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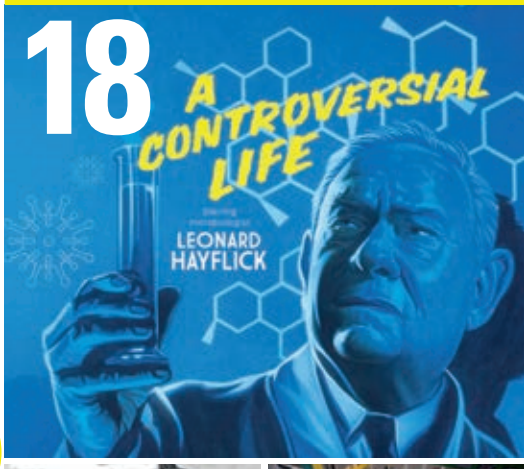

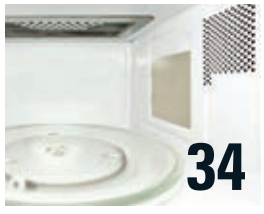

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PUBLISHED BY
Redactive Publishing Ltd
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+44 (0)20 7880 6200 redactive.co.uk

DISPLAY ADVERTISING
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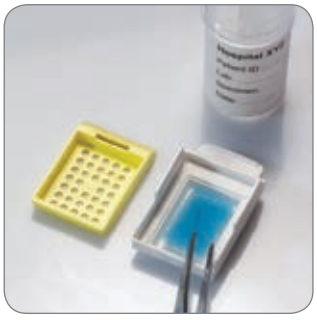

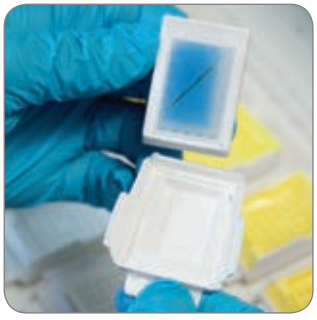

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REGULATION AND REFORM

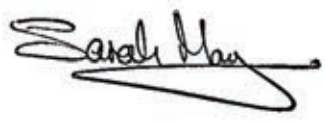
Regulation is set to see significant change, but what about organisational cultures?

At the time of writing this piece, the Nursing and Midwifery Council (NMC) has been heavily criticised by the Professional Standards Authority (PSA) through its "Lessons Learned Review" into the NMC's handling of concerns about midwives' fitness to practise at the Furness General Hospital.

I know it is coincidental, but following so soon after the Department of Health consultation on reform of the UK healthcare regulatory system, it adds weight to the view that there is a need for significant and effective regulatory reform. The consultation had already identified that the regulatory complaints system is slow, expensive, complicated, reactive and confusing for patients, professionals and employers. This has been dramatically demonstrated by the Furness General Hospital review that showed a length of eight years for some fitness-to-practise investigations and hearings to conclude.

Although this specific investigation focused on the NMC, I was unsurprised to see this had been preceded by a wider investigation into the midwifery unit at Furness General Hospital (the Kirkup report). This report had found multiple issues involving multiple staff groups, which together had created the perfect storm that allowed mistakes to happen and the causes to go unchallenged or even denied. In essence, a defensive and damaging culture whereby everyone loses, but particularly the patient. In reading this sorry review I was reminded of the Francis report into the Mid-Staffordshire NHS Foundation Trust.

I believe that the whole system of healthcare regulation will see significant change that will address issues of the nature identified in the PSA report, but I have greater concerns about the organisational cultures that allow these multi-factorial failings to occur in the first place. Every profession has its individual "bad eggs" and healthcare is no exception, but I do not believe that whole departments, or even whole hospitals, set out to neglect or harm patients. I believe that failure of this nature is the result of the pernicious creep of cuts and pressure on a workforce that is already overstretched. I accept the criticism of the NMC, but I suspect that its inefficient systems were also overloaded by the sheer volume of cases that were referred to it in the first place. This situation too is the product of overstretched managers and employers who, rather than address deficiencies locally, resort to the default action of referring to the regulator. For real change to occur there needs to be a change in individual recognition of responsibilities and this means individual professionals, employers and regulators together. However, that brings us back to the catch-22 of time and resources. I fear that this will not be the final time we hear of the catastrophic failings of an agency or employer.



Sarah May
Deputy Chief Executive

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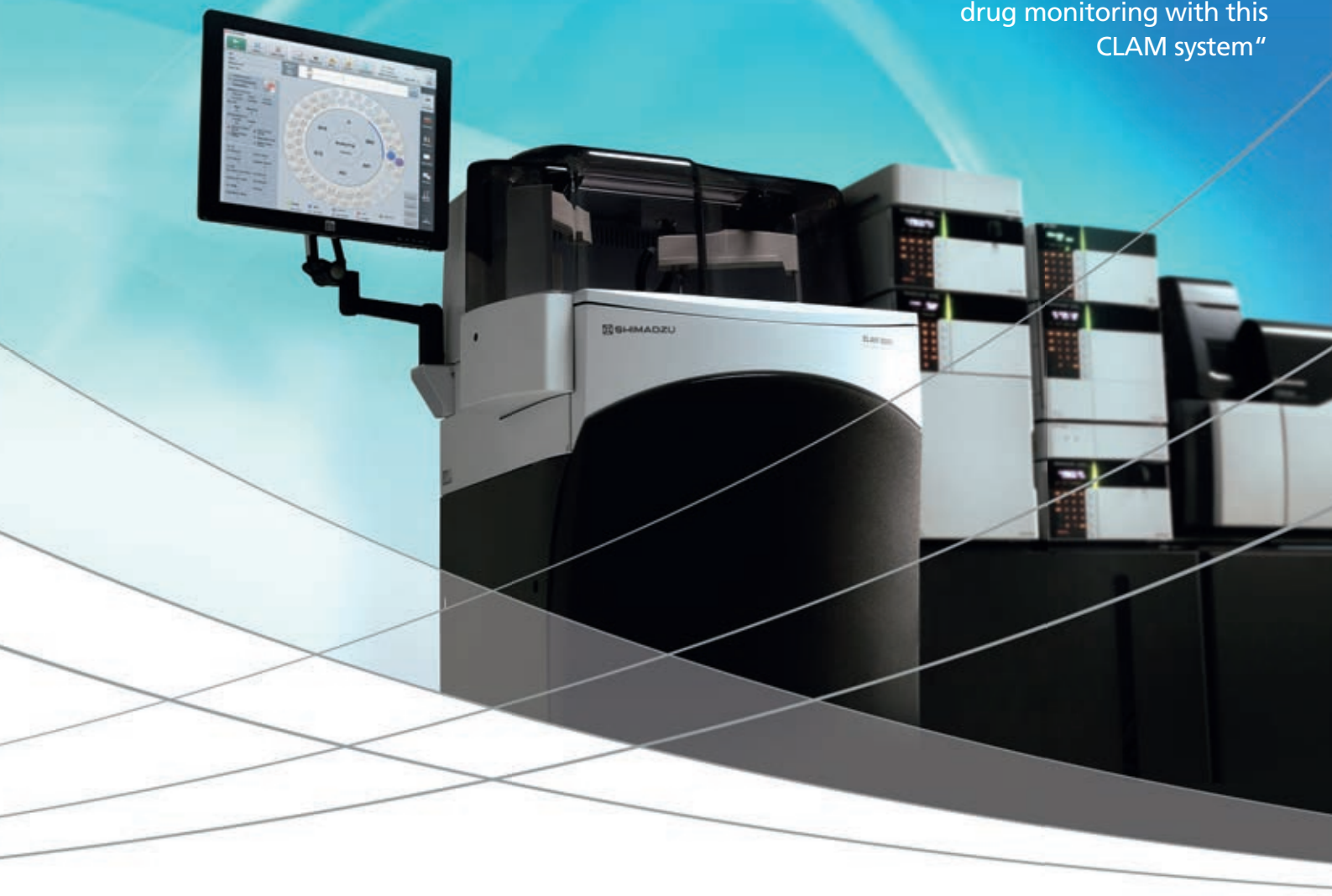

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SCIENCE NEWS IN NUMBERS

Would you help? A new poll from YouGov reveals the majority of the UK public are willing to help the NHS advance medical research and fight diseases of the future.

Are you willing to provide a blood sample to be part of a national DNA database for medical research?

YES **58%** NO **26%**

Are you willing to register as an organ donor for research purposes?

YES **57%** NO **22%**

Are you willing to allow the NHS to use your healthcare data for medical research?

YES **66%** NO **19%**

Sitting down: A Finnish study of 2,011 participants transitioning to retirement found the following increases in sedentary behaviour:

Total time sitting increased by 73 minutes a day

Television viewing time increased by 28 minutes a day

Computer use at home increased by 19 minutes a day

Other sitting time at home increased by 37 minutes a day.

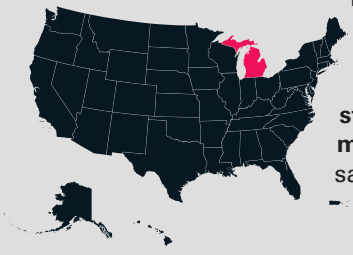
Preventing breast cancer

Six in seven women with a family history of breast cancer opt out of taking tamoxifen as a preventative measure.

The claim comes from a study funded by Cancer Research UK. Researchers asked 258 healthy women at **increased risk of the disease** whether they had agreed to take the drug to **help prevent breast cancer developing**. In total, **38 women had initiated tamoxifen treatment**. Women who had children were more likely to initiate **chemoprevention** than those without children – **17.6% compared with 3.8%**, respectively.

5 million

A fedr al lawsuit has been filed in the S agi nst the state of Michign on the behalf of parents who say the blood of their newborns was d awn and stored without proper consent.



More than **five million people born in Michigan** may have had their **blood stored by the state for medical research purposes,** says attorney Philip Ellison, representing nine children in the lawsuit.

SCIENCE NEWS

NICE GUIDELINES

New treatment to shrink prostate

A new treatment for non-cancerous enlargement of the prostate has been recommended for use by the NHS.

The National Institute for Health and Care Excellence has approved prostate artery embolisation (PAE).

The treatment blocks some of the blood supply to the prostate using tiny synthetic beads, causing the troublesome tissue to shrink and die.

It involves inserting hundreds of very small (0.2mm) plastic beads into a blood vessel in the groin and is carried out under local anaesthetic, with no overnight stay in hospital.

A total of 18 centres in the UK have already been offering the treatment as part of a trial.

In trials, PAE was compared to conventional prostate surgery and was found to be safe.

It also provided a clinically and statistically significant improvement in symptoms and quality of life for men with enlarged prostate.

Dr Nigel Hacking, Consultant Interventional Radiologist at University Hospital Southampton, said: "Results from the study show PAE can help large numbers of men suffering with the symptoms of an enlarged prostate. It is a good option for men who are not yet ready to undergo more invasive prostate surgery."

