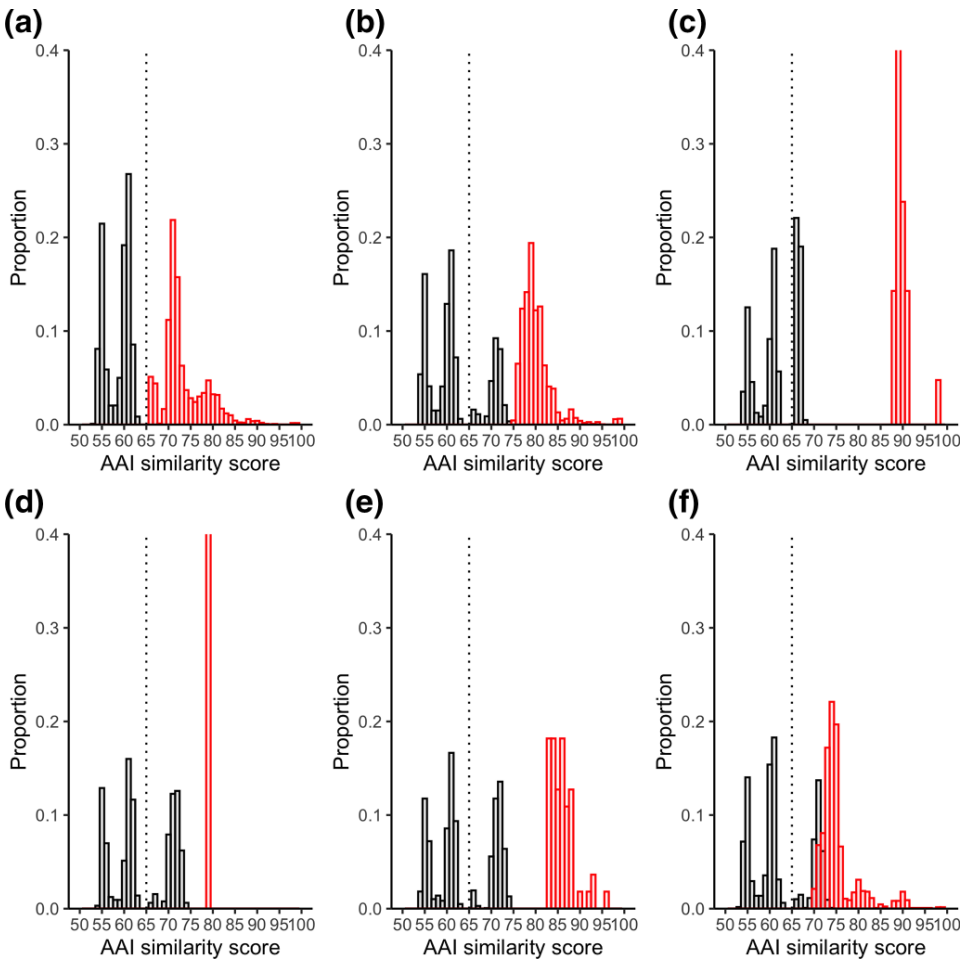


Paz et al (2015); Front Microbiol

Fedrizzi, Meehan et al (2017); SciRep

16S and AAI

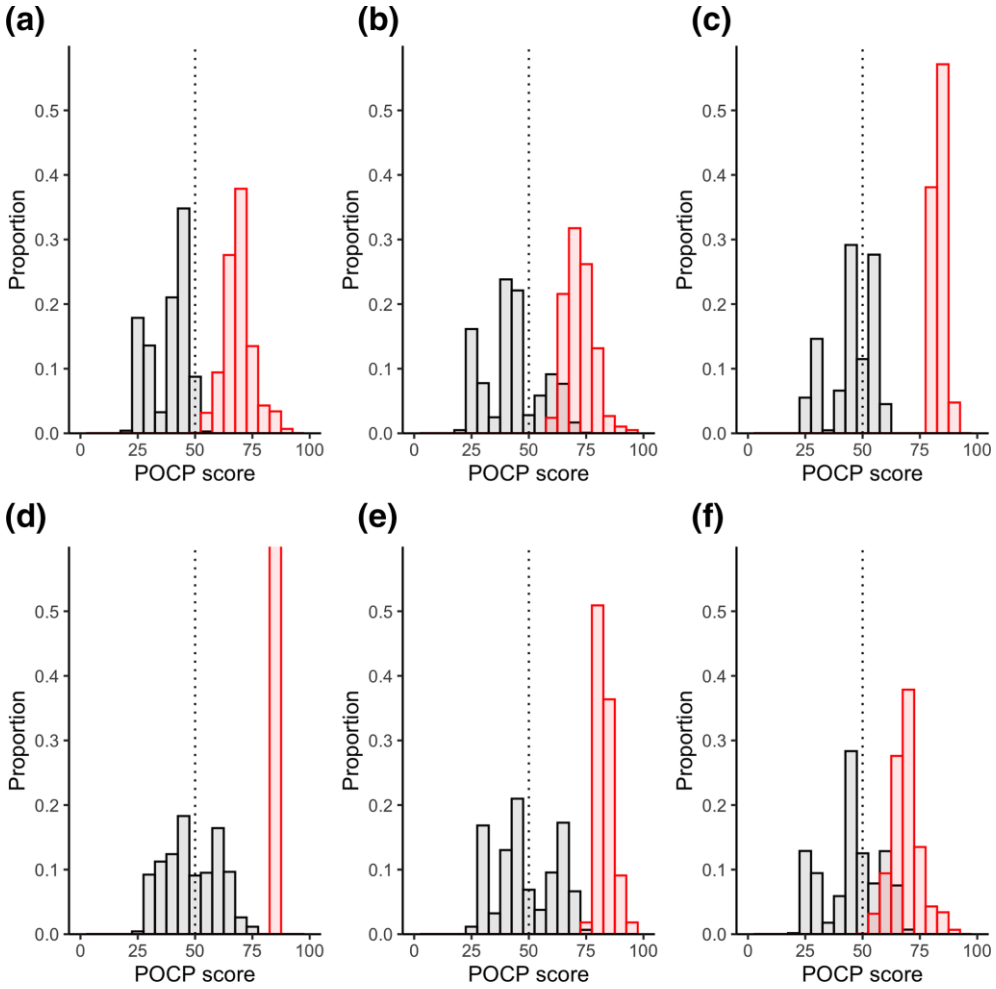




- *(a) Mycobacterium* (original)
- (b) *Mycobacterium* (Gupta)
- (c) *Mycobacteroides*
