Looking deeper

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Competence is key

Looking Deeper Editor, **Susan Pearson**

While the Government's claim that it will build 40 new NHS hospitals has so far failed to stand up to scrutiny, there is in fact significant new asset development taking place in the NHS — though it remains surprisingly unpublicised. These new developments include a new emergency department at Queen Alexandra Hospital, Portsmouth NHS Trust and a major cancer hub for the South West at Royal United Hospitals Bath NHS Foundation Trust.

Such new estates assets and refurbishments are always good news, but what about the way they are commissioned? Are they really being built with patient safety in mind?

The reality is that the healthcare built environment if not properly thought out can present numerous under-estimated hazards for patients — and there have been several highly publicised failures as a result of poor planning, some of them linked to hot and cold water systems.

In order to prevent facilities being constructed with in-built issues right from the start of a project the commissioning process needs to be carried out by people who have a strong understanding of how, for example, pipe work could become a reservoir for opportunistic pathogenic microorganisms. However, when there are failings this is often due to those at the top of the commissioning ladder not having this competence.

The second part of our report (pp 6-10) from last summer's Water Safety Forum (see Issue 12, pp 6-11 for Part 1) looks at the question 'does the design really work for patients?' — and how this is not always the first consideration in the commissioning process. Yet this issue is key to understanding some of the reasons why new healthcare facilities fail.

This issue's report examines what we mean by 'competence', concluding that competency is not just about 'training', but importantly, should also take into account knowledge, training, skills and experience.

Competence — and how to assess a potential external authorising engineer — is also explored further in our interview with Peter Alesbury (pp 12-13), former of Head of Estates at St George's Healthcare NHS Trust, who emphasises that evidence of an individual's CPD (continuing professional development) is crucial.

> *"An ounce of prevention is worth a pound of cure."*
>
> *Benjamin Franklin*

We also present the second in our series of practical 'How to...' guides on pp 14-15, which focuses on temperature testing procedures for thermostatic taps, and report on the swelling ranks of newly discovered *Legionella* species (see both 'News' and 'Latest Research').

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For commercial applications, Armitage Shanks, is the definitive British brand with pioneering solutions in washroom fixtures, fittings and water conservation. These solutions extend to bacteria sensitive healthcare environments, where the safe management and delivery of water is critical to infection control, controlling the spread of infectious diseases. Now leading the industry in safe water management, Armitage Shanks is committed to supporting the Water Safety Forum.

Editorial Contributions

Susan is an independent journalist and communications specialist with a background in biology, medical research and publishing. She has been writing on medical issues for over 30 years and on waterborne infection and water management since 2010. She has been a frequent contributor to IHEEM's Health Estate Journal, WMSoc's Waterline and the Clinical Services Journal.

Susan Pearson

Elise is an independent consultant to the water and medical devices industries and a former Chair of the Water Management Society (WMSoc). She is a state-registered microbiologist, a BSI committee member and was on the steering group for Department of Health HTM 04-01: Safe water in healthcare premises. Elise is a Fellow of WMSoc, IBMS, IHEEM and also of the Royal Society of Public Health (RSPH), where she is an active member of the water special interest group. She chairs and presents at numerous international conferences.

Elise Maynard

Peter is the Water Hygiene Contract Manager, Water Hygiene AP, for University Hospital Southampton NHS Foundation Trust, with a background in building construction technology, mechanical ventilation and engineering.

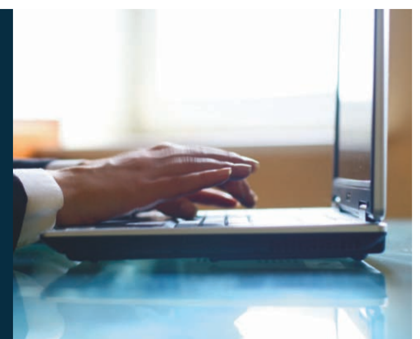
Peter Orendecki

Former Head of Estates at St George's Healthcare NHS Trust, Tooting, with extensive experience in both the NHS and the private sector. An expert in infrastructure/capital development, energy/sustainability and facilities management within complex and technical estates. Currently Director of Estates and Facilities for the Royal Opera House in London and previously Director of Estates for the Royal Botanic Gardens at Kew.

Peter Alesbury

Share your thoughts with us in the next issue

We would really value your reactions to this latest issue of Looking Deeper. We'd like to hear from you about what you liked, what you feel could be improved on and what topics you want to see discussed. You can contact us at **editorial@lookingdeeper.co.uk**



In the news...

New species swell *Legionella* ranks

Now in the sixties, the list of *Legionella* species has been growing continuously since the first was identified in 1976 — and now two new species have further swelled the ranks.

An unidentified *Legionella*-type bacterium isolated in 2012 from the hot water distribution system in both a hospital and shopping centre in the Czech Republic has finally been confirmed as a previously unknown *Legionella* species. Extensive analysis based on the 16S rRNA gene sequences from a polyphasic study has now established the original isolates as representing a single novel species to be known as *L. maioricensis*. This is the 65th species of *Legionella* to be identified.

However, this is not the only new species of *Legionella* to be discovered recently. Last September's 10th International Legionella Congress held in Yokohama, Japan saw the announcement of the official recognition of *L. bononiensis*. This was the 64th species of *Legionella* to be identified worldwide, and the second to be isolated in Italy since the discovery of the pathogen. It was discovered in a north Italian hotel facility in 2019 by researchers from the Laboratory of Environmental Microbiology and Molecular Biology (MAb) at the University of Bologna.

