



Changing Microbiology

# IR Biotyper<sup>®</sup>

Microbial strain typing for real-time epidemiology

Innovation with Integrity

GP

# IR Biotyper

## Supporting proactive infection control

Efficient microorganism strain typing is vital in healthcare settings, for infection control, epidemiological studies, and to better understand the causes of infection. However, traditional strain typing technologies like pulsed-field gel electrophoresis (PFGE), multi-locus sequence typing (MLST) and whole-genome sequencing (WGS) are time-consuming and resource-intensive, and not commonly available in microbiological laboratories.

Fast, easy-to-use, and economical, the IR Biotyper addresses this challenge by using infrared spectroscopy to classify microorganism strains with high specificity. Its discriminatory power is comparable to routine molecular genetic methods.

The IR Biotyper's ability to perform real-time strain typing, along with its efficient software, allows for proactive infection control.



## Benefits of using the IR Biotyper

Implementing the IR Biotyper in your hospital hygiene management system will:

- Enable swift identification of microbial outbreaks
- Allow investigation of unusual patterns in a set of samples
- Enable classification of isolates based on predefined classification models, e.g., allowing fast detection of known serotypes and strains
- Allow transmission routes to be monitored in real time
- Support preventive action through routine screening
- Enable improved data-based hygiene management through further analytical studies; however, the IR Biotyper is not intended for patient management



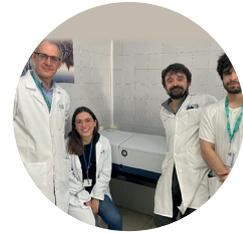


## Dr. Juan de Dios Caballero

Associate Dr. in Hospital Ramón y Cajal, Madrid

“We have successfully tested the IR Biotyper for the identification of outbreaks caused by ceftazidime/avibactam-resistant *Klebsiella pneumoniae*, GES-carbapenemase-producing *Pseudomonas aeruginosa*, and linezolid-resistant *Enterococcus faecium*. In all cases we have observed good correspondence with classical typing techniques (PFGE) and/or with massive sequencing techniques.

We are also exploring the IR Biotyper to distinguish contaminating microorganisms from blood cultures and joint prosthesis infections. In both cases we are isolating coagulase-negative staphylococci from diverse samples and are quickly testing if we have the same microorganism.”



## Dr. Cristina Pitart

ID and AST Specialist in Microbiology Dept. Hospital Clínic de Barcelona

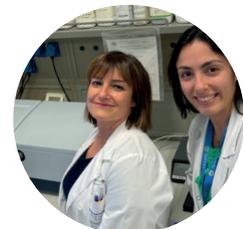
“We are currently using the IR Biotyper for the early detection of outbreaks. Diverse clinical and surveillance samples of all vancomycin-resistant *Enterococcus faecium*, carbapenemase-producing *Enterobacterales*, and multidrug-resistant *Pseudomonas aeruginosa* strains are measured by the IR Biotyper and archived. When an accumulation of cases occurs, the clonality of the strains is analyzed by the IR Biotyper. We have very good experience with *K. pneumoniae*, *P. aeruginosa* and *Enterobacter cloacae*. Thus, thanks to the speed and good discriminative power of the method, we can corroborate the nosocomial transmission of these microorganisms and establish more rapid and effective prevention measures. ”



## Dr. Elena De Carolis

Department of Microbiology at the University Hospital Fondazione Policlinico A. Gemelli, Rome