- (d) *Mycolicibacillus*
- (e) *Mycolicibacter*
- (f) *Mycolicibacterium*

- *Red: intra-genus comparison*
- *Black: inter-genus comparison*

POCP and AF/ANI



(a) *Mycobacterium* (original)

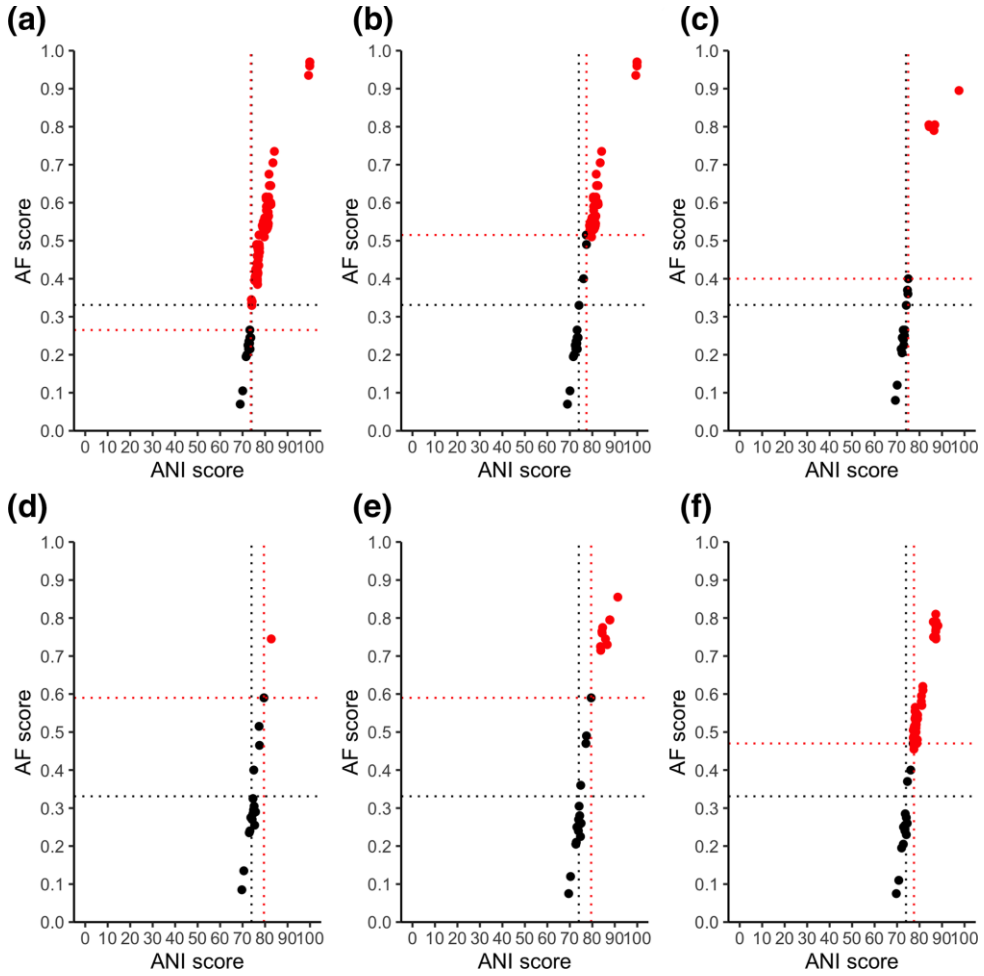
(b) *Mycobacterium* (Gupta)