Not all species of *Legionella* cause disease in humans; the pathogenic significance of *L. maioricensis* and *L. bononiensis* is not yet known.

FIRST HELPING HAND FOR SCALD RISK ASSESSMENTS

The Water Management Society has published the first available guidance for scald risk assessments — an important step forward in the conflict between the need for hot water temperatures that will kill opportunistic waterborne pathogens and the need for comfortable water temperatures for hand washing.

Scalding of vulnerable patients is classed by the NHS as a 'never event'. For vulnerable patients, it can take only seconds for a severe scald to occur from water above 63°C, the temperature needed to pasteurise water.

However, HTM 04-01 states that mixer taps, including thermostatic mixing valve taps, should only be installed where a risk assessment (RA) indicates their need — yet no previous guidance on the best way to carry out such a RA has been available until now.

The new guidance outlines how after appointment of a competent person, the water safety group should ensure there are processes within the water safety plan to identify where there is the potential for exposure to hot water that poses a risk of scalding once the hazards have been identified. The RA should cover all hot or blended water outlets present within the area to be assessed.

Plant world reveals possible super antibiotic

A plant toxin that is itself produced by a bacterium looks set to form the basis of a new generation of powerful antibiotics that could defy antibiotic resistance in the bacteria they protect against.

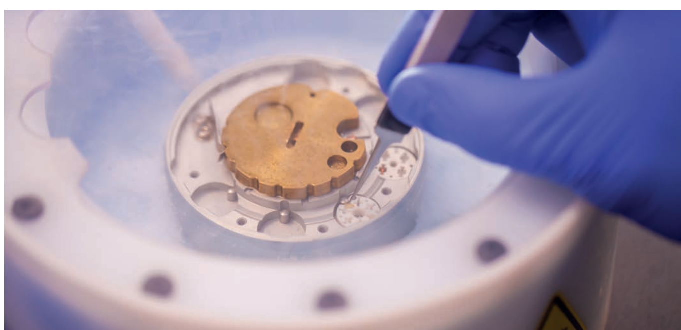
Albicidin, a hybrid polyketide-peptide is produced by the Gram-negative *Xanthomonas albilineans*, which causes ravaging leaf scald disease in sugar cane. Although identified several decades ago as being highly effective at killing bacteria, albicidin has not previously been developed as an antibiotic because its precise mechanism of attack could not be established.

Now, researchers based at the John Innes Centre in Norwich have been working with scientists at the Technische Universität Berlin in Germany and the Jagiellonian University in Kraków, Poland to reveal how albicidin attacks bacteria completely differently from the way existing drugs work.

Publishing in Nature Catalysis,[1] the scientists described how they used advanced cryo-electron microscopy to discover exactly how albicidin interacts with gyrase, its target bacterial enzyme DNA.

Gyrase binds to DNA by twisting up via 'supercoiling' movements, which are an essential cell function process. Albicidin was found to form an L shape, allowing a unique interaction with both gyrase and the DNA to prevent the gyrase bringing the two ends of DNA together.

Dr Dmitry Ghilarov, from the John Innes Centre said: "It seems, by the nature of the interaction, albicidin targets a really essential part of the enzyme and it's hard for bacteria to evolve resistance to that.



"Now that we have a structural understanding, we can look to further exploit this binding pocket and make more modifications to albicidin to improve its efficacy and pharmacological properties."

Tests have found initial antibiotics based on albicidin to be effective against infections such as *E.coli* and *Salmonella*, even those resistant to widely used antibiotics such as fluoroquinolones.

Dr Ghilarov said: "We believe this is one of the most exciting new antibiotic candidates in many years.

1. Michalczyk, E. *et al* "Molecular mechanism of topoisomerase poisoning by the peptide antibiotic albicidin." *Nat Catal* **6**, 52—67, 2023. https://doi.org/10.1038/s41929-022-00904-1

Dates for diaries...

ECCMID 2023
15-18/04/2023 hybrid: Copenhagen, Denmark and on-line
eccmid.org/

Microbiology Society Annual Conference 2023
17-20/4/2023 Birmingham, UK
microbiologysociety.org/event/annual-conference/annual-conference-2023.html

IPC: Predict. Prevent. Protect.
25-26/04/2023 Birmingham, UK
infectionpreventioncontrol.net

RSPH conference: Thinking outside the box — planning plumbing systems for the future
18/05/2023 On-line
rsph.org.uk/events.html

ASM (American Society for Microbiology): Microbe
15-19/06/2023 Houston, Texas, US
asm.org/Events

Installer Show
27-29/06/2023 Birmingham, UK
installershow.com/

International Conference on Biofilm Research ICBR
28-29/6/2023 London, UK
waset.org/biofilm-research-conference-in-june-2023-in-london

ASM/ESCMID Joint Conference on Drug Development to Meet the Challenge of Antimicrobial Resistance
19-22/09/2023 Boston, Massachusetts, US
asm.org/Events

IHEEM: Healthcare Estates Conference, Exhibition and Awards 2023
10-11/10/2023 Manchester, UK
healthcare-estates.com or office@iheem.org.uk

WATER SAFETY FORUM

New BS 8580-2:2022 standard for risk assessing *Pseudomonas aeruginosa* — Part 2: Delivering for patient safety

In the list of priorities for constructing new hospitals, building on time and within budget can overtake "being safe" for patients. Two recent influential reports, one from England and the other from Scotland,[1,2] have identified major deficiencies within the construction industry guidelines/guidance and compliance as insufficient to deliver safe buildings and "a change in culture is [now] required," according to Dr Mike Weinbren, Chair of the Hospital Infection Society Working Group on Water.

