Prepare for the rare – fast exchange of database entries for strengthening MALDI-TOF MS diagnostics on the example of Streptobacillus

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Introduction

MALDI-TOF mass spectrometry (MALDI-TOF MS) is a rapidly spreading diagnostic technique, e.g. within medical microbiology, food control and





veterinary medical diagnostics (Fig. 1).

MALDI-TOF MS combines a matrix-assisted laser desorption/ionization (MALDI) with a time of flight (TOF) analyzer and mass spectrometry (MS) (Fig. 1). Hereby, ionizable large biopolymers, such as proteins from microorganisms, can be analyzed gently.

The identification of an unknown sample is achieved by comparing the resulting mass spectrum with the references in a database.

The Database is the Key:

- central role of the database
- commercial databases have gaps
- however, most systems allow the addition of own spectra
- \rightarrow quick response to unexpected pathogens or changing taxonomy by in-house database-extensions



Example



Fig. 3: A Dendrogram of MSPs from species of taxa closely related to Streptobacillus red: Bruker Biotyper database (5989); blue: additional own MSPs B Comparison of MSPs. above: sample; below: reference-MSP from the database C Hit list of samples, depicting the identity with database entries by descending score values. red box: BT 5989; blue box: with additional own MSP

Long-term Advantage

So far, 11 independent data entries of 7 different species closely related to Streptobacillus were added to our in-house databases. The correct assignment to the correct species is obtained for all isolates (Fig. 3).

Exchange Platform MALDI-UP



and Haverhill fever:

- an under-reported, orally-transmitted zoonosis with mortalities in untreated cases equally high as e. g. in brucellosis
- highly similar, recently described novel species have not yet been included in manufacturers' databases:
 - S. hongkongensis, S. notomytis, S. felis, S. ratti, Oceanivirga salmonicida,

Caviibacter abcessus [1-4]

Workflow

- reference samples of respective type strains were prepared by ethanol/formic acid extraction protocol (Bruker Daltonik, Bremen, Germany)
- raw spectra acquisition (2-20 kDa, Biotyper LT-microflex, Bruker)
- reduction to "MSPs" (Main Spectra Projections) (Biotyper 3.0; Fig. 2)
- inclusion to in-house database as a reference

Results

- species specificity is supported by varying MSPs (Fig. 3 B)

In order to provide information regarding proprietary new database entries from users for other users, we have set up an open catalog under http://MALDI-TOF-MS-user-platform.ua-bw.de [5].

Fig. 4: Screen shot of the home page



MALDI-TOF MS User Platform

MALDI-UP

This non-commercial catalogue was designed to provide specific information about spectra that were created and can be shared by users:

- species names, isolate numbers, sources, details on the validity of the isolate designation
- technical details of the entries (instrument, cultivation, preparation etc.)
- contact information about the creator of spectral entries, but no free download of spectra or MSPs
- copyrights of the data and the updating process of the equipment manufacturers are not affected

The list is open to users under the aforementioned conditions. A specific user guide for creators and recipients is available [6].



sample result is given as a score-value reflecting the accordance of the sample MSPs with the database entries (Biotyper, Fig 3 C)



Outlook

- new entries can easily be found and exchanged using MALDI-UP
- further additions to the catalog and the utilization by the scientific community will increase the actuality and taxonomical range of MALDI worldwide especially for databases pathogens rare and microorganisms like Streptobacillus.

[1] Eisenberg et al. (2015) Streptobacillus ratti sp. nov. IJSEM Epub ahead of print [2] Eisenberg et al. (2015) Phenotypic and genotypic characteristics of members of the genus Streptobacillus. PLoS One. 0134312 [3] Eisenberg et al. (2016) Caviibacter abcessus sp. nov. IJSEM Epub ahead of print [4] Eisenberg et al. (2016) Oceanivirga salmonicida sp. nov. IJSEM Epub ahead of print [5] Rau et al. (2016) MALDI-TOF MS User Platform.

http://maldi-up.ua-bw.de

[6] Rau et al. (2016) MALDI-UP – An Internet Platform for the Exchange of MALDI-TOF Mass Spectra / User guide. 01/2016 http://ejournal.cvuas.de