→ **bit.ly/BS_JuneNews01**

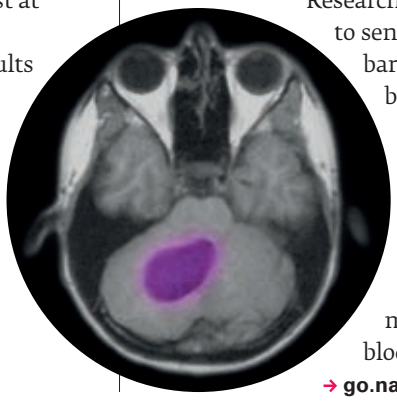
DETECTING BIOMARKERS

BLOOD TEST FOR BRAIN TUMOURS

US researchers are developing the means to detect tumour biomarkers through a simple blood test, avoiding invasive surgery.

A team of engineers, physicians and researchers has developed a groundbreaking, proof-of-concept technique.

It allows biomarkers from a brain tumour to pass through the tough blood-brain barrier into a patient's blood using non-invasive focused ultrasound and tiny bubbles, potentially eliminating the need for a surgical biopsy.



Researchers had previously learned how to send a drug through the blood-brain barrier into the brain via the bloodstream. But, until now, no one had found a way to release tumour-specific biomarkers – in this case, messenger RNA (mRNA) – from brain to blood.

Hong Chen, a biomedical engineer, said: "Our... technique may make it possible to perform a blood test for brain cancer patients."

→ **go.nature.com/2l999W4**

IMMUNOLOGY

NEW DELIVERY METHOD FOR IMMUNOTHERAPY COMBINATION

Using nanoparticles to bind molecules that can unleash and stimulate immune cells, US researchers found they could more effectively trigger the body's defence systems against cancer in laboratory studies.

The researchers believe that their findings offer a promising new nanotechnology-based delivery method for an immunotherapy combination.

Andrew Z Wang, Associate Professor at the University of North Carolina (UNC) School of Medicine, was one of the research team.

He said: "Our study suggests that if you're able to present two different therapeutics at the same time to immune cells to help them fight cancer, the effect is greater.

"It's difficult to deliver them at the same time unless you tie them together, and a nanoparticle is one great way to tie the two together."

T-cells can fight and kill tumours, but they have regulatory signals that limit their effectiveness.

Treatments called checkpoint inhibitors have been developed to "release the brakes" on immune cells, and have been shown to be a powerful tool to fight lung cancer and melanoma for a subset of patients. Clinical trials have been launched to test combining checkpoint inhibitors that release the immune system's brakes with treatments designed to send "green light" signals to boost the immune response.

UNC researchers developed a mechanism that combines these two compound types on a single nanoparticle with the goal of producing better results.

Their research has been published in the journal *Advanced Materials*.

→ **bit.ly/BS_JuneNews02**

IMAGES: SCIENCE PHOTO LIBRARY/ALAMY/ISTOCK/SHUTTERSTOCK

RISK FACTOR RESEARCH

DO PEOPLE KNOW WHAT CAUSES CANCER?

Using microwave ovens, drinking from plastic bottles and consuming food additives are causes of cancer, believe a "worrying" number of people.

The findings come from a survey in which 1,330 people in England were quizzed on risk factors.

The results show that 40% wrongly thought that stress and food additives caused cancer. One-third incorrectly believed that electromagnetic frequencies (35%) and eating genetically modified food (34%) were risk factors.

While 19% thought microwave ovens and 15% drinking from plastic bottles caused cancer, despite a lack of scientific evidence.

Researchers from University College London and the University of Leeds carried out the survey.

Samuel Smith, from the University of Leeds, said: "It's worrying to see so many people endorse risk factors for which there is no convincing evidence.

"Compared to past research, it appears the number of people believing in unproven causes of cancer has increased since the start of the century."

→ **bit.ly/BS_JuneNews03**

3D PRINTING

TACKLING ORAL INFECTIONS

Nearly twothir ds of the denturewear ing population suffer frequent fungal infections that cause inflammation, redness and swelling in the mouth.

To treat denturer elated stomatitis, researchers have turned to 3D printers to build dentures filled with microscopic capsules that periodically release amphotericin B, an antifungal medication.

The results of new research show the drugfi lled dentures can reduce fungal growth.

Unlike current treatment options – such as antiseptic mouthwashes – the new development can also help prevent infection while the dentures are in use.

Applications from this research could be applied to various other clinical therapies, including splints, stents, casts and prostheses, according to those behind the research team.

→ **bit.ly/BS_JuneNews04**

WHAT'S HOT AND WHAT'S NOT

HOT

MEDIEVAL REMEDIES

Diabetes UK is funding new research investigating whether medieval remedies can be used to treat foot ulcers.

HOT

MARS

Technology that was used to map the craters and dunes of Mars has been adapted to help scientists measure the effects of treatment on tumours.

HOT

BAKING SODA

A daily dose of baking soda may reduce the destructive inflammation of autoimmune diseases, claim US scientists.

NOT

MILKSHAKES

Four hours after drinking a milkshake, blood vessels are less able to relax, raising the risk of high blood pressure, according to new research.

NOT

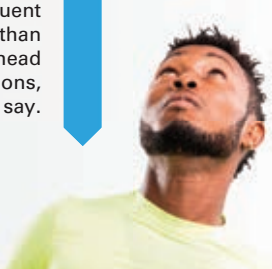
THE SUN

King's College London scientists say children may experience much more significant DNA damage from small amounts of sun than adults.

NOT

HEADING A BALL

Worse cognitive function in football players stems mainly from frequent ball heading, rather than unintentional head impacts due to collisions, researchers say.



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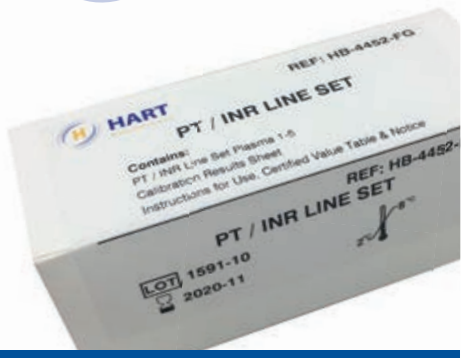

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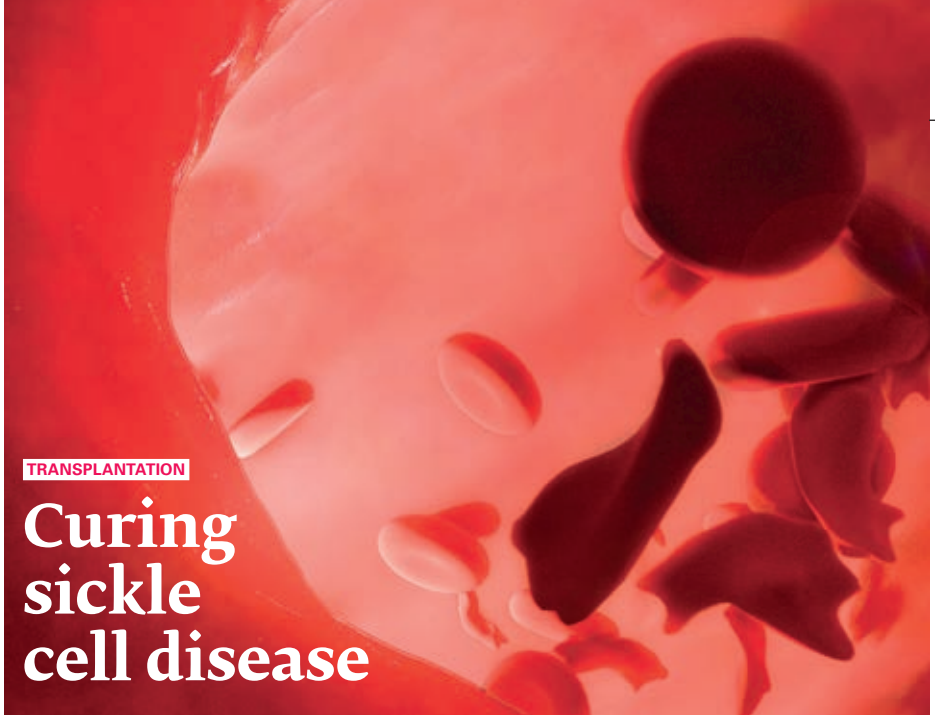

TRANSPLANTATION

Curing sickle cell disease

Doctors at the University of Illinois Hospital have cured seven adult patients of sickle cell disease.

They successfully used stem cells from donors previously thought to be incompatible, thanks to a new protocol.

With the protocol, patients with aggressive sickle cell disease can receive stem cells from family members if only half of their human leucocyte antigen (HLA) markers match.

Previously, donors had to be a family member with a full set of matching HLA markers, or a "fully matched" donor.

HLA markers are proteins on the surface of cells that help to regulate the immune system.

The human body uses these proteins to identify which cells belong in the body and which cells do not.

Because HLA markers are inherited from parents, family members are the most likely to have matching proteins.

In transplants, matching HLA markers between the patient and the donor helps to limit the risk that the body of the patient will reject the donor cells.

While doctors always try to find a closely matched donor for patients who need a stem cell transplant, only 20% of sickle cell patients have a family member with a full set of matching HLA markers.

By allowing for "half-matched" donors, the new treatment protocol, which uses only a small dose of chemotherapy, significantly increases the number of potential donors for each patient.

The doctors report on their new technique in the journal *Biology of Blood and Marrow Transplantation*.

→ **bit.ly/BS_JuneNews05**

NHS FINANCES

£50BN NEEDED FOR NHS

The NHS needs £50bn more in England by 2030, according to a former health minister and leading surgeon.

The prediction comes in a report from Lord Darzi, which has been supported by Labour and the Lib Dems.

It follows Prime Minister Theresa May revealing that the government is devising a long-term funding plan for the health service, which some expect to be unveiled during the 70th anniversary of the creation of the NHS in July.

Lord Darzi said:" While the prospect of a long-term funding settlement is welcome, it is vital that it delivers enough money to meet the demands of the decade ahead."

The report says the budget would need to grow to £173bn by 2030 to get back on track – and adds that significant improvements in productivity would be required, or the total bill would exceed £200bn. It also recommends another £10bn for social care.

→ **bit.ly/BS_JuneNews06**

UNDER THE MICROSCOPE

This month: Sweet wormwood

What is sweet wormwood?
Artemisia annua, also known as sweet wormwood, is a common type of wormwood that is native to temperate parts of Asia.

What else can you tell me?
It is hairless and grows up to 100cm tall. The leaves are 3-5cm long and are divided by deep cuts into two or three small leaflets.

Has this got anything to do with biomedical science?
Yes, I was just getting to that – it produces artemisinin, which is a potent antimalarial compound.

I'm a bit sceptical about herbal remedies...
Artemisinin was discovered in 1972 by Chinese scientist Tu Youyou, who was awarded half of the 2015 Nobel Prize in Physiology or Medicine for her discovery. Treatments that contain artemisinin derivatives are now standard worldwide for *P. falciparum* malaria.

