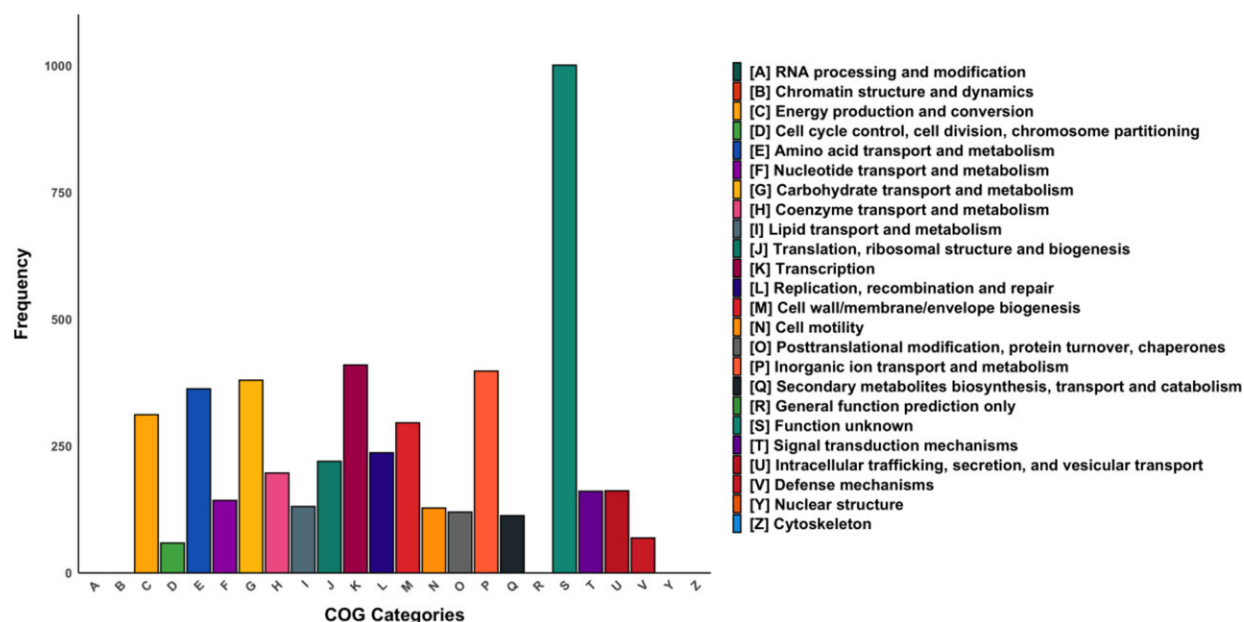


Researchers discover new antibiotic-resistant species of bacteria

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Quantitative KEGG analysis of genes identified in the UCI isolate. The bar chart illustrates the distribution of genes across different KEGG categories found in the UCI isolate. Each bar represents a specific category from the KEGG pathway analysis, and the height of the bar corresponds to the number of genes identified in that category. The X-axis shows the different KEGG categories, while the Y-axis represents the number of genes found in each category. Credit: *Journal of Hospital Infection* (2024). DOI: 10.1016/j.jhin.2023.12.010

Researchers at University of Limerick in Ireland have discovered a new species of bacteria that is resistant to antibiotics.

The discovery was made by researchers at UL's School of Medicine, who identified a novel antibiotic-resistant bacterial species that is capable of colonizing patients in a [hospital setting](#).

The new bacterial species was found in the wastewater system of University Hospital Limerick, while it was also identified from swabs taken from a patient admitted to one of the [hospital's](#) wards.

It comes following an extensive and unique study that saw the researchers, in partnership with University Hospital Limerick and Queen's University Belfast, dive deep into the hospital's wastewater to find a reservoir of bacteria resistant to antibiotics.

The new study, led by Professor Colum Dunne, Head of the University of Limerick's School of Medicine, and just [published](#) in the *Journal of Hospital Infection*, details large-scale genomic and microbiology analysis that was completed on UHL's wastewater system, the results of which were correlated with samples taken from patients as part of the hospital's cautious approach to management of microbiology and infection risk.

The researchers detected, characterized and identified a novel species of bacteria that is present in the wastewater system of the hospital and that was also isolated from a patient who was colonized by the bacterium following admission to the hospital wards for treatment.

Laboratory analysis found that the new species is resistant to many commonly used antibiotics, including some that are reserved for resistant bacteria. Fortunately, the patient, who was asymptomatic, did not need treatment with these drugs.

