Monitoring emerging pollutants and the future of environmental analysis

International Labmate meets with Leon Barron on the banks of the River Thames to find out what changes he's seeing in river pollution and how advances in lab technology is helping to capture this information.

Dr Leon Barron is leading research into emerging contaminants found in the River Thames

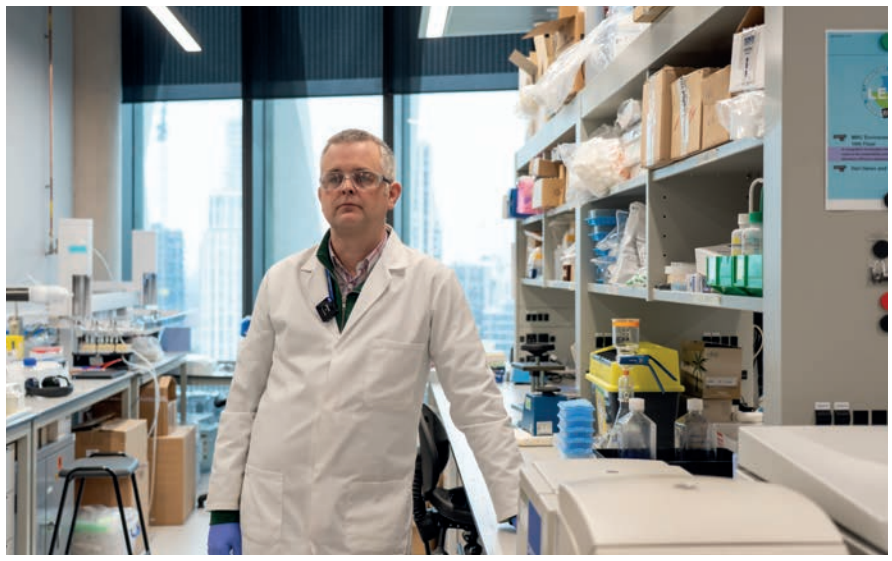
London is pioneering an effort to capture sewage overflows before they reach the Thames.

The ability to monitor and analyse pollutants in our waterways is a critical challenge for laboratories worldwide.

As industrial processes advance and urban populations grow, the presence of pharmaceuticals, pesticides, and microplastics in rivers and lakes has become a pressing concern.

Dr Leon Barron, Reader in Analytical and Environmental Sciences at Imperial College London, is at the forefront of research into emerging contaminants, including in the River Thames.

His work, alongside that of other environmental scientists and technicians, is shaping the future of pollutant monitoring and regulatory frameworks.



Dr Leon Barron is Reader in Analytical and Environmental Sciences at Imperial College London

Shimadzu provides Imperial College with cutting-edge, state-of-the-art solutions for environmental science

Understanding the sources of pollution

Dr Barron and his team have spent years investigating the presence and impact of chemicals in the environment.

'We started about 10 years ago looking at pharmaceuticals in the River Thames because of the issue of sewage overflows,' he explains.

'These substances serve as markers of urban activity and allow us to study their use and effects on humans, aquatic life, and ecosystems.'

Over time, this research expanded to include pesticides, tyre wear particles, and per- and polyfluoroalkyl substances (PFAS), also known as 'forever chemicals'.

PFAS compounds, commonly found in waterproof clothing, non-stick cookware, and firefighting foams, are of particular concern due to their persistence in the environment and potential health risks.

'We now have analytical methods to measure nearly 50 different PFAS quantitatively in river water, wastewater, and tap water,' Dr Barron states.

The role of analytical instruments in environmental monitoring

Advanced instrumentation is essential for detecting and quantifying these pollutants with precision.

Dr Barron's laboratory relies on liquid chromatography-mass spectrometry (LC-MS) to analyse water samples efficiently.

'For most of our river water and wastewater work, we use LC-MS because it provides the sensitivity and speed we need to detect even trace levels of mid-polarity contaminants,' he says.

Shimadzu, a key player in analytical instrumentation, provides state-of-the-art solutions for environmental analysis.

'For Dr Barron's laboratory, it is the robustness and sensitivity of our instruments that make the difference,' notes Dr Gennadiy Ilyashenko, Senior Business Specialist at Shimadzu.

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'Our technology enables high-throughput analysis, allowing researchers to process more samples in less time while maintaining accuracy.'

One of the key advantages of Shimadzu's instruments is their ability to handle complex and 'dirty' matrices without excessive maintenance.

'Our instruments are so robust that even with minimal sample preparation, they can tolerate challenging wastewater samples and still produce high-quality data,' he adds.

Addressing the super sewer and its impact

One of the most ambitious infrastructure projects in London's history, the Thames Tideway 'Super Sewer,' is expected to reduce pollution in the river by 95%.