And why is this in the news?
The low amount of artemisinin produced in the leaves of this plant does not meet global demand. But researchers in China have reported using a high-quality draft genome sequence of *Artemisia annua*, along with gene expression data, to engineer higher levels of artemisinin.

How much are we talking about?
The compound typically makes up a maximum of 1% of the weight of the dry leaves. However, the new leaves have an artemisinin level of 3.2%.

So what happens now?
Artemisinin-rich seed samples have been sent to Madagascar for a field trial. Meanwhile, the researchers from Shanghai Jiao Tong University, who published their findings in the journal *Molecular Plant*, are continuing to explore ways to enhance artemisinin production.

IMAGES: ISTOCK/SCIENCE PHOTO LIBRARY/ALAMY

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TECH NEWS

HART BIOLOGICALS

UNIVERSAL CALIBRATION SOLUTION

Hart Biologicals has consolidated its INR Correction Kit and ECAA PT/INR Line Plasma Set into a single product format.

This is part of the continued product improvement programme in order to better address the needs of the modern-day lab.

The new PT/INR Line Set is a replacement for the discontinued INR Correction Kit as a reformatted version of the ECAA PT/INR Line Plasma Set, for use as a 'universal' PT/INR calibration solution. The combined set will carry the following calibrations for use in INR correction purposes: plasma (rabbit brain); plasma (recombinant); whole blood (capillary and venous).

→ **hartbio.co.uk**

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NEW TESTS FOR ANALYSER

Radiometer is pleased to announce the commercial launch of its CE-marked point-of-care tests for creatinine and urea.

These are the latest additions to the ABL90 Flex Plus blood gas analyser's test menu.

The versatile ABL90 Flex Plus is the only compact blood gas analyser on the market to offer such an extensive range of critical care parameters – blood gas, electrolytes, metabolites and co-oximetry. It provides rapid analysis of 19 parameters from as little as 65µL of blood, with results available in just 35 seconds.

The addition of creatinine and urea to the ABL90 Flex Plus analyser's test menu makes this device ideal for point-of-care testing, providing fast results that allow clinical decisions to be made faster and more accurately.

→ **radiometer.co.uk**

MAST GROUP

CRYOBANK HAS ARRIVED

Mast Group is pleased to announce the arrival of the new cryobank.

It is based on a cryovial system that comprises chemically treated beads covered with a special cryogenic preserving solution.

Cryobank offers a reliable, convenient and versatile system for storing and preserving fastidious bacteria for long periods. It permits the easy establishment of a culture collection for laboratory accreditation or research purpose.

It is suitable for use in all laboratories dealing with bacteria, including clinical, water, brewing, veterinary, food, pharmaceutical, dairy and biotechnology. Among the features are barcoding for full traceability, stackable boxes and a simple-to-use procedure.

→ **mastgrp.comw**

THE BIG QUESTION

THIS MONTH WE ASK:

Has Modernising Scientific Careers (MSC) delivered what it promised?

Graham Wilson

Training Officer, Biochemistry
Gloucestershire Hospitals
NHS Foundation Trust

MSC programmes were initiated by the CSO to harmonise the registration and regulation of all clinical scientists across the NHS, reassuring the public of the quality of the clinical science workforce in areas where there was often no statutory regulation. They are rightly challenging clinically and academically but the rewards to the NHS are immense.

The innovative programmes up-skill the scientific workforce and provide routes to "Consultant Clinical Scientist" acknowledged by Medical Royal Colleges as equivalent to their medical counterparts. STP and HSST are helping to develop scientists to deliver 21st century diagnostic services and innovation. The Topol technology review is an example where visible scientific leadership will be required.

The training programmes provide opportunities across life sciences, but sadly there are areas where the buy-in isn't there – particularly cell sciences and haematology. Change is difficult for some and there has been resistance. Despite this, there are successful examples of scientists moving on to higher levels.

If I could change anything it would be for a higher level of engagement from all life science professionals and more support or less resistance from some professional bodies. I'm sure programmes will evolve, but there is no doubt in my mind that the programmes have and will continue to deliver, thanks to the many professionals supporting the delivery.

IMAGE: GETTY

Chris Murphy

Associate Dean, Faculty of Science and Engineering
University of Hull

For some areas, there have arguably been some successes, but concerning biomedical science, for me the answer is "no".

Attempting to get more recognition for healthcare scientists can only be viewed as a positive, but trying to treat this very varied group of workers as the same was, in my opinion, overly ambitious and a mistake.

At the time of its launch, biomedical scientists already had registered status and a clear and proven educational pathway to achieve this. MSC had nothing to offer the profession and for several years simply caused confusion. At the time, I was the programme leader of a very successful commissioned biomedical science degree course, which placed 30 to 35 students into laboratory placements with around 60% to 70% of these going on to become biomedical scientists. MSC halted this programme (and others) and set in place the Practitioner Training Programme.

Given my background, links with our placement providers and the desire to train future biomedical scientists, we set up a programme and worked hard to make it a success. Unfortunately (and we were not alone), despite our best efforts, we have withdrawn the programme after only three cohorts; the programme was not popular with students or laboratory staff and was resource-heavy. In conclusion, biomedical science didn't need MSC and, in the end, has managed very well despite it.

Andrew Usher

Laboratory Manager
Gloucestershire Hospitals
NHS Foundation Trust

MSC promised a new way of training and a career escalator. You could come in at the bottom and work your way up, but only for a few. Most of us working in labs haven't seen any real change. Trainees still come in with a biomedical science degree and gain registration. Despite promising change and a new career pathway, for the majority, the structures have been reinforced and the promised modernisation hasn't happened.

The promise of being able to reach consultant scientist – that hasn't been fulfilled

INTO THE DEEP

We talk to Professor **Simon Evetts**, Space Operations Director at Blue Abyss – a cutting-edge deep-sea and space extreme environment research centre.

Of all the impressive new high-tech research centres that are popping up around the world, the one that will occupy the old RAF Henlow site in the heart of the Bedfordshire countryside takes some beating.

Called Blue Abyss, it will be a training, research and development centre for exploring human and robotic reactions to the extreme environment of deep water and, by proxy, the weightless and airless conditions of space. Due to be operational by 2020, the centre hopes to draw work not just from the burgeoning commercial spaceflight sector, but also from offshore exploration and healthcare research.

The eye-catching centrepiece of Blue Abyss will be a 50-metre by 40-metre pool with multi-stepped depths. The platform at a depth of 12 metres will be able to host a mock section of space craft for astronaut training, while the deepest level will reach down to 50 metres, where the pressure will be five times the level at the surface. Overall, the pool will hold 42,000 cubic metres of water, making it, in terms of volume, the biggest facility of its kind in the world.

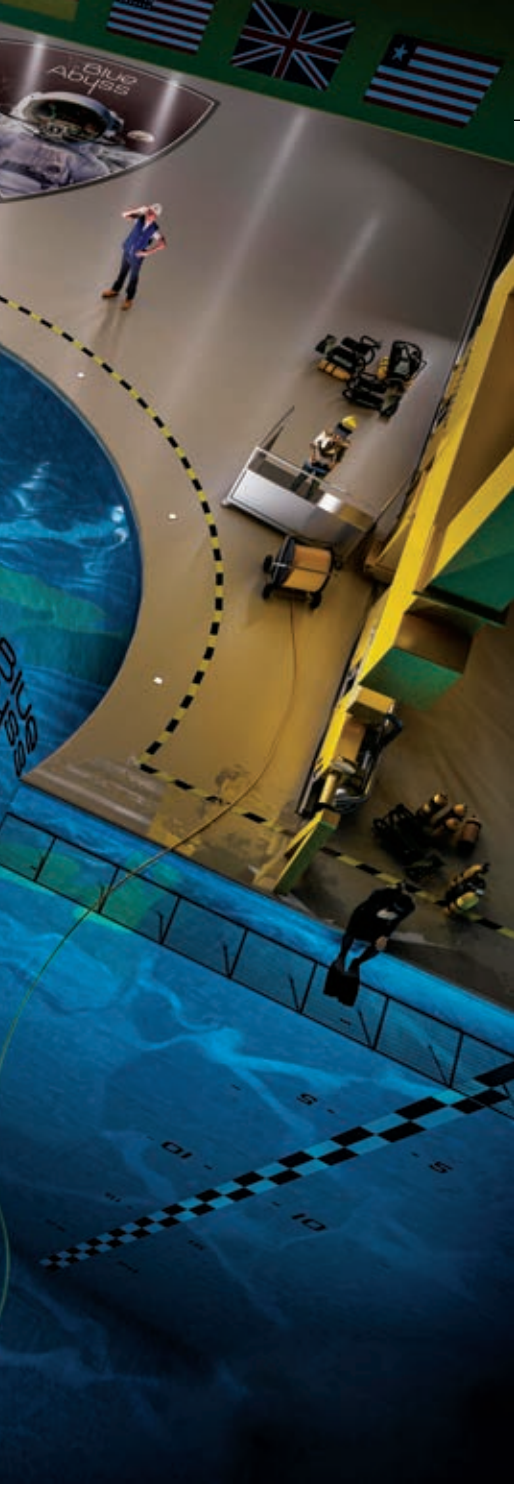
It will also have a sliding roof to allow training capsules to be winched into the pool, and it will be equipped with hypobaric and hyperbaric chambers, a microgravity suite, and a high-G centrifuge. In a nod to its intended status as a worldwide attraction, it will also have an on-site hotel. Discussions are already underway for developing similar centres in the US and Middle East.

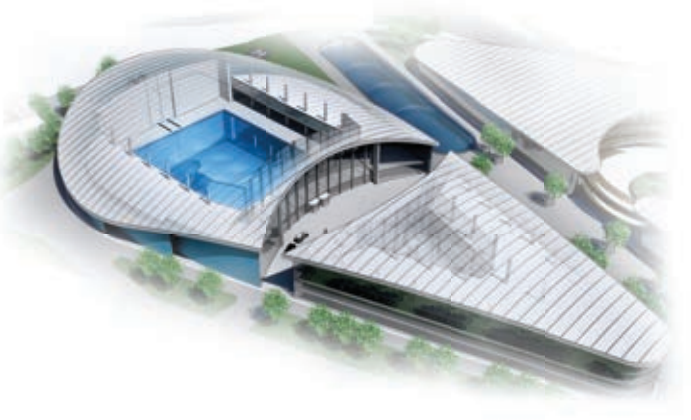
Ambitious project

Blue Abyss is the vision of John Vickers, a former soldier and management consultant. Raising the money for such a project is one thing, but his ambitions for the centre also rest on attracting top scientific talent, and among those he has signed up is Professor Simon Evetts.