Dr Weinbren stated at last year's Armitage Shanks Water Safety Forum (WSF):*"There's only one reason for getting a new hospital, and that's to make it safer for patients. The healthcare built environment is a significant and underestimated source of infection to patients. Additionally, waste water systems, not just in developing countries, but in the most sophisticated healthcare systems around the world are increasingly recognised as a source for dispersal of antimicrobial resistance."*

The WSF gathered a group of water safety experts (see p 10) at Ideal Standard's London Design and Specification Centre last summer to discuss the implications of the new British Standard BS 8580-2:2022, which revolutionises the approach to prevention of the pathogenic bacterium *Pseudomonas aeruginosa* in healthcare water systems. This standard for the first times outlines how to carry out risk assessments (RAs) specifically for *P. aeruginosa* — and also for other waterborne pathogens — and promotes the importance of a multidisciplinary approach.

The discussion was so extensive that we split our Looking Deeper report into two parts. The first part, in Issue 12 (pp6-11), included snapshots of talking points on: RAs in practice, communication between disciplines, training of different teams involved in infection prevention and control (IPC), the connection between drains and antimicrobial resistance (AMR), how to mitigate AMR in drains and the part manufacturers might play in reducing risk. Part 2 below highlights issues around competency when commissioning and designing new facilities, hand hygiene and different types of outlets. How new hospitals are designed in relation to water and therefore patient safety was a recurring theme throughout the WSF, echoing previous discussions of this topic in Looking Deeper (see Issue 10, pp 6-8).

Competency

BS 8580-2 has been designed to be used alongside the BS 8680 Code of Practice for water safety plans (WSP) (see Looking Deeper Issue 8, pp 8-9), which recommends that a WSP should be developed from the concept stage of any new capital or refurbishment project, remain under constant review and include design RAs. However, the panel concluded that patient safety is still often compromised even before the opening of a new facility because mistakes are made in hospital and refurbishment design — and this is often due to those involved in commissioning not being sufficiently competent to understand the crucial water safety aspects that need to be addressed.

But what does 'competence' look like? Authorising Engineer (AE) and Water Consultant Steven Van De Peer echoed the group's opinion that 'training' and

'competence' are not necessarily the same thing. "We are overstepping when we say 'training' is 'competency'. [A competent person has] knowledge, training, skills, experience and recognition of their own limitations."

"A competent person has knowledge, training, skills, experience and recognition of their own limitations."

Steven Van De Peer

Given the 'make' or 'break' nature of correct pipe work and fittings in delivering safe water in healthcare, the panel focused in particular on plumbing and the need to ensure that plumbing contractors understand how crucial their role is.

A not uncommon issue, both within and outside of construction, is to label a task as menial without asking two basic questions: can it be performed incorrectly and if so what are the consequences of the actions on the patient? Dr Weinbren provided numerous examples: glueing plastic pipe work together may seem simple but if too much glue is applied this can occlude the lumen and impede the flow in hot water return pipes as occurred in one hospital; clinical hand wash stations are often installed with the elbow operated lever too close to the IPS wall panel above to be properly operated with an elbow (although some leading tap designs do encourage assembly of the lever to avoid this issue); or overzealous use of sealant impairs drainage out of the basin into the downpipe. Unless risk is identified at inception of projects it cannot be mitigated against.

Procurement

While the group agreed on the importance of commissioning 'competent' contractors, including architects, to carry out work on a build, in the first instance end users themselves also need to be well 'educated' or 'competent' in order to establish a contractor's expertise and to make the correct procurement choices.

Microbiology consultant and panel Chair Elise Maynard said: *"We need to focus on inclusion in water safety groups (WSGs) [prior to a build] of those involved with commissioning design and specification, construction and installation. And although there is already a certain amount of understanding [among the different disciplines in WSGs]...we still need to get project managers and the right clinical people to those WSGs to get [the appropriate] procurement in place."*

For example, clinical staff are best placed to prescribe how many water outlets would be needed in any given area, which might include clinical hand wash basins (HWBs), regular HWBs, showers, baths, sluices and kitchen sinks.

Infection Control Nurse Specialist Alyson Prince described an as yet unopened new build where a HWB was fitted in an ICU room, another in the same room's lobby area and yet another outside the lobby. This arrangement would inevitably lead to water stagnation and contamination that would be likely to spread, she said.

Hygiene

In the above context, the panel discussed the problems when facilities are designed with too many HWBs, as is often the case. This can lead to under-usage of some outlets, in turn leading to areas of stagnant water and build up of contaminating biofilm (described in more detail in Part 1: see Issue 12, p 6). However, they also commented that even in healthcare situations, not everyone is practising basic hygiene such as washing hands after going to the toilet or washing their hands before going onto a ward.

Sufficient HWBs are therefore needed to encourage hand hygiene compliance: a compromise needs to be struck between over-provision and sufficient provision of strategically placed hand wash stations that staff will readily use.