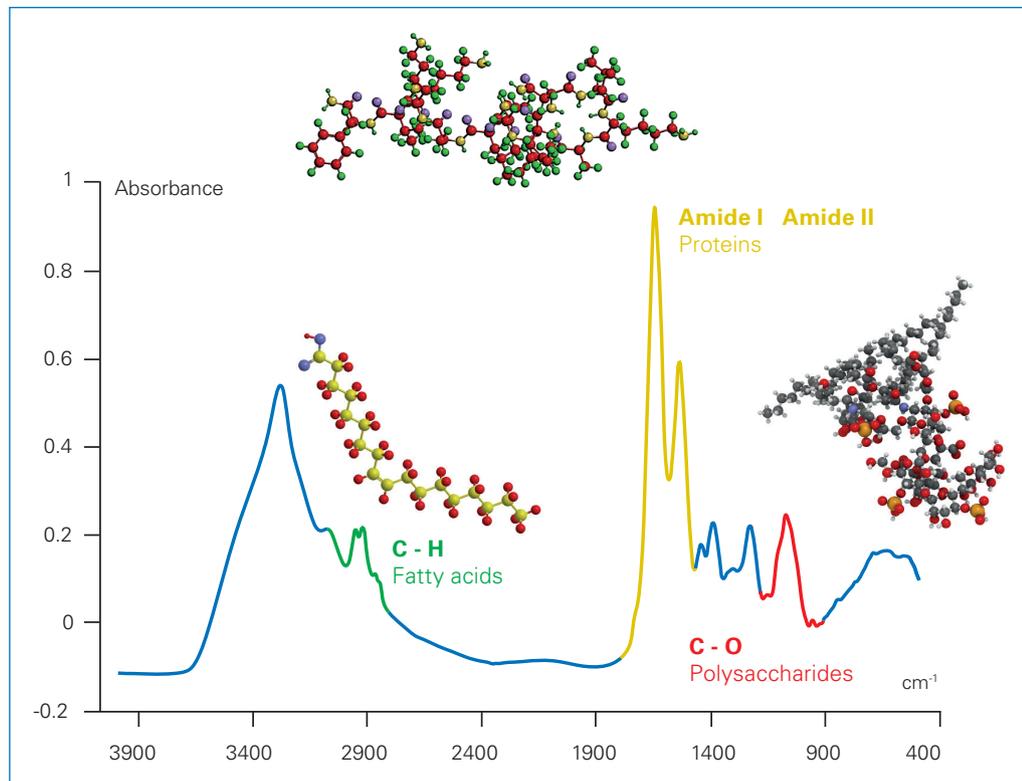
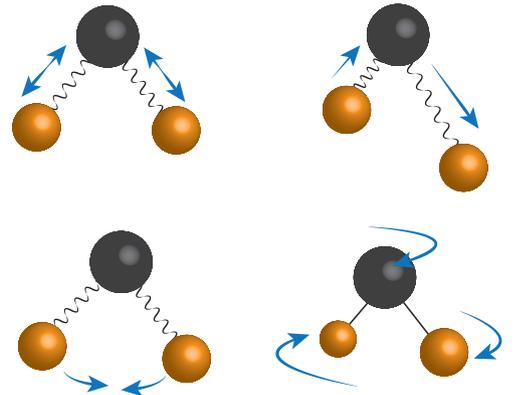
“The IR Biotyper is going to become a reliable and useful tool to perform a “Real-Time” hospital surveillance strategy in our hospital. Thanks to the biochemical fingerprint approach based on FT-IR spectroscopy, it is possible to type diverse bacterial isolates using a rapid and easy to use technology. Showing good correlation with molecular typing technologies, the IR Biotyper will help to overcome the spread of multidrug resistant microorganisms in the future.”



# The principle of FT-IR

The IR Biotyper uses Fourier Transform Infrared (FT-IR) spectroscopy to analyze the molecular vibrations caused by absorption of infrared light. Different chemical structures vibrate at different wavenumber regions – for example, the carboxyl group in fatty acids (and lipids) vibrates at 2800–3000  $\text{cm}^{-1}$ , the amide group in proteins vibrates at 1500–1800  $\text{cm}^{-1}$ , and the carboxy group in polysaccharides vibrates at 900–1200  $\text{cm}^{-1}$ .

The IR Biotyper offers the option to use data from all these regions, to provide information about the full range of diagnostic molecules present in the sample. In routine use, the polysaccharide region (900–1200  $\text{cm}^{-1}$ ) is the most useful one, as this part of the spectrum is like a ‘fingerprint’, providing information about the carbohydrates present in many molecules such as glycoproteins, and allowing microorganisms such as *Streptococcus pneumoniae* serotypes to be classified.



By default, the IR Biotyper analyzes IR spectra in the wavenumber range typical for carbohydrates (red), but other regions such as those indicating fatty acids (green) and proteins (yellow) can easily be selected for analysis in the software as well.