Simon has a long and distinguished history in space biomedicine, so what was it that attracted him to the role of Space Operations Director for the project? "I had been working for the European Astronaut Centre in Cologne for the best part of a decade on astronaut health," he says, "and I was looking for the opportunity to come back to the UK and continue working in the field of human space flight. When I left 10 years ago, there wasn't really much going on, but when I heard from John Vickers, well, that brought me back."

For the past three years, Simon has been busy defining the space element of the Blue Abyss proposition, and helping to develop the blueprints for the services and





facilities that will enable agencies and companies to prepare people for travelling into space. He has also been exploring academic partnerships with a number of key universities, including Imperial College London and the Massachusetts Institute of Technology. But Blue Abyss is also reaching out beyond academia, and wants to connect with multiple sectors and disciplines. "We intend to be a melting pot," he says, "bringing in industry and research teams for sectors such as energy, defence, space and healthcare. We will help innovation happen."

IMAGES: BLUE ABYSS: CITYSCAPE DIGITAL

Life sciences

Once the centre opens and finds its feet, the part of his job that focuses on the facilities for space training will recede ("we will bring in astronauts who know much more about space than I do"), to be replaced by more in the way of pure research. "The research and development fields we want to pursue will encompass more or less anything related to extreme environments for human beings and robots, and even the machine-human interface," he says.

While he can't be more specific on the details of the research just yet, Simon is clear-eyed about what he wants it to achieve: "My research background is in space medicine and life sciences, and along the lines of understanding the de-conditioning processes that happen in the body, and how we rehabilitate or even prevent those processes. In space, people de-condition something like seven times faster than they do on Earth. It's not just our muscles, but lots of other physiological aspects. This is very closely related to the de-conditioning processes we encounter with ageing and sedentary lifestyles. If we can understand more about those de-conditioning factors, we are in a much better position to tackle them."

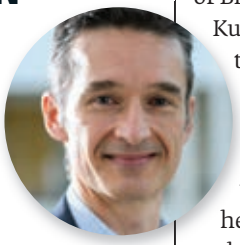
Weightless treatments

He continues: "In this way, we want as much of the research and development we do here at Blue Abyss into the effects of the space environment on the human body to translate outwards into healthcare on Earth."

To this end he wants to ensure that the centre has plenty of capacity to suspend human bodies in different ways and to replicate as far as possible the weightlessness that takes muscles and limbs out of their normal operational conditions. Also involved in this aspect of Blue Abyss's work is Professor Walter Kuehnegger, who prepared astronauts to walk on the moon for NASA's Apollo programme. "He really understands locomotion in a low-G environment," says Simon, "and has translated that from space to healthcare as an orthopaedic surgeon, and in providing new treatment for people with locomotive conditions."

But as the personnel and the ideas continue to solidify, the main job remains to get Blue Abyss open. "It will take a couple of years to get it built, and over the next 12 months we will be defining much more closely what we want in terms of research. It has been a very exciting first three years. Now I am looking forward to the next three years and beyond." BMS

ALL ABOUT SIMON



- ✔ Ran the multidisciplinary Medical Projects and Technology Unit at the European Astronaut Centre in Cologne, Germany.
- ✔ Developed space biomedicine at Wyle – NASA's main astronautics services provider.
- ✔ Visiting senior lecturer at King's College London; visiting professor at Northumbria University.
- ✔ Co-founder of the UK Space Life and Biomedical Sciences Association and the UK Space Environments Association.

AN EVIL MAN AND A THIEF, OR A PIONEER WORKING FOR A BETTER TOMORROW?

As he turns 90, **Leonard Hayflick** talks to **George F Winter** about his life.

Professor Leonard "Len" Hayflick was the first person to isolate *Mycoplasma pneumoniae*; the first person to develop cell strains of normal human fibroblasts; and in 2014 was co-recipient of the City of Philadelphia John Scott Award for his discoveries in ageing, an award "given to the most deserving men and women whose inventions have contributed in some outstanding way to the comfort, welfare and happiness of mankind".

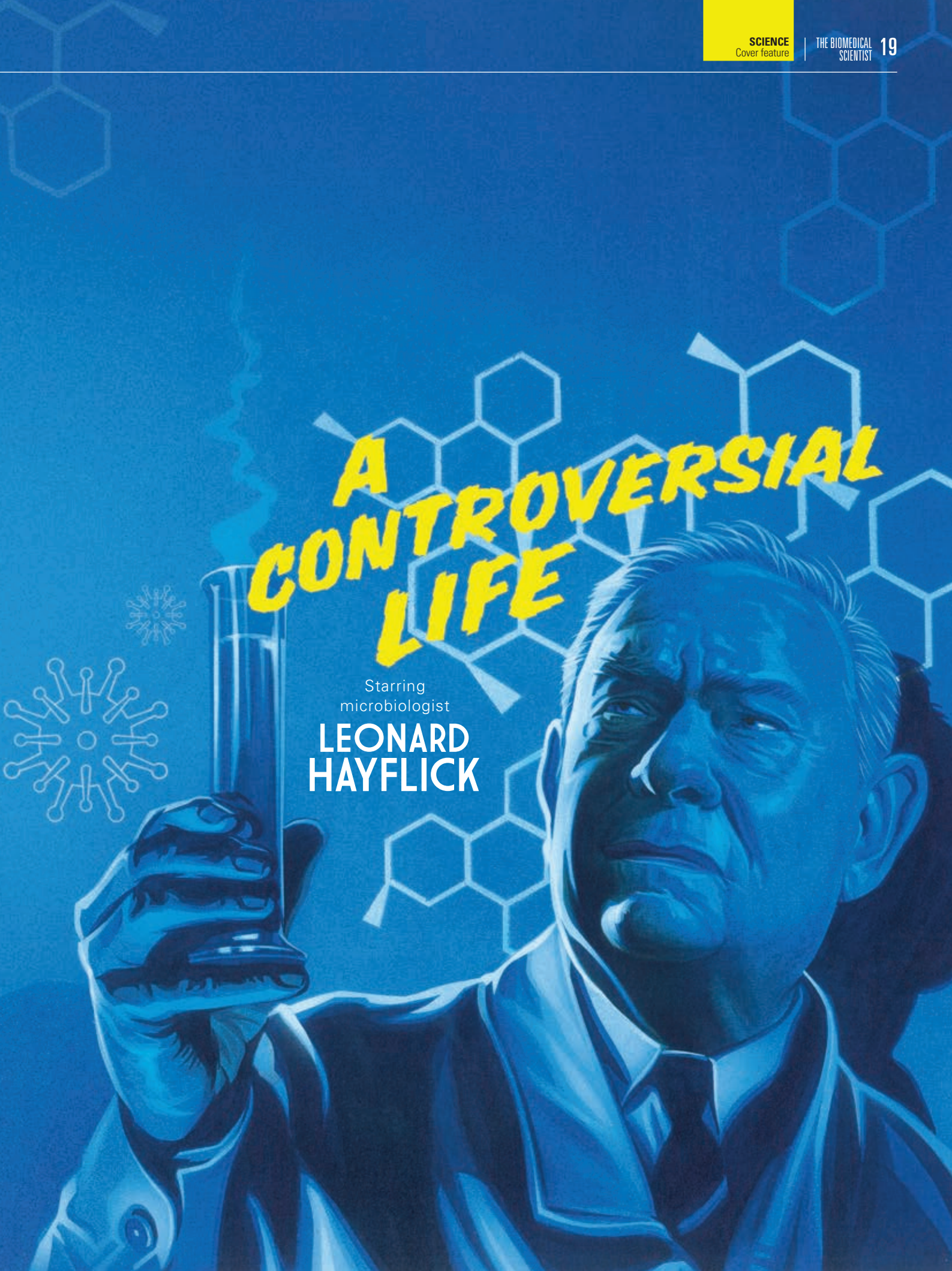
Yet Leonard Hayflick was described as "evil" by the Vatican.

Currently Professor of Anatomy at the University of California, San Francisco, Leonard celebrated his 90th birthday on 20 May this year. Here, he reflects on his life and times; from his early scientific development, to working in the "golden age of virology", to overthrowing dogma and courting controversy.

ILLUSTRATION: MARK THOMAS

Early days

"My sister and I were raised in a terraced house in Philadelphia, Pennsylvania, during the Great Depression, so times weren't easy. Aged nine, my scientific interest was aroused when an uncle bought me a chemistry set." With Leonard and a friend exploring the chemistry of explosives, they acquired sodium. "There was a concreted area behind our house with holes for clothes-drying racks," he recalls. "One rainy day


A CONTROVERSIAL LIFE
Starring microbiologist
LEONARD HAYFLICK

we threw small cubes of sodium into the holes. A minute later there was an explosion, and an orange flame shot out."

After high school, in January 1946, Leonard was accepted to study at the University of Pennsylvania, and after 18 months of army service he majored in microbiology.

University and the Wistar Institute

Leonard's career was shaped when his adviser at university, Warren Steinbring, took a course in cell culture at a hospital in New York State. "Under Steinbring I grew chick embryo tissue into which I introduced what at that time were called pleuropneumonia-like organisms (PPLOs). Today they're called mycoplasmas. As a master's degree student, I attended the Wistar Institute – on the University of Pennsylvania campus – the oldest biological research institute in the US. The Director was Hilary Koprowski – who I'd describe as a benevolent dictator – and it's a little-known fact that Koprowski was the first to produce and test a live poliovirus vaccine, contrary to the popular belief that it was Albert Sabin."

Gaining his doctorate in 1956, Leonard accepted a post at the University of Texas: "We travelled to Galveston, my wife pregnant with the first of our five children. I worked in the microbiology department with the renowned cell culturist Charles Pomerat, who pioneered time-lapse photography, and I also met a cytogeneticist called Paul Moorhead, who played an important role in my career."

Golden age of virology

In 1958, Leonard returned to the Wistar Institute, running its cell culture laboratory. "I entered the field when cell culture was enjoying a renaissance, with the subsequent decade often called the golden age of virology." Leonard's daughter played an important role too. "Because my laboratory was close to the University of Pennsylvania Hospital, where my wife gave birth to our third child, Susan, I arranged with the obstetrician to obtain the placenta and amnion, which I cultured. After several weeks I noticed that these normal amnion cells had converted to an immortal cell population. I named the cell line WISH (Wistar Institute Susan Hayflick), which became popular."

Human diploid cell lines

Now investigating the role of viruses in human cancers, Leonard sought normal human cells that could be cultured, and began working with aborted fetal tissue from the University of Pennsylvania Hospital, establishing a series of fetal diploid cell strains WI-1 to WI-25. The scientific dogma was that cultured cells, if properly treated, would replicate forever. But Leonard – now working again with Paul Moorhead – found that after about 50 population doublings, the cells replicated more slowly before stopping, having reached what is now known as the Hayflick Limit. "I discovered that, upon freezing, and after reconstitution, the normal human fetal cells retained their 'memory' of what population doubling level they had attained upon freezing and, when thawed months or years later, replication continued until the maximum total of about 50 population doublings was reached. This suggested that normal human cells have a mechanism for counting DNA replications, an idea later confirmed by the 2009 Nobel laureates, who discovered the molecular basis [telomere attrition] for my findings."

