

Editorial

Editorial: Special Issue “Molecular Epidemiology of Antimicrobial Resistance”

Raffaele Zarrilli ^{1,*}, Tommaso Giani ² and Rémy A. Bonnin ³¹ Department of Public Health, University of Naples Federico II, 80131 Naples, Italy² Department of Experimental and Clinical Medicine, University of Florence, 50139 Florence, Italy³ Team Resist, UMR-1184 (INSERM-Université Paris-Saclay-CEA), LabEx Lermite, Faculty of Medicine, 94270 Le Kremlin-Bicêtre, France

* Correspondence: rafzarri@unina.it

Antimicrobial resistance and multidrug-resistant organisms currently constitute a severe public health problem. Multidrug-resistant organisms are resistant to multiple antibiotic classes, resulting in limited therapeutic options and difficult-to-treat health-care-associated and community infections, with high morbidity and mortality rates. In particular, carbapenem-resistant (CR) *Acinetobacter baumannii*, CR *Pseudomonas aeruginosa*, CR *Enterobacteriales*, methicillin-resistant *Staphylococcus aureus* and vancomycin-resistant *Enterococcus* spp. are recognized by the World Health Organization as global priority pathogens of critical or high priority [1].

This Special Issue was dedicated to updates on the “Molecular Epidemiology of Antimicrobial Resistance”. Two manuscripts investigated new patterns in the epidemiology of infections caused by isolates belonging to the *A. baumannii-calcoaceticus* complex. The epidemics of *A. baumannii* are characterized by the spread of multidrug-resistant clonal lineages [2]. Monnheim et al. [3] analyzed the phenotypic and genotypic features of carbapenem-resistant *A. baumannii* isolates responsible for wound infections in Ghana. Chopjitt et al. [4] investigated the genomic epidemiology of extensively drug-resistant *Acinetobacter pittii* isolates from Taiwan and China.

The molecular determinants, genetic and genomic elements of antimicrobial resistance in *Enterobacteriales*, have been the subject of four studies. The research paper by Bilal et al. [5] reported the occurrence of *bla*_{NDM-1} bearing IncX3 plasmid in clinically isolated ST11 *Klebsiella pneumoniae* from Pakistan. A new resistance-mediating plasmid chimera was detected in *bla*_{OXA-48}-positive *Klebsiella pneumoniae* strain at a German university hospital [6]. *bla*_{OXA-48} plasmids mobilising the carbapenemase gene *bla*_{IMP-4} were identified both in *Escherichia coli* Australian clinical samples and in multiple sublineages of *E. coli* ST216 colonising silver gulls [7]. Edowik et al. [8] demonstrated that the amino acid changes T55A, A273P and R277C in the beta-Lactamase CTX-M-14 render *E. coli* resistant to the antibiotic nitrofurantoin, which is used as first-line treatment of urinary tract infections. Lin et al. [9] showed that the dissemination of multidrug-resistant composite transposons MESPM1 or MES6272 between *Enterococcus* and ST59 *S. aureus* was mediated by insertion sequence IS1216V.

One manuscript focussed on diagnostics of antimicrobial resistances. Vasilakopoulou et al. [10] reported the evaluation of the NG-Test CARBA 5 immunochromatographic assay for detecting KPC, NDM and VIM-producing carbapenemases organisms directly from rectal swabs.

Therapeutics and management for the prevention and control of infections caused by multidrug-resistant organisms were investigated in three manuscripts. Yang et al. [11] analyzed the in vitro and in vivo efficacies of ceftazidime–avibactam and aztreonam–avibactam against carbapenem-nonsusceptible *Enterobacteriaceae* isolates collected in

Citation: Zarrilli, R.; Giani, T.; Bonnin, R.A. Editorial: Special Issue “Molecular Epidemiology of Antimicrobial Resistance”. *Microorganisms* **2023**, *11*, 579. <https://doi.org/10.3390/microorganisms11030579>

Received: 13 February 2023

Accepted: 21 February 2023

Published: 24 February 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Taiwan. Siméon et al. [12] reported the use of cefiderocol to treat a case of prosthetic joint infection due to extensively drug-resistant *Enterobacter hormaechei*. Karruli et al. [13] identified the use of central venous catheters and length of hospitalization as risk factors of multidrug-resistant infections after heart transplants in a single-center study.

In conclusion, the genomic epidemiology of multidrug-resistant organisms, the analysis of molecular determinants of antimicrobial resistance, the identification of innovative diagnostic and therapeutic approaches are important to prevent and control antimicrobial resistance.

Author Contributions: Writing—original draft preparation, R.Z.; writing—review and editing, R.Z.; T.G.; R.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding. It is a part of a Special Issue, entitled “Molecular Epidemiology of Antimicrobial Resistance”, of the journal *Microorganisms* and led by Raffaele Zarrilli, Tommaso Giani and Rémy A. Bonnin as Guest Editors.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: We are deeply thankful to all authors and reviewers who provided their contribution to this Special Issue.

Conflicts of Interest: The editors declare no conflicts of interest.