It is crucial that this delicate balance is understood at the design stage of commissioning, which should include an exploration of how users might move around and utilise a space.

WATER SAFETY FORUM

Outlets

There was a comprehensive discussion on the pros and cons of different types of outlets, which would be appropriate for different spaces:

Elbow operated taps: a hands-free option to limit cross contamination between hands and taps and between users. However, these are often used incorrectly, especially if, as is often the case, they are not properly installed and the elbow levers are at the wrong level resulting in hand operation by users (see Issue 12, pp 12-13, 16).

Sensor taps: these eliminate cross user contamination and tap contamination from users making contact with tap ends, providing they are easy to wave on and off. Some models also have a regular automatic flush cycle to prevent water stagnation if the outlet is underused.

Knee and foot operated taps: these are again an excellent mechanical hands-free option, but need significant maintenance.

Thermostatic mixing valve (TMVs): these taps with integral hot and cold water mixing valves reduce any risk of scalding from the high water temperatures needed to reduce the risk from *Legionella* within plumbing systems. This makes TMVs highly suitable for staff hand washing areas and where vulnerable groups need to wash their hands, for example, elderly people in care homes.

However, the group agreed that TMV outlets should not be overused. For example, there are locations fitted as standard with HWBs where in fact they are not needed. HWBs, which may have TMVs, are often fitted in augmented care areas where patients do not utilise the facilities.

Dr Weinbren described observations from his visit to the first water-free care ICU globally, located in the Netherlands. This had only two hand wash stations on the whole unit, one in a central open area for surgical scrubbing and the other in the dirty sluice. Additionally, thought had gone into other areas of design such as keeping touch surfaces in the built environment to a minimum, e.g. doors were designed to be 'kicked' open.

It is notable that there is no standard or guidance for scald risk RAs;* however, Elise Maynard described a WSG that has given every ward a scald risk rating. *"This has been valuable because it focused us on where we needed to do RAs for Pseudomonas. However, a counter argument from the nurses stressed the need for blended water at a good temperature [in order] to wash their hands correctly...TMVs are still needed,"* she said, *"but they must be in the right place."*

Conclusion and solutions

The panel emphasised the importance of preventing contamination via robust cleaning regimes with staff trained well to understand the issues (see opposite page).

Suggested solutions to the issues discussed by the group included:

- the initial RA must be robust about the potential risks to patient safety from a hot and cold water system
- the pre-project RA must assess the project process, not just design, to cover installation, storage of materials such as pipe work before it is fitted, etc.
- appointing a 'water safe' contractor, with water industry approved plumber (WIAP) accreditation

Continues on P10 ▶

REMOTE MONITORING

The participants discussed the use of new remote monitoring systems that produce real-time data logging for temperature and even flow — which some of the panel considered the only way forward in the industry.

Continual flow monitoring can provide data to demonstrate trends in water usage and speedy alerts on under-used outlets and therefore under-flushed stagnant outlets that might cause contamination problems. Logged data can be sent automatically to the building management system, which could allow continuous updating of RAs as live documents.

Steven Van de Peer said: "We need to specify it... particularly in new builds. You need real time data, once a month isn't enough if it takes three years to build a trend. Using remote monitoring, you could build a trend in three weeks depending on what's going on....Remote monitoring [can emphasise] temperature. But the biggest risk will always be stagnation of flow. [That should be] prioritised as a piece of data collection." **

ONE BASIN, TWO CLOTHS

Part 1 of our report on Armitage Shank's Water Safety Forum in the last issue of Looking Deeper outlined why carrying out specific risk assessments (RAs) for *Pseudomonas aeruginosa* contamination can prevent contamination issues and illustrated how multidisciplinary working can make a difference (Issue 12, p 7).

This first report also noted that a more specific Water Action Group (WAG) as an adjunct to a Water Safety Group (WSG) can provide a closer focus for reviewing water sampling results and planned preventative maintenance (p 8).

Peter Orendecki, Senior Contract Manager for Water Hygiene, explains how refinement of processes by University Hospital Southampton (UHS) NHS Foundation Trust's WAG, that previously concentrated more on engineering solutions, is now putting hygiene procedures in the spotlight.

At UHS, the WAG includes representatives from maintenance, domestic services, infection prevention and control (IPC) leads and clinical staff. Peter Orendecki emphasises that while *"Legionella is an engineering problem, Pseudomonas is an 'everybody' problem — so bringing people on board from across the disciplines makes everyone more mindful of what the problem is."*

> *"Legionella is an engineering problem, but Pseudomonas is an 'everybody' problem"*

'Clean' to 'dirty'

The standard protocol devised by the WAG instructs cleaning staff to use two separate red microfibre cloths for each basin, one for the basin and another for the taps and drain. These cloths must not be used anywhere else.

This is a "fairly basic procedure," Peter Orendecki says, "everything around the sink is cleaned first and then cleaning [progresses] from 'clean' to 'dirty,' from the taps towards the more 'dirty' plughole."

At each basin, cleaners are asked to check if a tap needs de-scaling and if so to carry out de-scaling with a scourer and de-scaling solution. The basin should then be emptied and any debris removed from the plughole and overflow area. Cloth 1 is to be used to clean the basin surroundings such as any mirror, soap and gel dispensers, the hand towel dispenser, tiles and the splash back, and on completion should be returned to the laundry bag.