Overturning dogma

Would Leonard and Paul Moorhead confront established dogma? "Paul and I were young men, starting our careers. George Gey, the man who established the HeLa cell line, warned, 'Lenny, you're

Pictured: Leonard Hayflick holds a cell culture tube by a liquid nitrogen refrigerator in his lab at Stanford University, California, in November 1971.

IMAGE: GETTY

going to get yourself in a lot of trouble if you publish this.' Furthermore, the publicity-seeking surgeon Alexis Carrel, working at the Rockefeller Institute in New York, claimed he had cultured cells from a chick heart for almost forty years, contradicting my observations. But we thought that Carrel had erred."

Leonard played a masterstroke. "I contacted three top cell culture experts – including Harry Eagle, whose name is given to a widely used media formulation – and they agreed to grow my cells. After six months, they phoned: 'Len, the cultures you sent us have stopped dividing.' Well, I figured that if I'm wrong and go down in flames, I'll have important company."

Leonard and Paul submitted their paper to the *Journal of Experimental Medicine*, who rejected it, with future Nobel laureate Peyton Rous insisting that cells cultured properly *in vitro* would replicate indefinitely. "That was precisely the dogma we thought we'd torpedoed," recalls Leonard.

However, their paper was published, without alteration, in *Experimental Cell Research*, prompting a surge of interest in the biology of cellular ageing and becoming one of the most cited papers in biomedical science.

Then disaster. "My recollection," says Leonard, "is that while the paper was on press our electrical freezer failed, and we lost everything. So I started another cell population called WI-26, since the first 25 were named WI one through 25. The WI-26 cell line came from a male fetus and it was widely circulated, nationally and internationally." In 1962, Leonard, in collaboration with the UK's Common Cold Research Unit, described a new rhinovirus isolated in WI-26 cells.

Ageing

"The suggestion I made," recalls Leonard, "that the finite lifetime of cultured normal cells relates to ageing, was dismissed by many as foolish, but it's been confirmed thousands of times since, worldwide. The relationship that this work had to ageing was then picked up by many people worldwide. However, those working in the field of the biology of ageing in the 1960s were outside the scientific mainstream."

In 2007, Leonard referred to a prevailing belief that resolving age-associated diseases will advance our understanding of the fundamental ageing process. "It will not. The distinction between disease and ageing is also critical for establishing science policy because although policy makers understand that the funding of research on age-associated diseases is an unquestioned good, they must also understand that the resolution of age-associated diseases will not provide insights into understanding the fundamental biology of age changes."

Interestingly, with Leonard now aged 90, he revealed that his mother lived to the age of 106 years.

LEONARD HAYFLICK IN QUOTES

Because my laboratory was close to the hospital, where my wife gave birth to our third child, Susan, I arranged with the obstetrician to obtain the placenta and amnion, which I cultured.

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I put all my several hundred ampoules into a liquid nitrogen container and strapped it to the back seat of my Pontiac sedan. Two of my children sat next to it, and off we went to California.

Had I patented the cells, I might own the world's supply of WI-38, which would make me sufficiently wealthy to buy London, I think

Mycoplasma pneumoniae

With news of the sensitivity of Leonard's WI diploid cell strains to human viruses spreading, a researcher named Robert Chanock, at the National Institutes of Health (NIH), Bethesda, Maryland, visited the Wistar Institute and told him that Monroe Eaton was working at Harvard with his eponymous "Eaton agent", believing that it caused primary atypical pneumonia. "I said to Bob," Leonard remembers, "'have you and Eaton considered PPLOs?' And Bob said, 'What are they?' Well, he educated me about Eaton agent, I educated him about PPLOs and we decided that Bob would send me embryonated egg yolk in which this organism grew, and I would test it for mycoplasmas."

While Leonard was undertaking this work, his boss Hilary Koprowski appeared in the laboratory one day: "He was worried that I would spread mycoplasmas, and said 'Len, I didn't hire you to work on mycoplasmas. I hired you to work on cell cultures, and I'd appreciate it much if you stopped your *Mycoplasma* work.' I disobeyed him. My isolation and identification of the new *Mycoplasma* – *Mycoplasma pneumoniae* – was published in *Proceedings of the National Academy of Sciences* and because it was an important discovery, it made the front page of *The New York Times*."

WI-38 cell line

In 1962, following a legal abortion at a Swedish hospital, the lungs from a female fetus were flown from Stockholm to Leonard's laboratory, where he established the WI-38 cell line of the first "normal" human cells to provide licensed human virus vaccines against poliomyelitis, measles, mumps, rubella, varicella, shingles, adenovirus, rabies and hepatitis A.

His discovery happened to be made at the same time that primary monkey kidney cells used to manufacture poliomyelitis vaccines were found to be contaminated with simian viruses.

Last year, a report estimated that the number of cases treated or averted with WI-38-related vaccines was 4.5 billion globally. But in a letter from the Vatican dated 9 June 2005, Cardinal Elio Sgreccia questioned the ethics of parents using such vaccines on their children: "Would it not be a matter of true (and illicit) cooperation in evil, even though this evil was carried out 40 years ago?" In this context, it is perhaps noteworthy that the "evil" rubella vaccine has prevented many abortions worldwide.

Stakeholder controversy

But that was not the only controversial aspect of Leonard's WI-38s. "The cells," he says, "couldn't be patented because the patent laws in the US and most other countries prevented patenting of living materials. So I delivered ampoules of WI-38 worldwide freely to most virus vaccine manufacturers. For instance, I set up with Dr Frank Perkins in London a repository for WI-38s that I brought in a liquid nitrogen container on board an aircraft, which is impossible today. The aluminium vessel looked like a 500-pound bomb."

Meanwhile, Leonard was unaware that Koprowski had arranged with Wellcome Laboratories that in return for providing WI-38 cells, royalty payments would be made to support members of the Wistar Institute. "Technically I wasn't a full member of the Institute," notes Leonard, "so to learn that my efforts would yield returns only to full members of the Wistar and not to me was bothersome. I decided to leave, accepting a professorship at Stanford University, California."

But what about Leonard's WI-38 ampoules? "I decided to take all the ampoules to Stanford until this matter was resolved, so that all stakeholders could have a say. The stakeholders were Paul Moorhead; the Wistar; the WI-38 embryo's estate; myself; and although the government may have had a stake, that remained undetermined. It couldn't be a decision made to favour a single stakeholder, so I put all my several hundred ampoules into a liquid nitrogen container and strapped it to the back seat of my Pontiac sedan. Two of my children sat next to it, and the third in the front seat, and off we went to California."

Now charging the same amount as the American Type Culture Collection to ship WI-38s to scientists worldwide, Leonard's untouched "Cell Culture Fund" amounted to a total of $66,000 by the mid-1970s, when an accountant from the NIH, with no biomedical background, examined his documentation and accused Leonard of having stolen the WI-38s which the accountant said belonged to the federal government.

Following seven years of litigation, with Leonard's career on hold, an out-of-court settlement was reached. "The Cell Culture Fund, now worth $90,000, was awarded to me and it all went deservedly to my lawyers, and I became the sole scientist in the US legally entitled to ownership of the cells. Had I patented the cells, I might own the world's supply of WI-38, which would make me sufficiently wealthy to buy London, I think." BMS

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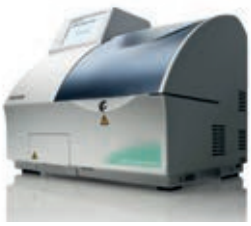

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A LIFE-THREATENING CONDITION

Clinical Scientist **Matthew Hopkins** gives a primer on fetal/neonatal alloimmune thrombocytopenia and the screening and treatment options available.

Fetal/neonatal alloimmune thrombocytopenia (FNAIT) is a rare but potentially life-threatening condition that can cause severe thrombocytopenia in the fetus *in utero*, or neonate postpartum. Intracranial haemorrhage (ICH), which can occur in 10-20% of cases, is the most damaging complication of FNAIT and can cause severe disability or even death.

Incidence in a Caucasian population is estimated to be 1:1000-1:5000 live births, although it appears to be under-diagnosed. The condition manifests due to fetomaternal incompatibility against human platelet antigens (HPA). That is, platelet-specific antigens inherited from the father that are absent in the mother cause an immune response generating maternally-derived antibodies (IgG) that can lead to destruction of fetal platelets. FNAIT can be considered the platelet equivalent of haemolytic disease of the fetus/newborn (HDFN) but, unlike HDFN, FNAIT can occur primigravidae due to transplacental passage of fetal platelets early in pregnancy. Maternal HPA alloantibodies are the most common cause of severe thrombocytopenia (<50x10^9/L) (normal range: 150-450x10^9/L) in an otherwise healthy neonate.

Human platelet antigens are localised to either platelet glycoproteins (GP)IIb/IIIa, GPIa/IIa, GPIb/IX/V or to GPI-linked anchor membrane molecule CD109. Most alloantigens are bi-allelic and result from single nucleotide polymorphisms (SNP) (see Table 1).

A diagnosis of FNAIT is confirmed serologically by detection of maternally derived alloantibodies in an alloantigen-negative mother, where the child has inherited the cognate alloantigen from the father. Antibodies directed to HPA-1a and HPA-5b are responsible for approximately 95% of serologically confirmed cases of FNAIT in a Caucasian population; alloantibodies to HPA-1a are implicated in

Antigen	Location	Nucleotide change	Amino acid change	Phenotype frequency % Caucasoid pop.
1a	GPIIIa	T196	Leucine33	97.9
1b		C196	Proline33	28.8
2a	GPIbα	C524	Threonine145	>99.9
2b		T524	Methionine145	13.2
3a	GPIIb	T2622	Isoleucine843	80.95
3b		G2622	Serine843	69.8
4a	GPIIIa	G526	Arginine143	>99.9
4b		A526	Glutamine143	<0.1
5a	GPIa	G1648	Glutamic acid505	99.0
5b		A1648	Lysine505	19.7
6a	GPIIIa	G1564	Arginine489	>99.0
6b		A1564	Glutamine489	0.7
9a	GPIIb	G2603	Valine837	>99.0
9b		A2603	Methionine837	0.6
15a	CD109	C2108	Tyrosine703	35.0
15b		A2108	Serine703	23.0

Table 1. Common HPA polymorphisms

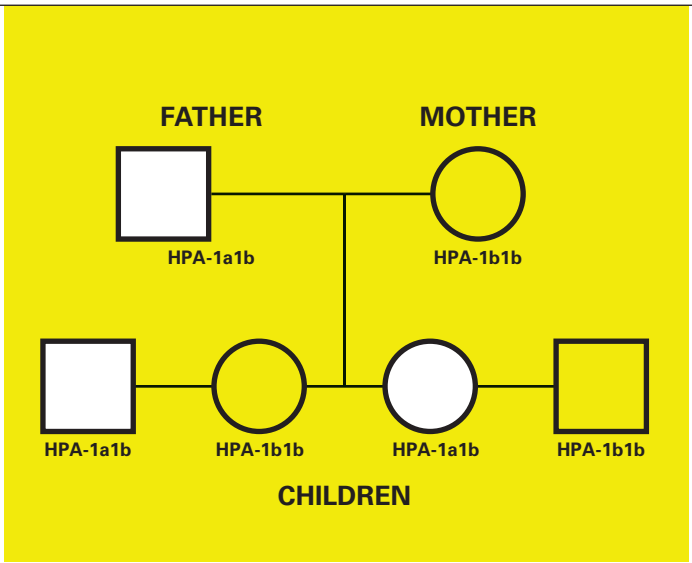

Figure 1. In this example, the mother is HPA-1b1b and the father is HPA-1a1b. The children may be either HPA-1a1b or HPA-1b1b depending on whether the baby inherits HPA-1a or HPA-1b from the father. There is a 50% chance that a child will inherit HPA-1a and be at risk of FNAIT.

approximately 80% of these cases and 15% are due to HPA-5b alloantibodies.