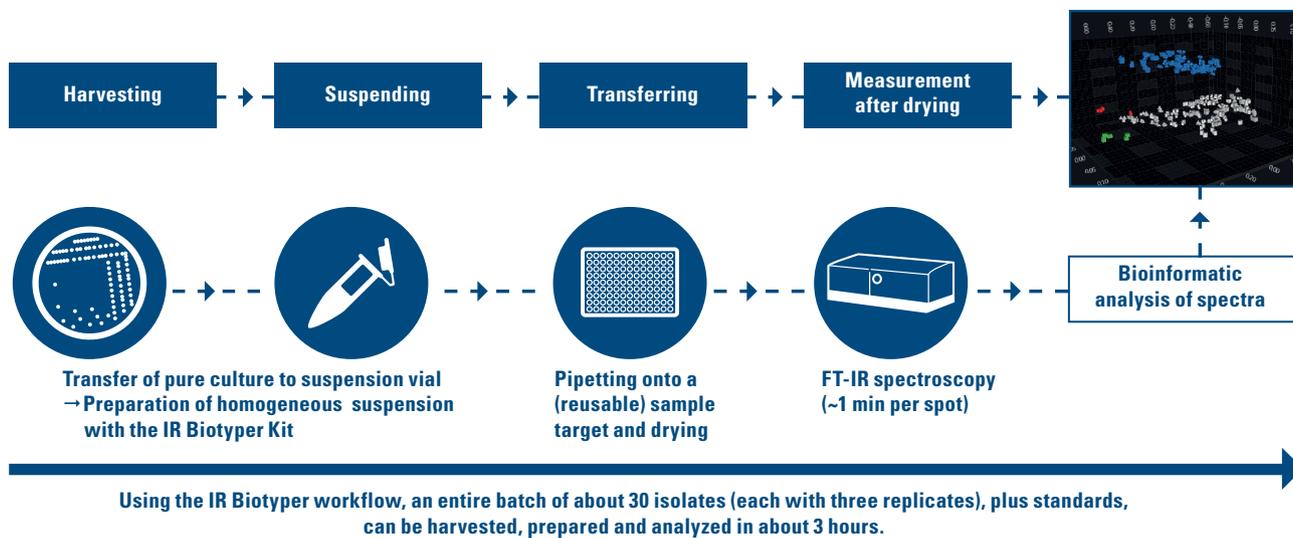
# Simple workflows for rapid processing

The IR Biotyper is quick and easy to use. Following harvesting, preparation of a suspension, spotting on a 96-well silicon microtiter plate and drying, the plate is simply inserted into the instrument, and analysis begins.

The instrument processes an individual spot in about a minute, meaning that an entire plate can be analyzed in about 90 minutes. Across the whole workflow, and using three replicates per isolate, this means that up to 30 isolates can be analyzed in 3 hours.



96-Spot silicon microtiter plate and IR Biotyper Kit



## Integrated workflows for microorganism identification and strain typing

The IR Biotyper and Bruker's MALDI Biotyper® can be combined into a single seamless workflow. Data from the MALDI Biotyper – which uses MALDI-TOF MS to identify microorganisms to species or genus level within a few minutes – can be imported into the IR Biotyper software, and once analyzed, the entire set of results can be exported to the laboratory's LIMS in CSV format.

# IR Tracker

## Changing the game for hospital hygiene



Following an easy sample preparation protocol, up to 30 isolates can be processed at the same time on one reusable IR Biotyper sample plate. In just a few steps, the simple-to-use IR Biotyper software provides a clear result output for strain relatedness/clonality, answering the important question in hygiene and infection control.

**„Is it the same strain?“**

The image shows a table with columns: Isolate ID, Nearest Neighbor, NDI, and Neighbor Labels. A blue arrow labeled 'Review' points to the table.

Isolate ID	Nearest Neighbor	NDI	Neighbor Labels
Environment	Sample 5	2.88	
Reference Strain	Sample 3	5.25	
Sample 1	Sample 8	0.45	
Sample 2	Sample 5	4.92	
Sample 3	Sample 8	0.48	
Sample 4	Sample 1	0.47	
Sample 5	Environment	2.88	
Sample 6	Sample 4	0.62	
Sample 7	Environment	6.34	
Sample 8	Sample 1	0.45	

The new IR Tracker software feature is based on the k-Nearest Neighbors (kNN) algorithm. The results are displayed in an easy-to-understand color coding: unrelated isolates are displayed in cold blue, isolates showing matches are colored warm orange. This enables fast and easy detection of suspected outbreak isolates.

The image shows a table with columns: NDI, Neighbor ID, Last neighbor acquisition, Spec. count, and Neighbor labels. A blue arrow labeled 'Report' points to the table.

NDI	Neighbor ID	Last neighbor acquisition	Spec. count	Neighbor labels
0.45	Sample 8	2020-01-16 00:00	12	
0.47	Sample 4	2020-01-16 00:00	12	
0.60	Sample 3	2020-01-16 00:00	12	
0.65	Sample 6	2020-01-16 00:00	12	
5.44	Reference Strain	2020-01-16 00:00	12	
14.32	Environment	2020-01-16 00:00	12	
14.74	Sample 7	2020-01-16 00:00	12	
16.17	Sample 5	2020-01-16 00:00	12	
17.55	Sample 2	2020-01-16 00:00	12	

Detailed report for sample 1

Most of the current genotyping or sequencing methods need high bioinformatic knowledge and IT resources. The latest innovation of the IR Biotyper software – the IR Tracker - changes the game in terms of speed, cost-efficiency, and ease of reporting. The results of the IR Tracker can quickly be reported to the hospital hygiene team, to fight nosocomial transmission.