(c) *Mycobacteroides*

(d) *Mycolicibacillus*

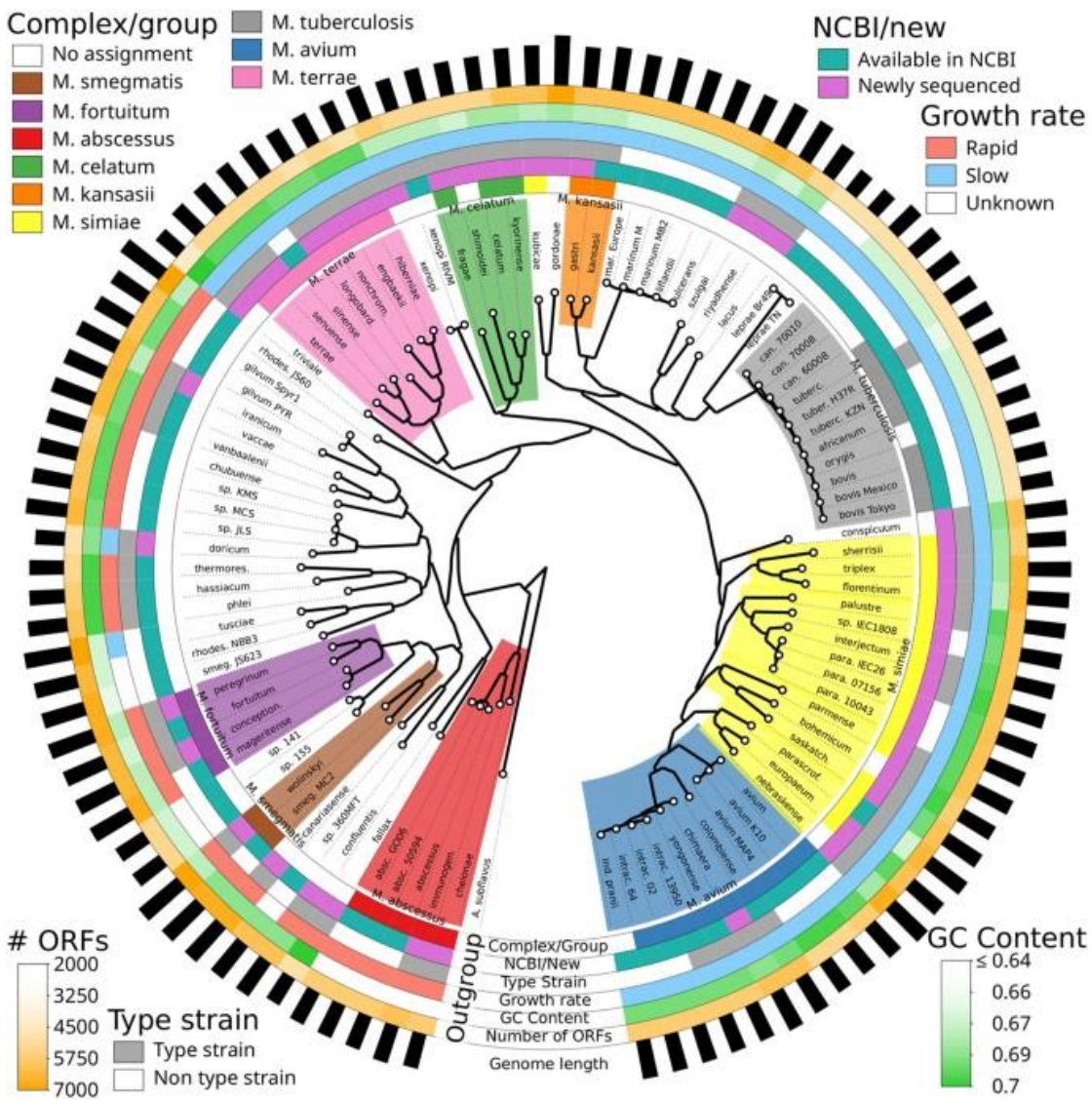
(e) *Mycolicibacter*

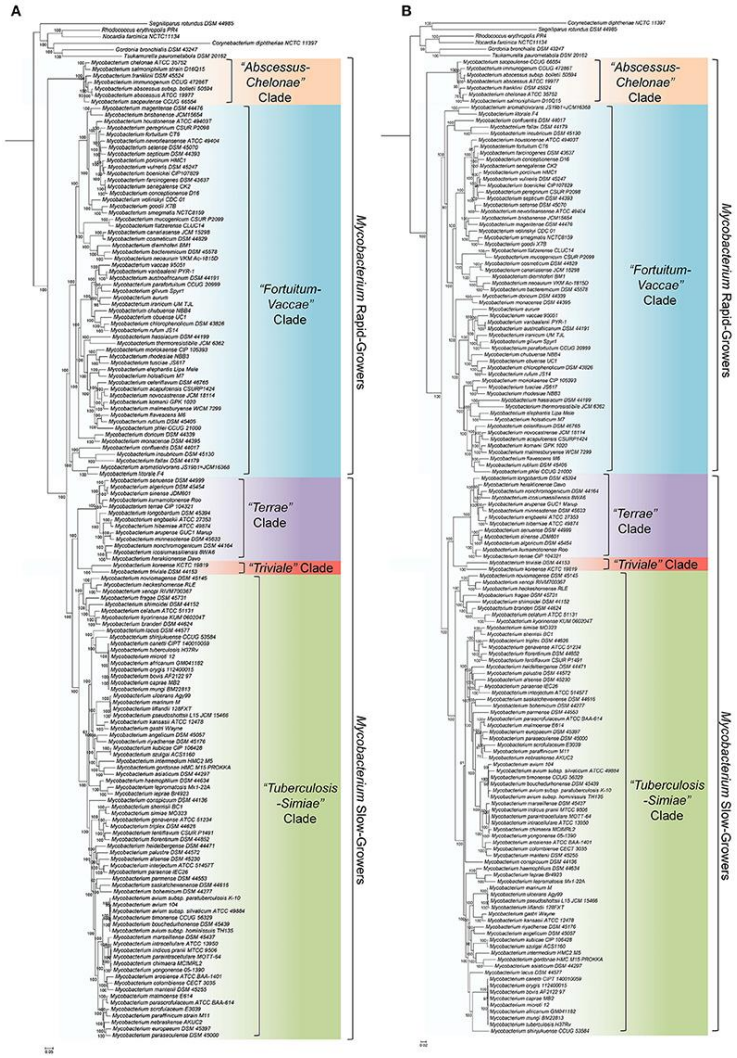
(f) *Mycolicibacterium*



- *Red: intra-genus comparison*
- *Black: inter-genus comparison*

Mycobacterium: single genus





Fedrizzi, Meehan et al (2017); SciRep

Gupta et al (2018); Front Microbiol