Currently, 29 different HPA polymorphisms have been described; however, alloantibodies to HPAs that are not HPA-1 to -5 or HPA-15 are rare, often appearing within a single family (low frequency antigens). The rarity of these alloantigens means that testing is not performed routinely, but can be identified by cross-matching paternal platelets with maternal serum if there is a strong clinical suspicion of FNAIT.

Laboratory testing

The Histocompatibility and Immunogenetics (H&I) laboratory at NHSBT Filton is an international reference centre for platelet and granulocyte immunology testing. The laboratory provides specialist tests for the detection and identification of platelet-specific antibodies. The standard testing protocol in our laboratory comprises two "in-house" assays: the platelet immunofluorescence test (PIFT) and monoclonal immobilisation of platelet antigens (MAIPA), using suitably HPA typed platelet donor cell panels (HPA-1, 2, 3, 5 and 15).

The PIFT uses a flow cytometric end point to detect bound antibodies (IgG) to the platelet membrane. This test can detect both HPA-specific and non-specific antibodies. The MAIPA is a sandwich enzyme-linked immunosorbent assay (ELISA) that uses glycoprotein-specific mouse monoclonal antibodies to capture fragments of platelet membrane expressing HPA epitopes.

Bound human IgG is visualised using a horseradish peroxidase-conjugated immunoglobulin that reacts with its substrate, promoting a colour change within the microplate. This colour change is analysed in order to visualise HPA-specific antibodies. Testing can be further augmented, if required, by the use of a bead-based assay (Immucor, Norcross, GA) which utilises Luminex x-map technology. The assay uses polystyrene beads coated with HPA antigens as a target. Anti-human IgG conjugated with a fluorochrome is used to identify if platelet-specific antibodies are present.

Additionally, the parents and infant (if available) are HPA genotyped by amplifying DNA using polymerase chain reaction-sequence based typing (PCR-SBT) with "in-house" HPA-1-6, -9, and -15 primers. Identifying the zygosity of the father can aid in predicting FNAIT risk (see Figure 1).

Treatment options

Since FNAIT can occur in first pregnancies, it is often identified post-delivery, usually presenting with a low platelet count with or without external petechiae/purpura, or bleeding. A platelet count should be performed and if severe isolated thrombocytopenia is evident ($<50x10^9$/L) in an otherwise healthy neonate, then FNAIT should be suspected and investigated. Platelet support for the neonate should not be delayed while waiting for confirmation from laboratory tests.

The 2013 *Guidelines for the Blood Transfusion Services in the UK* advises that neonatal platelet counts should be maintained above $30x10^9$/L or $100x10^9$/L if intracranial haemorrhage (ICH) is evident. NHSBT provides specialist stock of "on-the-shelf" neonatal platelet components which are phenotypically HPA-1a(-) -5b(-). These products are held in strategically placed holding centres throughout England and should be effective in 95% of FNAIT cases due to the prevalence of HPA-1a and HPA-5b antibodies. In subsequent pregnancies for women who are alloimmunised, FNAIT can often be more severe. These pregnancies are closely monitored by regular ultrasounds for any signs of fetal abnormalities, such as ICH or ventriculomegaly that might indicate thrombocytopenia. The mother will also be screened regularly throughout her pregnancy. Fetal HPA genotyping from amniotic fluid can also be performed to confirm whether the antigen has been inherited from the father and thus calculate the risk of FNAIT. First-line antenatal treatment for mothers who are alloimmunised is intravenous immunoglobulin G (IvIgG) (1g/kg body weight at weekly intervals) usually used in isolation or in conjunction with corticosteroids.

Intrauterine transfusion (IUT) of HPA-1a(-) -5b(-) platelet hyperconcentrates can be given while fetal blood sampling is performed. These products only have a shelf life of 24 hours and the laboratory requires at least one week's notice in order to arrange a suitable blood donor to provide this product. Due to a high risk of fetal morbidity and mortality, this treatment option should only be considered if the first-line treatment therapy fails. BMS

Matthew Hopkins is a Clinical Scientist working in Histocompatibility and Immunogenetics at NHS Blood and Transplant, Filton.

To see the article with full references, visit **thebiomedicalscientist.net**

TROPICAL MEDICINE THROUGH THE AGES

Stephen Mortlock goes global and analyses the rich history of tropical medicine.

"All nature is alive and seems to be gathering all her entomological hosts to eat you up as you are standing out of your coat, waistcoat and breeches. Such are the tropics."

The Nautical Magazine (1857). CR Maclean

International travel is not only increasing but is often to more exotic destinations for those travellers who want to challenge themselves. Unfortunately, depending on the travel destination, travellers may be exposed to a number of infectious diseases that they may not have encountered before. Of course the risk of becoming infected will vary according to the purpose of the trip and the itinerary within the area, the standards of accommodation, hygiene and sanitation, as well as the behaviour of the traveller. Travel to exotic countries with associated illness is not a new phenomenon.

When Alexander the Great crossed the Beas River in 327 BC and entered India, his army, already reduced from a mainly Greek army to a mixed bag of mercenaries of different nationalities, was stricken with many new diseases, including smallpox. According to contemporary records Alexander was able to employ local doctors and healers who were experts in these diseases to treat his men many of whom returned to Greece with the army to continue their work. Certainly, during this time Hindu medicine was at its zenith and there is unmistakable evidence in the works of the great scholars like Dioscorides (40–90 AD) of the influence of Ayurvedic medicine. But by the end of the campaign the fighting and the diseases took their toll and the army that returned to Greece was only a few hundred men.

The Middle Ages

By the end of the 11th century, Western Europe still lagged behind other Mediterranean civilisations, such as that

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Previous page. The phalanx attacking in the Battle of the Hydaspes, by André Castaigne
Left. The Battle at Ptolemais – Turkish cavalry attacks the vanguard of the army of Hugh III, King of Cyprus, August 1268.

IMAGES: ALAMY/ISTOCK

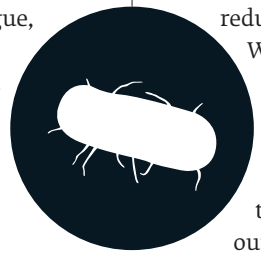
Crusaders brought back with them leprosy (Mycobacterium leprae), considered to be an expression of the wrath of God

of the Byzantine Empire (formerly the eastern half of the Roman Empire) and the Islamic Empires of the Middle East and North Africa in many aspects. In 1095, Pope Urban II called on Western Christians to take up arms to aid the Byzantines and recapture the Holy Land from Muslim control. This marked the beginning of 200 years of the Crusades and started a mass migration of tens of thousands of people from Europe to the eastern Mediterranean.

The overland and sea journeys were hazardous themselves, which could lead to malnutrition, frostbite and drowning but the travellers would also encounter new diseases for which they had little knowledge such as trachoma, schistosomiasis and dracunculiasis, all of which were probably endemic in the area. Also, for a medieval army it must have been very difficult to maintain personal hygiene or eat an adequate diet and chronicles suggest epidemics of scurvy, dysentery and fevers in army encampments. A disease that returning Crusaders brought back with them was leprosy (*Mycobacterium leprae*), considered to be an expression of the wrath of God and the sufferers were often left to the ministrations of priests and monks. Segregation was thrust upon those suffering from the disease and the sick, already regarded as dead, were often cast out of the cities and forbidden to mingle with the healthy folk. In consequence, thousands appear to have died from such diseases during and following the Crusades.

Europeans were a comparatively backward people and isolated from the world around them compared to other civilisations of this time, like the Muslim civilisations and the Chinese. But the Crusades encouraged the Europeans to interact and trade with these new countries. This brought many things into Europe like silks, spices and also, unfortunately, the bubonic plague, or Black Death. It is believed that the Black Death originated in central China in 1333 as the population succumbed to starvation, but new research shows that it probably began in the spring of 1346 in the Steppe region, where a plague reservoir stretches from the north-western shores of the Caspian Sea into southern Russia. People occasionally contract plague there even today. At this time China was one of the busiest of the world's trading nations and it did not take long for the outbreak to spread to western Asia and Europe. In October 1347, several Italian merchant ships returned from a trip to the Black Sea, one of the key links in trade with China. When the ships docked in Sicily, many of those on board were already dying of plague. Within days the disease spread to the city and the surrounding countryside. The chronicler Agnolo di Tura relates from his Tuscan home town that "in many places in Siena great pits were dug and piled deep with the multitude of dead [...] And there were also those who were so sparsely covered with earth that the dogs dragged them forth and devoured many bodies throughout the city".

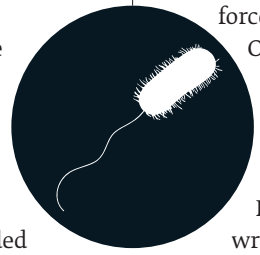
He lost his wife Niccoluccia and his five children in the plague outbreak. Before long the plague was spreading across Europe reaching London by November 1348. The following February, 200 people were being buried every day in the plague pits of Bishopsgate and East Smithfield. Joan (or Joanna), the daughter of King Edward III, died of the plague in Bordeaux on her way to marry Don Pedro, heir to the throne of Castille. During the 1300s and 1400s Europe was hit very hard with plague outbreaks and as many as 33% of Europe's population died. This depopulation started to cause a social change in many countries. With all the deaths much of the farmland went into disuse and the farm animals died, reducing the output of food. In Western Europe, with fewer people to work the land, the demand for labour increased, as did the wages. Landlords in need of people to work their lands began renting out their land to peasants for



sharecropping, and great estates were being replaced by small farms. In cities, workers rose against the wealthy merchants who had been running the city halls for better pay and working conditions. Peasants and workers revolted in Spain, The Netherlands, southern Germany, Italy, and ultimately, in England, the Peasants Revolt of 1381.