Cloth 2 will be used to clean the taps first, then the outside and under the basin and inside the basin avoiding the waste and plughole. The waste plughole is cleaned last before also disposing of this cloth into a laundry bag.

Enhancing the protocol

However, the WAG is now considering 'tweaking' this protocol so that each basin is first cleaned with a dry cloth prior to 'wet' cleaning. The thinking behind this step is the removal of any residues of water lingering in the basin that may dilute the chlorine solution in which the cloths are dipped. In addition to the 'dry' cloths, rather than wiping round point-of-use (POU) filters, these will first be removed before flushing and cleaning, and then fitted back.

This new method has been trialled on one ward, since January 2023, with the expectation of reducing the minimal *Pseudomonas* counts that are already at a very low level and completely eliminated in outlet water through filtering. The idea is to add even more "belt and braces" to the already robust cleaning cycle to entirely eliminate any *Pseudomonas* on augmented care wards — in other words, to provide "mitigation of the mitigations" already in place.

Basins on one initial study ward are being sampled every two weeks, resulting in a reduction of positive sample results by 53%.

By making small changes to the cleaning regime and adding and maintaining three cleans a day, a positive outcome has been achieved that will ultimately protect the patient.

Credit: Royal Society of Public Health

WATER SAFETY FORUM

Continued from P8 ▶

- ensuring that all plumbers working on hospital systems hold a minimum of an NVQ level 2 or Regulations Certificate, as well as a Pressure Certificate for working on pressure systems
- introducing specialist plumbing apprenticeships backed up by further courses before being qualified to work on healthcare water systems
- ensuring a build has a specifications guide that must be adhered to by contractors. For example, Peter Orendecki described how UHS has a water hygiene design guide for installation and operations that is sent out with tender applications
- creating graphics specifically for architects to ensure their understanding of activities taking place in specific clinical areas and how things can go wrong for patients if the design is not right
- consider leaving standards as 'live' documents to keep them up-to-date.

Water Safety Forum Panel

Elise Maynard, Chair, Independent microbiology consultant to the water and medical devices industries; *Eugene Conroy,* Managing Director, Eta Projects Ltd; *Graham Griffiths,* Water Services Manager, Tunbridge Wells Hospital; *Karina Jones,* IHEEM-registered AE, Eta Projects Ltd; *Peter Orendecki,* Senior Contract Manager, Water Hygiene AP, University Hospital Southampton (UHS) NHS Foundation Trust; *Alyson Prince,* Built Environment Infection Control Nurse Specialist; *Steven Van De Peer,* Principal Consultant and AE (Water), Tetra Consulting Ltd; *Dr Mike Weinbren,* Chair of the Hospital Infection Society Working Group on Water (see also: Issue 12, p 11).

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2. https://www.gov.scot/binaries/content/documents/govscot/publications/corporate-report/2018/06/report-review-compliance-enforcement/documents/00537870-pdf/00537870-pdf/govscot%3Adocument/00537870.pdf

Footnote

* The Water Management Society has recently published:

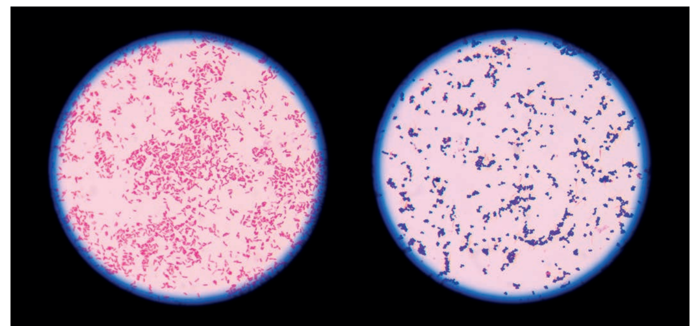
Guidance on the Principles of Scald Risk Assessment in Domestic Water Systems — W046-10 — Jan 2023

** See also: www.waterhygienecentre.com/news/wmsoc-guidance-temperature-monitoring

Gram staining explained

Much has been covered in the news about the recent high prevalence of 'Strep A' infections in children, and poor hand hygiene can be implicated in its transmission. Unlike most waterborne pathogens, which are Gram-negative, *Streptococcus* A bacteria are Gram-positive. Here, *Elise Maynard* explains the significance of Gram staining as a major tool in distinguishing between groups of bacteria.

Bacteria are microscopic, single celled organisms that are classified based on several morphological characteristics such as: shape, genetic make-up, cell wall composition, number of flagella (hair-like organelles that allow movement), nutrition, biochemical reactions, etc.



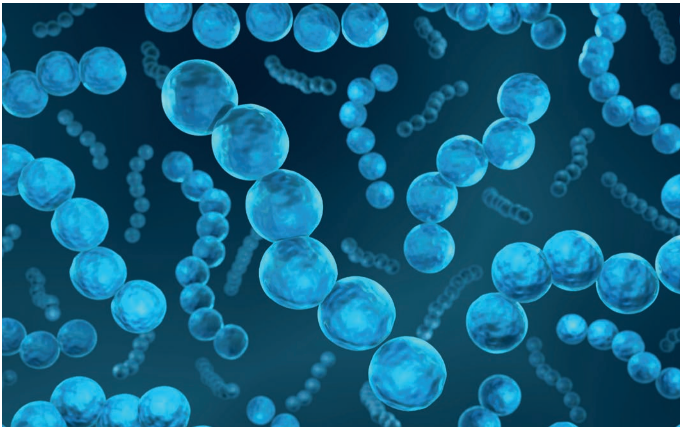
Gram-negative bacteria left, Gram-positive bacteria, right

One of the broadest differentiators between groups is the Gram stain, a method used to classify bacterial species into two groups: Gram-positive and Gram-negative. The technique was developed by Danish bacteriologist Hans Christian Gram in 1884 and today his method of staining is still used to differentiate bacteria by the chemical and physical properties of their cell walls:

- Gram-positive cells have a thick layer of peptidoglycan in the cell wall that retains the primary stain, crystal violet;
- Gram-negative cells have a thinner peptidoglycan layer that allows the crystal violet to wash out on addition of ethanol.