Early counter measures help reducing the spread of a potential outbreak, hence assist to

- reduce hospital expenses
- fight the battle against AMR
- improve patient care
- shorten the length of hospital stays

### Benefits of the new IR Tracker software feature

- Enables fast screening/monitoring to understand the relatedness of isolates
- Compares isolates of the current run and all isolates in the customer database by an easy-to-interpret ranking list instantly available after each run
- Provides a cut-off value for easy data interpretation or relatedness
- Covers most important microbial species including all ESKAPE organisms
- Reports easy-to-understand results with color coding
- Offers a cost-effective prevention tool for daily routine use

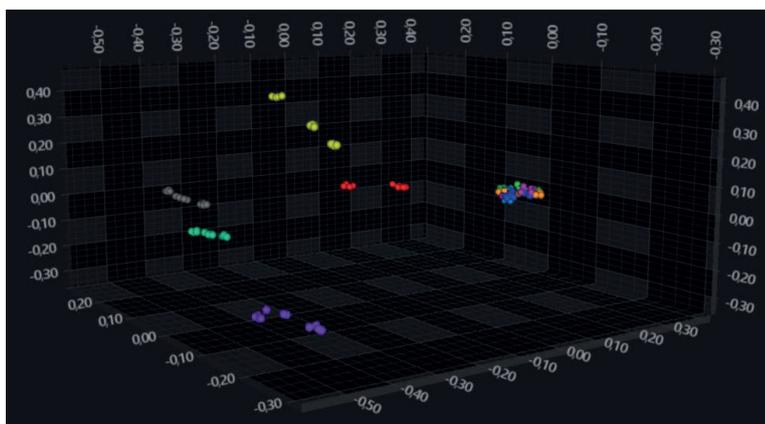
# Intuitive software aiding epidemiology

## Real-time isolate quality-checking and classification

Isolate classification using the IR Biotyper software is based on artificial neural networks, support vector machine or random forest machine learning algorithms. Classifications can be based on predefined or customized models, allowing fast identification of serotypes or serogroups. Classifications rely on a score value, which is rendered in real-time using a 'color code' system for at-a-glance understanding and streamlined workflows.

Name	Target group	Species	Project classification
sample 1	9N	Streptococcus pneumoniae	9N
sample 2	6A	Streptococcus pneumoniae	6 (A-D)
sample 3	6A	Streptococcus pneumoniae	6 (A-D)
sample 4	6A	Streptococcus pneumoniae	6 (A-D)
sample 5	9N	Streptococcus pneumoniae	9N
sample 6	9N	Streptococcus pneumoniae	9N
sample 7	9N	Streptococcus pneumoniae	9N
sample 8	7F	Streptococcus pneumoniae	7 (F)

Fast and automated classification of pneumococci serotypes.



Results of principal components analysis can be visualized using 2D or 3D scatter plots, as shown here for *Klebsiella pneumoniae* isolates.

## Clear data visualization through reliable and intuitive data analysis

Strain typing results achieved with FT-IR spectroscopy are equivalent to molecular methods, and are easy to interpret, with smart isolate classification complemented by convenient reporting tools. Results can be displayed in table format by the IR Tracker feature, or visualized graphically using distance matrices, dendrograms or scatter plots.

## Up-to-date software for streamlined operation

- Clear and easy-to-interpret ranking list of isolates, available immediately after each run, with the IR Tracker
- Customizable isolate metadata, including biological, such as virulence factors and resistances, and circumstantial, such as location, isolation date, and matrix
- Data can be imported from MALDI Biotyper into the IR Biotyper software, and further into the laboratory information management system (LIMS)
- Simple building and automated application of classifiers based on artificial neural networks (ANN), support vector machine (SVM) and random forest algorithms for isolate classification
- Built-in classifiers, subject to regular updates
- 3D principal component analysis (PCA) plots and one simple color coded report
- Straightforward reports for classification results

## Order information

### IR Biotyper

Part No. 1845471

High-performance FT-IR spectrometer with capability for analyzing 96-spot silicon microtiter sample plates, and updated software for sample setup and data analysis.

### 96-Spot silicon microtiter plates

Part No. I23258P

Set of five reusable plates with 96 positions each designed for use with the IR Biotyper.

### IR Biotyper Kit

Part No. 1851760

Includes two bacterial IR test standards (IRTS 1 and IRTS 2) for five runs, and sample preparation vials for 50 isolates.

Not for use in clinical diagnostic procedures.  
Please contact your local representative for availability in your country.

IR Biotyper® and MALDI Biotyper® are registered trademarks of the Bruker group of companies.

**Online information**  
[bruker.com/microbiology](https://bruker.com/microbiology)

 **Bruker Daltonics GmbH and Co. KG**

Bremen · Germany  
Phone +49 (0) 421-2205-0

[info.md@bruker.com](mailto:info.md@bruker.com)

**Bruker Scientific LLC**

Billerica, MA · USA  
Phone +1 (978) 663-3660