European expansion

It was the continued European exploration and early settlement from the 15th and 16th centuries that started physicians investigating those diseases that occur in countries with tropical or subtropical climates. When Hernando Cortes (1485-1547) and his army conquered Mexico in 1519, there were roughly about 25 million people living in the area. A hundred years later, after a series of epidemics decimated the local population, perhaps as few as 1.2 million natives survived. Records show that there were smallpox epidemics in 1519 and 1520, immediately after the Europeans arrived, killing between five and eight million people. But the diaries kept by Francisco Hernandez (1514-1587), the surgeon general of New Spain, described a highly-contagious and deadly epidemic in 1576 that killed the infected person within days. The disease caused raging fevers, jaundice, tremors, dysentery, abdominal and chest pains, enormous thirst, delirium and seizures. "Blood flowed from the ears," the physician observed, "and in many cases blood truly gushed from the nose." These symptoms are not indicative of smallpox or any other known European disease but are more like those of a haemorrhagic fever. The Spanish army was unlikely to have brought it with them, so it is probably safe to assume that it was already in the country. So did the Spanish themselves fall ill with the same disease? Spanish conquistadors, missionaries and writers recorded the presence of yellow fever, malaria and cholera in the Americas long before their arrival, certainly translations of pre-Columbian records by Martín de la Cruz and Bernardino de Sahagún seem to suggest that the Aztecs were stricken with many diseases including syphilis, tuberculosis, typhus and other rickettsial infections. The Spanish arrival certainly brought exposure to new diseases like smallpox, influenza, measles and, much later, cholera, which may have overshadowed the persistent mortality by endemic infectious diseases already present in the country.



Infectious and tropical diseases have been a problem for military expeditionary forces ever since the Crusades. Outbreaks were especially common on British Navy ships from the 16th to 18th centuries due to poor living conditions and travel to the tropics. Dr Henry Marshall (1775-1851) wrote extensively in the post-Waterloo era about the health of soldiers, he began his service career as a surgeon's mate in the Royal Navy, then transferred to the 89th (Princess Victoria's) Regiment of Foot, which participated in expeditions to Cape Town, Buenos Aires and Colombo. While in the East Indies, Marshall accumulated detailed records about the incidence of mortality in the troops resulting from disease in the tropics, Marshall studied the medical history of the 40,000 British troops who participated in the ill-fated Walcheren expedition (1809) to the Dutch coast during the Napoleonic Wars. He noted that sickness rates varied considerably from regiment to regiment and he asked: "What can have been the cause why some corps on the same service and exposed to the same climate suffered so much more than others did?" In a commentary Marshall wrote: "We dread, and justly dread, the influence of epidemics, such as the plague and cholera, while we submit with apparent indifference to the perennial consequences of malaria in unhealthy localities." In 1817-18, in an effort to provide relief to the many unemployed and distressed mariners who were found in large numbers in London, the Seamen's Hospital Society (SHS) was formed with an emphasis on the management of illnesses (especially fevers), which were introduced into the city from tropical and subtropical countries. A series of ships, HMS Grampus, HMS Dreadnought and HMS Caledonia (later renamed the Dreadnought) were commissioned to establish permanent floating hospitals on the Thames for the exclusive use of sick mariners. Although they served a very valuable function, there were major practical problems: ventilation was poor, and there was nosocomial spread of disease; lack of light was a major drawback during the winter months, and other problems which were associated with being situated in the midst of an extremely busy part of quite a polluted

THE PLAGUE IN NUMBERS

1333-1346

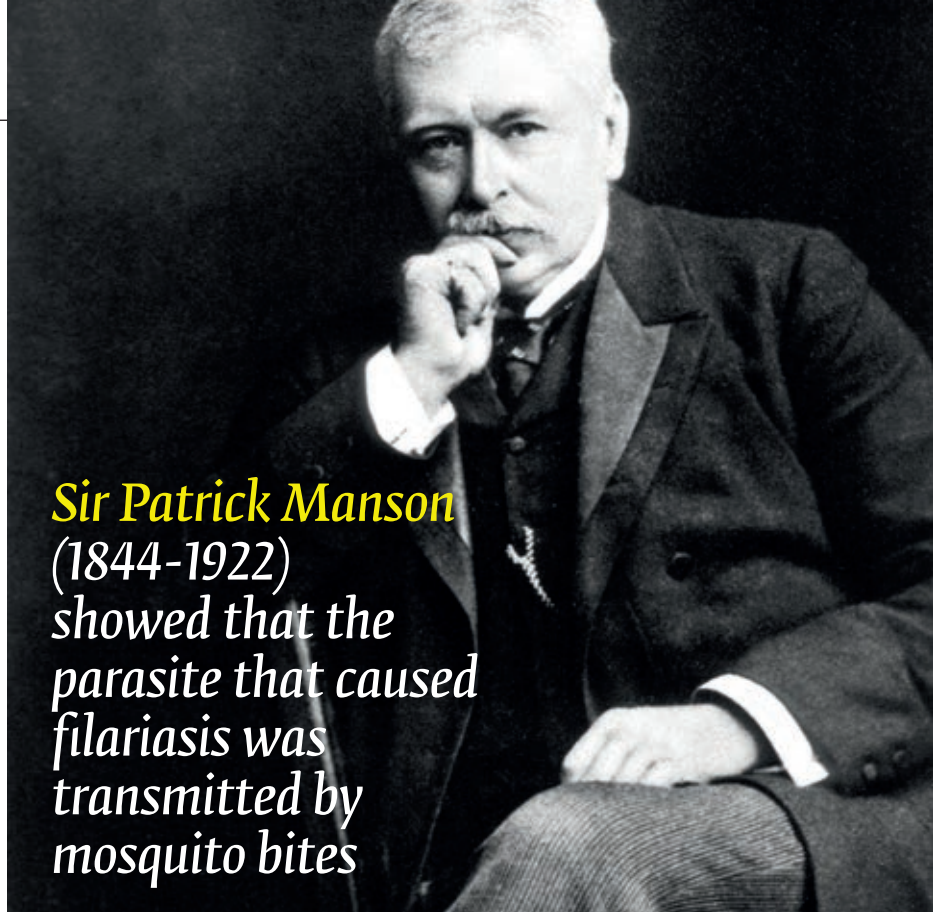
The period in which the plague originated.

200

The number of people buried per day in Bishopsgate and East Smithfield during the plague.

33%

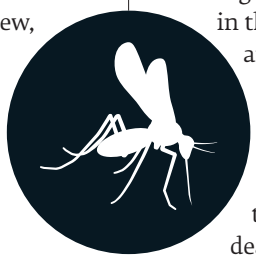
of Europe's population is estimated to have died due to the plague.



Sir Patrick Manson (1844-1922) showed that the parasite that caused filariasis was transmitted by mosquito bites

river. In 1832, John Lydekker (1778-1832), a member of Lloyds and prominent ship owner suddenly died of cholera, and he left the SHS nearly £60,000 (about £5m today) which led to a successful approach to Parliament for an Act of Incorporation (1833); this gave greater legal status to the organisation and conferred a number of additional rights on the SHS. In 1870, the Commissioners of the Admiralty granted the SHS a 99-year lease of the infirmary (and adjoining Somerset ward) of the Royal Hospital, Greenwich in lieu of the loan of the ship(s). This offer was initially made because they felt that the number of pensioners residing in the hospital was declining to low numbers during the peaceful years following the battle of Waterloo in 1815. Unfortunately, these numbers began to increase following outbreaks of infectious and tropical diseases that occurred in the Army during the Crimean and Boer Wars and the colonial era. Tropical medicine itself emerged as a new disciplinary field at the beginning of the 20th century and was deeply involved in the political and social aspects of the European empires. Europeans, especially soldiers, public servants and officials, were moving to the tropics, where the contraction of a life-threatening disease was a real danger. And this led to improved healthcare, which included the provision of hospitals and efforts to control tropical diseases by the draining of swamps and other mosquito-breeding areas. These and other environmental measures were among the most effective available, although these were initially for the military, they expanded to include expatriates and finally for the indigenous population.

From the scientific point of view, knowledge about tropical diseases became defined, both from an aetiological perspective and with respect to their transmission mechanisms, through the work of Alphonse Laveran (1845-1922) and his discoveries of parasitic protozoans as causative agents of diseases, such as malaria and trypanosomiasis, and Sir Patrick Manson (1844-1922), who showed that the parasite that caused filariasis was transmitted by mosquito bites. Other tropical diseases were also soon shown to be spread by mosquitoes, including yellow fever. Within a few years the role of the tsetse fly in transmitting sleeping sickness, the sand fly in kala-azar, the rat flea in plague, the body louse in epidemic typhus, and the snail in spreading schistosomiasis were also discovered.



Conclusions

Although Europeans were responsible for introducing new diseases to countries where they had never been prevalent causing massive death and morbidity there is another side to the story, the effects of indigenous diseases on foreign invaders and traders. Stories of invading forces being overcome by mysterious diseases go back to biblical times and in the writings of Greek, Roman and Persian physicians, but become more common and reliable with the advent of European explorations. All colonial powers experienced the same problems, excess deaths among their troops, civil servants and traders. At first these deaths were attributed to the climate and the inability of Europeans to survive in the tropics, but this changed as a result of scientific advances during the second half of the 19th century when it became apparent that these diseases were caused by infectious organisms, and that mosquitoes and other insects could transmit diseases. This knowledge led to the development of drugs, vaccines and methods of insect control and on disease control programmes. In 1898, the SHS Committee of Management received a letter from the Colonial Office requesting the formation of a School of Tropical Medicine; it said: "At present the newly appointed medical officers receive no special training in the diagnosis and treatment of tropical diseases before they proceed to West Africa, [...] and that the experience and training to be obtained at the Seamen's Hospital would be the most suitable in the present instance." It was against this background that the Royal Society of Tropical Medicine and Hygiene and other similar societies around the world came into existence. BMS

Dr Stephen Mortlock is Pathology Manager at the Nuffield Health Guildford Hospital.
To see the article with full references, visit **thebiomedicalscientist.net**

Using PCR to Diagnose Aspergillus: A Change in Clinical Practice

Invasive aspergillosis (IA) is a life-threatening Invasive Fungal Disease (IFD) affecting immunocompromised patients. Aspergillus spores are common throughout the environment and with the capacity to invade via the lung, cause a spectrum of disease. IA is difficult to diagnose, as symptoms are non-specific and the sensitivity of traditional techniques – such as respiratory culture – is poor and slow. Delayed diagnosis leads to an increased morbidity and mortality rate, highlighting the urgent requirement for a rapid, sensitive diagnostic method.

Current clinical practice

Due to the constraints of current diagnostic strategies, clinicians rely on prophylaxis and empiric antifungal therapy to manage patients at risk of, or with suspected, IA. Prophylaxis is used as a preventative measure for high risk, non-symptomatic patients, while empirical treatment is given to patients based on non-specific clinical signs of infection (i.e. antibiotic refractory fever). Both methods are costly, and broad use of antifungal drugs may lead to side-effects.