'London is pioneering a UK effort to capture sewage overflows before they reach the Thames,' Dr Barron explains.

'This should significantly improve water quality, but we must continue monitoring to understand the full impact.'

Dr Barron's team has been conducting extensive sampling before, during, and after the Super Sewer's implementation.

'From 2019 to 2021, we sampled 14 waterways across London and over 300 sites to establish a baseline.

'As the sewer comes online, we'll continue monitoring to see if pollutant levels decrease as expected,' he notes.

The power of citizen science

While advanced instruments and regulatory frameworks are crucial, community engagement also plays a vital role.

'We can't be everywhere all the time, so we collaborate with citizen scientists and local environmental groups to collect samples and report pollution events,' says Dr Barron.

A recent collaboration with Earthwatch Europe led to the UK's first 'Water Blitz,' where citizens provided water samples for laboratory analysis.

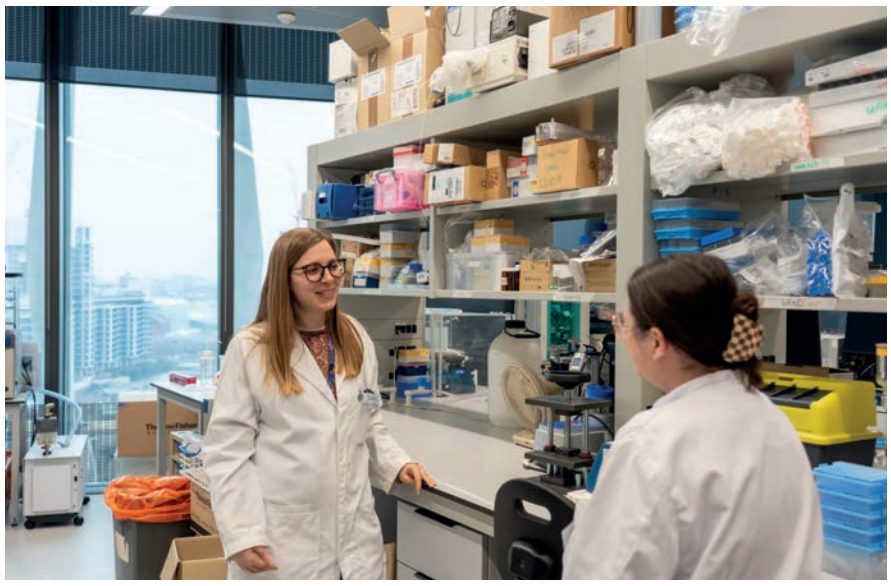
'These community-led efforts help us identify pollution hotspots and ensure timely interventions,' he adds.

Sustainability in laboratory practices

Sustainability is becoming an increasingly important focus in laboratory settings.

Dr Helena Rapp Wright, a Research Fellow at Imperial College London in Dr Barron's team, has been leading a project to reduce the environmental footprint of analytical labs.

'We must continue to monitor the Thames after the installation of the Thames Tideway 'Super Sewer', Leon Barron says



Dr Helena Rapp Wright is leading a project to reduce the environmental footprint of analytical labs

'One of the biggest issues in laboratory research is the high consumption of plastics, solvents, and energy,' she explains.

By optimising processes, Dr Rapp Wright and the team has successfully minimised plastic waste and solvent usage.

'We've tested different pipette tips, which we have found can be reused up to 40 times without affecting results,' she says.

'This approach could not only reduce waste but also lowers costs and resource consumption.'

Shimadzu is also prioritising sustainability in its instrument development.

'We continuously innovate to ensure our systems require less maintenance, consume fewer resources, and generate minimal waste,' says Gennadiy.

'It's about making science more efficient and environmentally responsible.'

Future directions in pollutant monitoring

Looking ahead, Dr Barron sees a need for greater investment in wastewater treatment and regulatory frameworks.

'Many treatment facilities operate near their capacity, and current processes are not designed to remove all pharmaceuticals, pesticides, or PFAS,' he warns.

'We need to rethink treatment technologies to ensure they can handle modern contaminants.'

From a regulatory standpoint, he emphasises the importance of updating chemical policies.

'Post-Brexit, the UK must develop a strong chemicals strategy for managing water pollution, tailored to the unique challenges our rivers face,' he says.

Cleaner rivers, healthier ecosystems, and a safer future for all

The combination of cutting-edge analytical technology, large-scale infrastructure projects, community engagement, and sustainable lab practices is shaping the future of environmental monitoring.

As pollutant detection methods improve and regulatory frameworks evolve, researchers like Dr Barron and industry leaders like Shimadzu will continue to play a pivotal role in protecting our waterways.

'With the right tools and collaborative efforts, we can ensure cleaner rivers, healthier ecosystems, and a safer future for all,' Dr Barron concludes.