They are then stained pink or red by a counter stain, generally safranin or fuchsine, and Lugol's iodine solution is added to strengthen the bonds of the stain with the cell membrane.

Although this is a highly valuable tool, there are exceptions such as *Mycobacteria* species, which require a modified staining technique because they lack a cell wall around their cell membranes (which also makes them resistant to antibiotics that target cell wall synthesis).



Streptococcus pyogenes

Gram-positive bacteria

These generally have a single membrane (monoderm) surrounded by a thick peptidoglycan layer and are often round in shape (cocci). An example is *Streptococcus pyogenes* (Group A Strep), which is responsible for a wide range of infections that are common and fairly mild — however, if they enter the bloodstream, infection can become severe and life-threatening.

Group A Strep (GAS) is spread by close contact between individuals, through respiratory particles — i.e. coughing and sneezing — and by direct skin contact. It can also be transmitted environmentally, for example through contact with contaminated objects, such as towels or bedding, or ingestion of food prepared by someone with the infection.

GAS is also known as scarlet fever and at the time of going to press incidence reports are above those expected at this point of the season. The rate of invasive (iGAS) infection in children aged under 10 years has been particularly elevated and substantially higher than in the past two years. In 2022, for England and Wales, there were 54,630 scarlet fever notifications. Such high numbers have not been seen since 1953, when recorded numbers reached 61,180.[1]

According to the UK Health Security Agency (UKHSA), reduced exposure to GAS infections during the pandemic are likely to have resulted in increased levels of susceptibility to these infections in children, noting the very low levels during the pandemic. However, there are several studies linking increased susceptibility to iGAS if the patient has contracted a viral infection such as chickenpox or flu, so it is likely that Covid-19 would also have a similar effect.[2,3]

While good hand hygiene should mitigate spread by contact, the quality and temperature of the tap water at hand wash stations also needs to be considered. If the water temperature is too hot or too cold, then hand washing will be compromised, so a mixed water supply is often preferable. In schools, blended water is also favoured to minimise any scald risks. Microbial contamination of the water should be minimal and a written scheme of control should be in place — although Gram-positive bacteria tend to have lower survival times in water, water is the preferred habitat of many Gram-negative bacteria.

Gram-negative bacteria

These generally possess a thin layer of peptidoglycan between two membranes (diderm) and are often rod-shaped. Lipopolysaccharide (LPS) is abundant on the cell surface with the lipid A in the LPS acting as an endotoxin that can trigger inflammation, resulting in fever, increased respiratory rate and low blood pressure. Consequently, some infections with Gram-negative bacteria (GNB) can lead to life-threatening septic shock.

The outer membrane protects the bacteria from several antibiotics, disinfectants and detergents. It also provides resistance to some antibiotics due to enzymes known as beta-lactamases within the cell membranes, which break down or modify certain antibiotics.

There are many GNB linked to water contamination, such as *Pseudomonas aeruginosa* and *Legionella* species. These need careful management and control as they are highly likely to form biofilms and can multiply given the right temperature and nutrition, especially in areas where water has low flow or can stagnate. GNB are often transmitted as aerosols, typically from showers or hot-tubs and they can also be spread by environmental contact via poor maintenance or cleaning of water outlets. Infections can be contracted by close human contact or poor hygiene, with the exception of *Legionella pneumophila*, which is rarely contracted in this manner.

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INVESTING IN PEOPLE — TAKING THE OUTSIDE BACK IN

Susan Pearson talks to Estates Director Peter Alesbury about the importance of choosing well qualified independent advisers and ultimately how ending outsourced estates teams can improve outcomes.

Peter Alesbury is a former Head of Estates at St George's Healthcare NHS Trust. With many years of senior estates experience behind him, both in the NHS and the private healthcare sector, he is now Director of Estates and Facilities for the Royal Opera House in London, which follows on from his role as Director of Estates for the Royal Botanic Gardens at Kew.

Arriving at St George's at the tail end of the fallout after a widely publicised *Pseudomonas aeruginosa* outbreak, Peter explains how his development of a specific water safety team became the heart of mitigations put in place to deal with water contamination issues. He also discusses the key qualities that he considers make for competent authorising engineers (AEs) and how his approach at Kew — taking outsourced water safety back in house — can offer a more efficient solution for many hospitals.

What approach did you develop to deal with major problems in a hospital water system?

The *P. aeruginosa* outbreak at St George's was detected because two highly unique multidrug-resistant strains were identified in the hospital waste water systems. This highlighted the potential of hospital drainage systems to act as a reservoir of nosocomial pathogens and was emphasised in one of the seminal papers on this subject by Breathnach and colleagues.[1]

The introduction of a 'water safety team' responsible for putting together a water safety plan (WSP) was a significant step forward. This brought infection control staff and estates personnel, who had previously been working on water quite separately, into a much closer working relationship that allowed more sharing and understanding of the issues and how they affected the hospital.