References

1. Tacconelli, E.; Carrara, E.; Savoldi, A.; Harbarth, S.; Mendelson, M.; Monnet, D.L.; Pulcini, C.; Kahlmeter, G.; Kluytmans, J.; Carmeli, Y.; et al. WHO Pathogens Priority List Working Group. Discovery, research, and development of new antibiotics: The WHO priority list of antibiotic-resistant bacteria and tuberculosis. *Lancet Infect. Dis.* **2018**, *18*, 318–327. [https://doi.org/10.1016/s1473-3099\(17\)30753-3](https://doi.org/10.1016/s1473-3099(17)30753-3).
2. Gaiarsa, S.; Batisti Biffignandi, G.; Esposito, E.P.; Castelli, M.; Jolley, K.A.; Brisse, S.; Sasser, D.; Zarrilli, R. Comparative Analysis of the Two *Acinetobacter baumannii* Multilocus Sequence Typing (MLST) Schemes. *Front. Microbiol.* **2019**, *10*, 930. <https://doi.org/10.3389/fmicb.2019.00930>.
3. Monnheimer, M.; Cooper, P.; Amegbletor, H.K.; Pellio, T.; Groß, U.; Pfeifer, Y.; Schulze, M.H. High Prevalence of Carbapenemase-Producing *Acinetobacter baumannii* in Wound Infections, Ghana, 2017/2018. *Microorganisms* **2021**, *9*, 537. <https://doi.org/10.3390/microorganisms9030537>.
4. Chopjitt, P.; Putthanachote, N.; Ungcharoen, R.; Hatrongjit, R.; Boueroy, P.; Akeda, Y.; Tomono, K.; Hamada, S.; Kerdsin, A. Genomic Characterization of Clinical Extensively Drug Resistant *Acinetobacter pittii* Isolates. *Microorganisms* **2021**, *9*, 242. <https://doi.org/10.3390/microorganisms9020242>.
5. Bilal, H.; Zhang, G.; Rehman, T.; Han, J.; Khan, S.; Shafiq, M.; Yang, X.; Yan, Z.; Yang, X. First Report of *bla*_{NDM-1} Bearing IncX3 Plasmid in Clinically Isolated ST11 *Klebsiella pneumoniae* from Pakistan. *Microorganisms* **2021**, *9*, 951. <https://doi.org/10.3390/microorganisms9050951>.
6. Schwanbeck, J.; Bohne, W.; Hasdemir, U.; Groß, U.; Pfeifer, Y.; Bunk, B.; Riedel, T.; Spröer, C.; Overmann, J.; Frickmann, H.; et al. Detection of a New Resistance-Mediating Plasmid Chimera in a *bla*_{OXA-48}-Positive *Klebsiella pneumoniae* Strain at a German University Hospital. *Microorganisms* **2021**, *9*, 720. <https://doi.org/10.3390/microorganisms9040720>.
7. Tarabai, H.; Wyrsh, E.R.; Bitar, I.; Dolejska, M.; Djordjevic, S.P. Epidemic *bla*_{H2} Plasmids Mobilising the Carbapenemase Gene *bla*_{IMP-4} in Australian Clinical Samples Identified in Multiple Sublineages of *Escherichia coli* ST216 Colonising Silver Gulls. *Microorganisms* **2021**, *9*, 567. <https://doi.org/10.3390/microorganisms9030567>.
8. Edowik, Y.; Caspari, T.; Williams, H.M. The Amino Acid Changes T55A, A273P and R277C in the Beta-Lactamase CTX-M-14 Render *E. coli* Resistant to the Antibiotic Nitrofurantoin, a First-Line Treatment of Urinary Tract Infections. *Microorganisms* **2020**, *8*, 1983. <https://doi.org/10.3390/microorganisms8121983>.
9. Lin, Y.-T.; Tseng, S.-P.; Hung, W.-W.; Chang, C.-C.; Chen, Y.-H.; Jao, Y.-T.; Chen, Y.-H.; Teng, L.-J.; Hung, W.-C. A Possible Role of Insertion Sequence IS1216V in Dissemination of Multidrug-Resistant Elements *MES*_{PM1} and *MES*_{S272-2} between *Enterococcus* and ST59 *Staphylococcus aureus*. *Microorganisms* **2020**, *8*, 1905. <https://doi.org/10.3390/microorganisms8121905>.
10. Vasilakopoulou, A.; Karakosta, P.; Vourli, S.; Kalogeropoulou, E.; Pournaras, S. Detection of KPC, NDM and VIM-Producing Organisms Directly from Rectal Swabs by a Multiplex Lateral Flow Immunoassay. *Microorganisms* **2021**, *9*, 942. <https://doi.org/10.3390/microorganisms9050942>.
11. Yang, T.-Y.; Hsieh, Y.-J.; Kao, L.-T.; Liu, G.-H.; Lian, S.-H.; Wang, L.-C.; Lin, I.-L.; Lin, Y.-T.; Wang, S.-F.; Tseng, S.-P.; et al. In Vitro and In Vivo Evaluations of β -Lactam/ β -Lactamase Mono- and Combined Therapies against Carbapenem-Nonsusceptible Enterobacteriaceae in Taiwan. *Microorganisms* **2020**, *8*, 1981. <https://doi.org/10.3390/microorganisms8121981>.

12. Siméon, S.; Dortet, L.; Bouchand, F.; Roux, A.-L.; Bonnin, R.A.; Duran, C.; Decousser, J.-W.; Bessis, S.; Davido, B.; Sorriaux, G.; et al. Compassionate Use of Cefiderocol to Treat a Case of Prosthetic Joint Infection Due to Extensively Drug-Resistant *Enterobacter hormaechei*. *Microorganisms* **2020**, *8*, 1236. <https://doi.org/10.3390/microorganisms8081236>.
13. Karruli, A.; de Cristofaro, J.; Andini, R.; Iossa, D.; Bernardo, M.; Amarelli, C.; Mattucci, I.; Zampino, R.; Zarrilli, R.; Durante-Mangoni, E. Risk Factors and Outcome of Multidrug-Resistant Infections after Heart Transplant: A Contemporary Single Center Experience. *Microorganisms* **2021**, *9*, 1210. <https://doi.org/10.3390/microorganisms9061210>.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.