Antimicrobial resistance (AMR) is a major challenge that is estimated to be directly responsible for over one million global deaths annually. AMR makes infections harder to treat and increases the risks associated with

other medical procedures and treatments.

One problem associated with AMR is hospital-acquired infection, which occurs when people who are admitted to the hospital for treatment become infected by microbes circulating in the hospital wards.

The Limerick group has been working for more than a decade to add to understanding of what these microbes are, where they are, and what drugs they are resistant to, which helps to put in place systems that prevent and control outbreaks of these infections.

The analysis, called a metagenome analysis because it is the study of the structure and function of the entire DNA sequences from these samples, allowed a comprehensive understanding of the bacterial communities in the hospital waterworks. It enabled the profiling of all the antimicrobial resistance genes carried by the bacteria present.

Professor Colum Dunne, senior author and study lead who is Head of School and Foundation Chair and Director of Research at the UL School of Medicine, said, "Our research strategy emphasizes clarification on real-world problems and seeks solutions. In this situation, bacteria were isolated from a patient who had been swabbed as part of a routine safety process put in place with the support of the hospital's management team."

"Unusually, the bacteria could not be identified using diagnostic approaches used routinely in hospital labs. Using data from our large-scale study of the hospital's wastewater system and by sequencing the genome of the new isolate, we confirmed two things: that the bacteria are present in the hospital system and the patient was colonized with the bacteria after they were admitted to the hospital."

"The bacterial family, called Pseudocitrobacter, has only recently been

classified, and we found that our isolate is a new addition to that family, having not been reported elsewhere and never isolated from a human sample."

"While an exciting microbiology find, it is important that we stress that the patient remained colonized only, asymptomatic, and did not merit antimicrobial treatment for this species."

Professor Colum Dunne continued, "It is very likely that identification of new bacterial species will happen more frequently. Hospitals internationally are environments where there is heavy use of pharmaceutical products, such as antibiotics, and in that type of ecosystem, mutations occur frequently."

"In our studies of these microbes, we see the emergence of new [antimicrobial resistance](#) patterns, novel genes, new plasmids—transmissible elements of DNA—encoding for the resistance, and potential for further colonization of patients."

"In our hospital group, there is recognition of these risks. Our work has been enabled by a forward-looking approach to infection prevention and the facilitation of research by the hospital's management. Such support is an indicator of a health care system focused on best practice for proactive and solution-oriented research that can make a difference. We acknowledge this and look forward to further collaborations across our universities and hospitals."

Study co-author Dr. Nuala O'Connell, who is a Consultant and UL Adjunct Associate Professor in Clinical Microbiology, explained, "It is fortuitous to have access to wonderful academic scientific researchers in UL and Queen's University Belfast who could perform specialist molecular testing to help identify the novel microbe. It has enabled us to understand the potential route of acquisition, which will impact on

infection prevention and control strategies."

Professor Dunne emphasized the importance of scientists and clinicians working together. "This is an example of innovation with real impact for society. University-based researchers bring expertise and access to sophisticated molecular equipment that, together with the clinical knowledge of hospital-based doctors and surveillance scientists, can help to ensure patient safety is protected."

"It is likely that the analysis we performed will become more widely available, less expensive, and allow identification of infectious agents more rapidly, possibly even through bedside or point of care testing as technology improves."

Professor Brendan Gilmore, co-author and Professor of Pharmaceutical Microbiology at QUB, said, "This All-Ireland collaboration underpins the importance of cross-disciplinary academic and clinical research in monitoring, identification, and control of potential emerging bacterial threats in the health care system."

The importance of the study was summarized by James Powell, who is a Surveillance Scientist at University Hospital Limerick.

"Recent advances in molecular techniques have allowed us to explore the microbial epidemiology of our patients and the hospital environment in ways that we couldn't have envisioned just a short time ago. It was an honor and privilege to be part of the research group that studied this new bacterial isolate."

Dr. Stephen Kelly, co-author, and Lecturer in Pharmaceutical Microbiomics at QUB's School of Pharmacy, added, "Studying this microorganism and its genome was very interesting, not only due to initial challenges in uncovering its identity but also due to its clinical

relevance. This research again highlights the benefits of high-level collaboration between academic and clinical partners."

More information: Stephen A. Kelly et al, A novel characterised multidrug-resistant *Pseudocitrobacter* isolated from a patient colonised while admitted to a tertiary teaching hospital, *Journal of Hospital Infection* (2024). [DOI: 10.1016/j.jhin.2023.12.010](https://doi.org/10.1016/j.jhin.2023.12.010)

Provided by University of Limerick

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