> *"They are there to 'challenge' you... A sign of a less 'competent' AE will be one who does not really challenge the site'...You have to choose wisely."*

This strategy to some extent pre-empted the water safety groups and WSPs now found as best practice in most hospitals. New AEs were brought in to prioritise water safety specifically, where previously the 'responsible person' might have been covering several areas of estates' concern. Investigations would now be carried out by the full team rather than by estates alone.

It was essential to track the problem areas, such as plumbing dead legs. While 'dead legs' can be caused by little used outlets that limit flow, in a complex aging system, as was the case in this Trust, many may be hidden — for example, bathrooms that had been removed and the old pipe work folded over behind new walls.

A major issue was ensuring that flushing of the system was carried out fully. This involved pinpointing and flushing little used outlets — but these needed to be fully identified because *"in reality it is very difficult to keep 1000 taps flowing — making sure people are using them and that flushing is actually being done."*

However, identifying 'little used outlets' was not an easy task: engineers were told that clinical hand wash basins (HWBs) were not being used, when in fact they were, and sometimes taps were flushed so often by so

many different people, due to a lack of understanding of how to define a 'little used outlet', for example, outlets hidden in store rooms, which became very expensive for the Trust.

Ongoing mitigations that were brought in included robust testing regimes and standardising access to results with both clinical and estates teams, to ensure an immediate response to poor tests — such as closing down 'failed' areas for high intensity cleaning and chlorination of outlets.

What were your criteria in appointing AEs to work with your team?

"'Engineer' is not a protected term — so I've always defined AEs as 'independent advisers' — a qualified chemist could be an 'independent adviser' (IA) as much as an engineer. The HTM [for the health sector][2] is clear...it is down to the person appointing the AE or IA to judge their skills and competence. I've employed AEs that were chemists and, again, AEs who were microbiologists — their views on water safety came from slightly different, but useful, angles."

When external companies provide 'competent engineers', what do they mean by 'competent'? The IHEEM definition would be someone who can demonstrate years of service, with years of evidence of actions taken. It is crucial that the client looks at a potential AE or IA's background, because competence may be defined differently by external companies: How did they become an AE/IA? What evidence can they show for their training? Have they kept up their continuing professional development (CPD)? Are they a registered member of a professional body — such as IHEEM, the Water Management Society (WMSoc) or the Royal Society for Public Health (RSPH) — that will provide on-going CPD opportunities and further learning via publications?

The Health and Safety Executive's ACOP "Legionnaires' disease. The control of legionella bacteria in water systems" (2013) says:

"Employing contractors or consultants does not absolve the dutyholder of responsibility for ensuring that control procedures are carried out to the standard required to prevent the proliferation of legionella bacteria. Dutyholders should make reasonable enquiries to satisfy themselves of the competence of contractors in the area of work before they enter into contracts for the treatment, monitoring and cleaning of the water system."

'Competency', however, should not only refer to external and internal AEs; CEOs and senior managers, architects and those involved in commissioning must also be able to understand potential issues.

"A sign of a less 'competent' AE will be one who does not really "challenge the site...or the people on the site...They are there to challenge you...You have to choose wisely...[You need] people having the right skills...the right people are sometimes better than cash."

Is it better to outsource estates teams or bring them in-house?

The NHS has been outsourcing aspects of estates for around 20 years and NHS estates teams have also generally become smaller.

While independent advice is essential, at Kew, bringing the engineering team back in-house worked out very well: the overheads paid to a third party company were re-directed back into building an estates team and into the facilities. Considerable savings were made (from the profits that the outsourced company needed to make) and significantly more 'buy-in' and therefore motivation was generated from the staff — a model that could be applied to any organisation.

So would the NHS be better off bringing outsourced functions back in again? The original out-sourcing model was risk-based — a possibly misplaced idea that companies would carry the risk, which is not what generally happens: when things go wrong, it will still be the Trust that is impacted by the blame.

"Although there are different views, in-sourcing can work very well, however, it is crucial to invest in the 'in-source' — i.e. "you have to invest in your people."

Reference

1. Breathnach, AS *et al* "Multidrug-resistant *Pseudomonas aeruginosa* outbreaks in two hospitals: association with contaminated hospital waste-water systems" *J Hosp Infect*, **82**(1):19-24, 2012. doi: 10.1016/j.jhin.2012.06.007.
2. https://www.england.nhs.uk/publication/building-engineering-in-the-health-sector-htm-00/

Thermostatic tap HTM 04-01 — supplement D08, temperature testing procedure

HTM 04-01 — supplement D08 requires that TMVs have to be tested on commissioning and checked to ensure “that the water supplies to it are appropriate and that the valve has been adjusted to provide a mixed water at an appropriate temperature for the intended application of use. It also provides records of the thermal performance of the TMV.”

Testing should be conducted six to eight weeks after commissioning and 12 to 15 weeks after commissioning. If the TMV passes then the next test can be extended up to 12 months.

Step 1

Turn the tap on full.

Measure the temperature of the mixed water at the maximum available flow.

The maximum temperature should be 41° C.

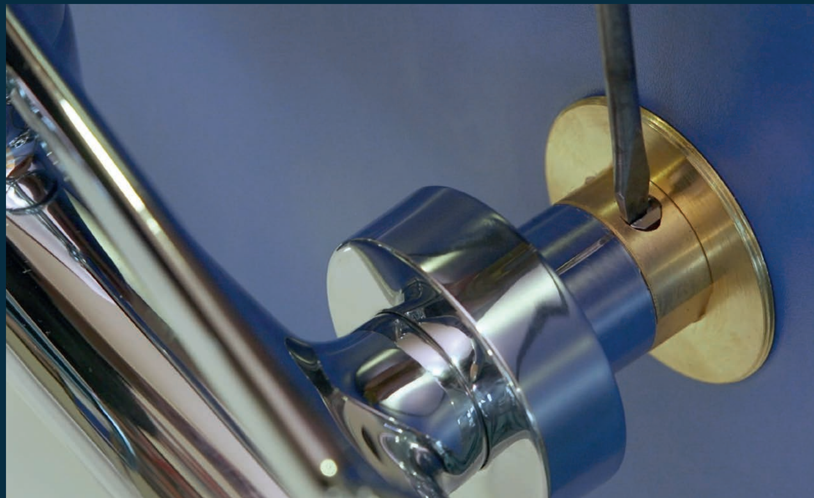
If the temperature is incorrect, you’ll need to adjust the device in accordance with the manufacturer's instructions.

Step 2

Isolate the cold water supply.

If there is no flow stream after 5 seconds you can restore the cold water supply, measure and take the temperature of the mixed water again after 15 seconds. If the water has deviated by more than 2° C then the tap has failed. The tap will require adjustment or service work.

If the tap is within 2° C of the original temperature then the tap has passed.



Step 3

If there is a flow stream of water after 5 seconds you need to collect the water from the tap for 60 seconds...

Step 4

Providing the water collected is less than 120 ml you can restore the cold water supply and after 1 second check the water temperature again.

If you collect more than 120 ml you will have to adjust the tap or service it according to the manufacturers instructions. You may also need to check supply conditions in terms of pressures and temperatures.

Latest Research

Front Microbiol.
2023, Jan 12; **13**:1091964. doi: 10.3389/fmicb.2022.1091964. PMID: 36713227; PMCID: PMC9879626.

Genomic characterisation and assessment of pathogenic potential of *Legionella* spp. isolates from environmental monitoring.

Svetlicic E *et al*

Several species in the genus *Legionella* are known to cause an acute pneumonia when the aerosols containing the bacteria from man-made water systems are inhaled. The disease is usually caused by *Legionella pneumophila*, but other species have been implicated in the infection. The disease is frequently manifested as an outbreak, which means several people are affected when exposed to the common source of *Legionella* contamination. Therefore environmental surveillance, which includes isolation and identification of *Legionella,* is performed routinely. However, usually no molecular or genome-based methods are employed in further characterisation of the isolates during routine environmental monitoring. During several years of such monitoring, isolates from different geographical locations were collected and 39 of them were sequenced by hybrid *de novo* approach utilising short and long sequencing reads. In addition, the isolates were typed by standard culture and MALDI-TOF method. The sequencing reads were assembled and annotated to produce high-quality genomes. By employing discriminatory genome typing, four potential new species in the *Legionella* genus were identified, which are yet to be biochemically and morphologically characterised. Moreover, functional annotations concerning virulence and antimicrobial resistance were performed on the sequenced genomes. The study contributes to the knowledge on little-known non-*pneumophila* species present in man-made water systems and establishes support for future genetic relatedness studies as well as understanding of their pathogenic potential.

Sci Rep.
2022 Dec 8;**12**(1):20493. doi: 10.1038/s41598-022-24686-5. PMID: 36481924; PMCID: PMC9732293.

Commercial toilets emit energetic and rapidly spreading aerosol plumes.

Crimaldi JP *et al*

Aerosols can transmit infectious diseases including SARS-CoV-2, influenza and norovirus. Flushed toilets emit aerosols that spread pathogens contained in faeces, but little is known about the spatiotemporal evolution of these plumes or the velocity fields that transport them. Using laser light to illuminate ejected aerosols we quantify the kinematics of plumes emanating from a commercial flushometer-type toilet and use the motion of aerosol particles to compute velocity fields of the associated flow. The toilet flush produces a strong chaotic jet with velocities exceeding 2 m/s; this jet transports aerosols to heights reaching 1.5 m within 8 seconds of initiating a flush. Quantifying toilet plumes and associated flow velocities provides a foundation for future design strategies to mitigate plume formation or to disinfect pathogens within it.

J R Coll Physicians Edinb.
2023, Jan 22; 14782715221145579. doi: 10.1177/14782715221145579. Epub ahead of print. PMID: 36683331.

The genus *Ralstonia*: The new kid on the block.

Rajni E *et al*

The genus *Ralstonia* comprises of aerobic, gram-negative, oxidase positive, non-fermentative, largely environmental organisms. They are an emerging pathogen in the hospital setting and are increasingly associated with opportunistic infections and outbreaks. We hereby present a case series of six patients diagnosed with bacteraemia caused by *Ralstonia* spp. and a brief review of literature. These cases highlight that isolation of a non-fermenting gram-negative bacillus from blood culture of a patient admitted in a critical care setting should not be ignored as mere contaminant. Clinicians and microbiologists need to work as a team to combat this novel bug.

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