Polymerase chain reaction (PCR) assays (such as Bruker's Fungiplex® Aspergillus IVD PCR), which target pathogenic DNA, can be used in the systematic testing of high-risk patients to support early detection of invasive aspergillosis (see Figure 1). By including PCR in surveillance biomarker testing strategies, patients can be monitored for the early signs of infection; minimising the use of empiric therapy and reducing the cost of care with no adverse effect on patient outcomes.

Overcoming the barriers to change

The widespread adoption of Aspergillus PCR into clinical practice has previously been hindered by a lack of standardisation and commercially available tests. Clinicians are often concerned by the risk of a false negative result from a diagnostic test, and this has led to over-prescribing of antifungal drugs. However, results from a specialist laboratory in Wales support the use of systematic PCR testing for the management of patients at-risk of IA. The high sensitivity of PCR, in combination with other biomarkers, allows negative test results to rule out IA diagnosis – thereby enabling a reduction in antifungal treatment, which patients may have been receiving unnecessarily.

The Regional Mycology Reference Laboratory, Public Health Wales, Cardiff, conducted a study assessing the impact of using an Aspergillus PCR and antigen test in a diagnostic algorithm to drive pre-emptive, rather than empirical, antifungal treatment. The results showed a reduction in overt invasive fungal disease by 75% as a result of using pre-emptive treatment. The laboratory was also involved in the validation of the Bruker Fungiplex Aspergillus real-time PCR assay, which produces results in less than two hours following DNA extraction, with a clinical sensitivity of 96% (respiratory culture sensitivity for Aspergillus has been reported at 20-50%) and specificity of 90%.

PCR as the new standard

The commercial availability of a rapid, highly sensitive and selective Aspergillus PCR assay can aid the quicker diagnosis of IA which will significantly improve patient outcomes. In addition to fast detection of Aspergillus DNA direct from patient samples, the adoption of PCR as part of a diagnostic strategy allows clinicians to identify sooner when to start, or stop, prescribing antifungal medication.

Authors Dr Jennifer Dougan is a PhD qualified chemist from Bruker Daltonics and Dr Lewis White is the Scientific Head of the UK Clinical Mycology Network Regional Mycology Reference Laboratory.

www.bruker.com

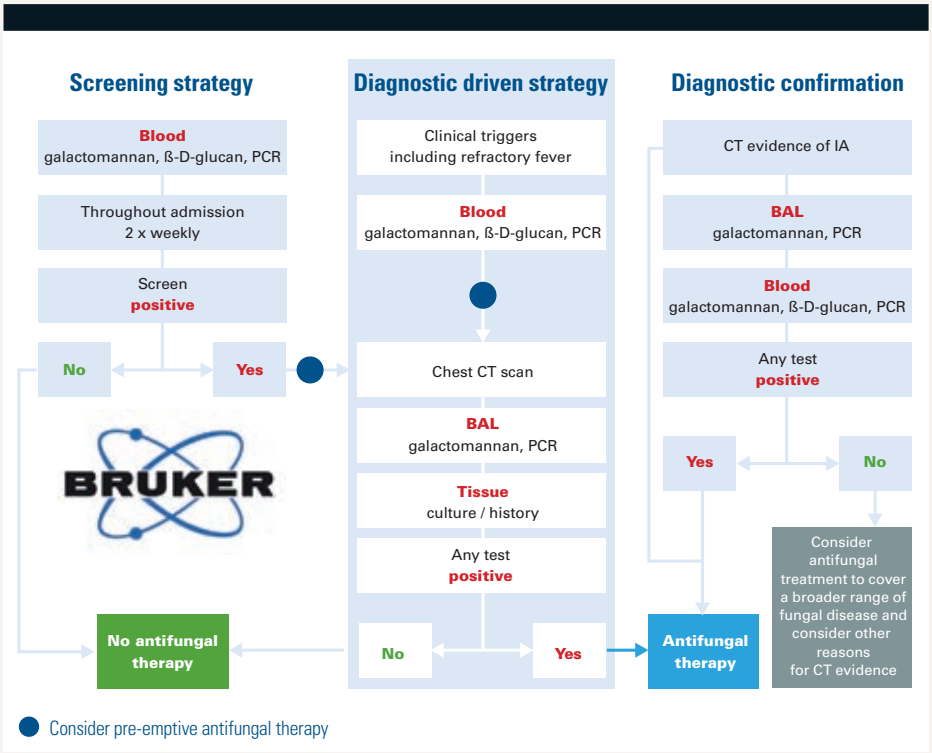


Figure 1: Different strategies used to manage patients at risk of invasive aspergillosis at the Regional Mycology Reference Laboratory, Public Health Wales, Cardiff, Wales.

ANTIBIOTIC RESISTANCE AND MICROWAVES

10m

DEATHS PER YEAR AS A RESULT OF BEING INFECTED WITH **ANTIMICROBIAL-RESISTANT BACTERIA**

Lecturer in Molecular Microbiology **Tina Joshi** looks at the detection of antimicrobial-resistant bacteria in the timeframe of a doctor's appointment.

By 2050, it is estimated that 10 million people worldwide will die per year as a result of being infected with antimicrobial-resistant (AMR) bacteria, costing approximately $100 trillion in lost output. The roots of antibiotic resistance lie within the genetic make-up of the bacteria themselves, which evolve to survive antibiotic action and persist. This process appears to have been accelerated by the inappropriate use of antibiotics within healthcare, coupled with the lack of new antibiotics in the discovery pipeline and lack of suitable and accurate diagnostics in development. This impending AMR crisis has led researchers and governments to accelerate diagnostics and drug development globally.

Worryingly, the last discovery of a major new class of antibiotics was over 30 years ago and the majority of bacterial diagnostic technologies have yet to advance from 70 years prior without use of the gold standard of microbial culture. Interestingly, the development of new affordable, accurate, fast and simple tests for bacterial infections is the focus of the Longitude Prize announced by NESTA in 2014, and voted for by the public as the challenge of our time. The prize aims to encourage the global development of diagnostics, which will enable health professionals to administer the appropriate antibiotic in a timely fashion.

Five minutes

This is also the focus of the research group that I lead at the University of Plymouth, where we are developing a diagnostic device that is able to specifically detect AMR genes from pathogens at point-of-care within the timeframe of a doctor's appointment – that is within five minutes – in line with the recommendations made by the report into AMR by Lord Jim O'Neill, published in 2016.

The technology aims to reduce the inappropriate prescribing of antibiotics in the GP surgery and to detect antibiotic-resistant infections rapidly. Indeed, in 2013, a total of 27 million prescriptions for antibiotics were given to patients in the UK when only 13 million were needed; and this doesn't take into account the ease with which antibiotics can be purchased over the counter in certain countries and their use in agriculture globally.

The diagnostic technology utilises two components – a rapid microwave DNA extraction methodology, and aptamer-based sandwich assay; both of which were designed in my previous post-doctoral posts at Cardiff University. These post-doctoral posts were focused on the development of real-time point-of-care detection assays for the bioterrorism agent *Bacillus anthracis*, methicillin-resistant *Staphylococcus aureus* and the nosocomial pathogen *Clostridium difficile*, for which patents have been filed. The uniqueness of the assay in development is the rapid lysis of bacteria using precision microwaves within five seconds to release DNA directly from a sample without any prior purification, combined with a highly specific five minute lab-on-a-chip assay targeted to the genes conferring resistance to certain antibiotics.

What's the frequency?

Microwaves have been routinely used in medicine for ablation of tumours, imaging and microbial decontamination. Interestingly, conventional microwave

ovens have been shown to release DNA from microorganisms via lysis at a frequency of 2.45 GHz. However, the microwaves within conventional microwave ovens are not precisely focused toward the sample and generate heat during the microwaving process. While this is great for heating food, it isn't great for releasing stable DNA for detection, as DNA is denatured during the heating process. Further, microwave ovens are cumbersome and do not lend themselves to be used at point-of-care. Thus there was a need to develop a microwaving system that could be integrated into a hand-held point-of-care detection device. In collaboration with Cardiff University, I helped design a bench-top microwave lysis system, which is able to deliver high precision, pulsed microwaves to a raw clinical sample. These microwaves lyse the target pathogen and instantaneously release stable DNA for detection.

In my new laboratory at the University of Plymouth, I am building upon this knowledge to develop a new portfolio of hand-held diagnostics for various pathogens and targets based on my lab-on-a-chip chemistry.

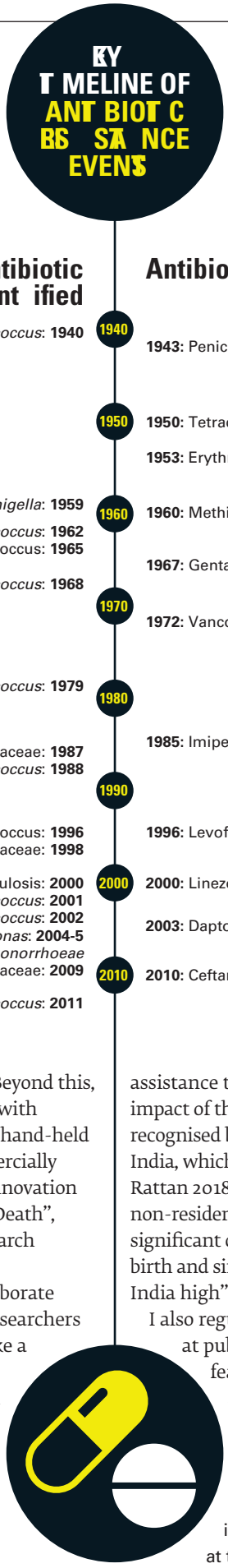
The challenges

In the UK, one in four people are infected with the antibiotic resistant urinary tract pathogen *E. coli*, and thus this is where I'm currently focusing the first iterations of my detection device. Other iterations include diagnosis of AMR pathogens at point-of-care in low/medium economically developing countries and tropical areas, which can make significant life-saving impacts.

Research such as this spans disciplines including chemistry, materials science, communications, microbiology and engineering. The main challenge is to bring everyone together to work on a common goal. Frontier science and new innovations rely on collaborative networks of scientists and each has a share in the tangible generation of a new product from the ideas stage. Beyond this, other challenges are emerging with integration of the device into a hand-held prototype, which can be commercially viable and ensuring that this innovation will not fall into the "Valley of Death", where so much innovative research unfortunately descends.

I feel lucky to be able to collaborate with such a diverse group of researchers from several disciplines to make a difference. The advent of antibiotic resistance is a global concern and, at present, the technology developed here has real potential to be used at point-of-care and in combatting AMR through providing real-time assistance to clinicians. The scope and impact of this research was recently recognised by the NRI Welfare Society of India, which awarded me with the Hind Rattan 2018 or "Jewel of India" award for non-resident Indians who have made a significant contribution to their country of birth and simultaneously "held the Flag of India high".

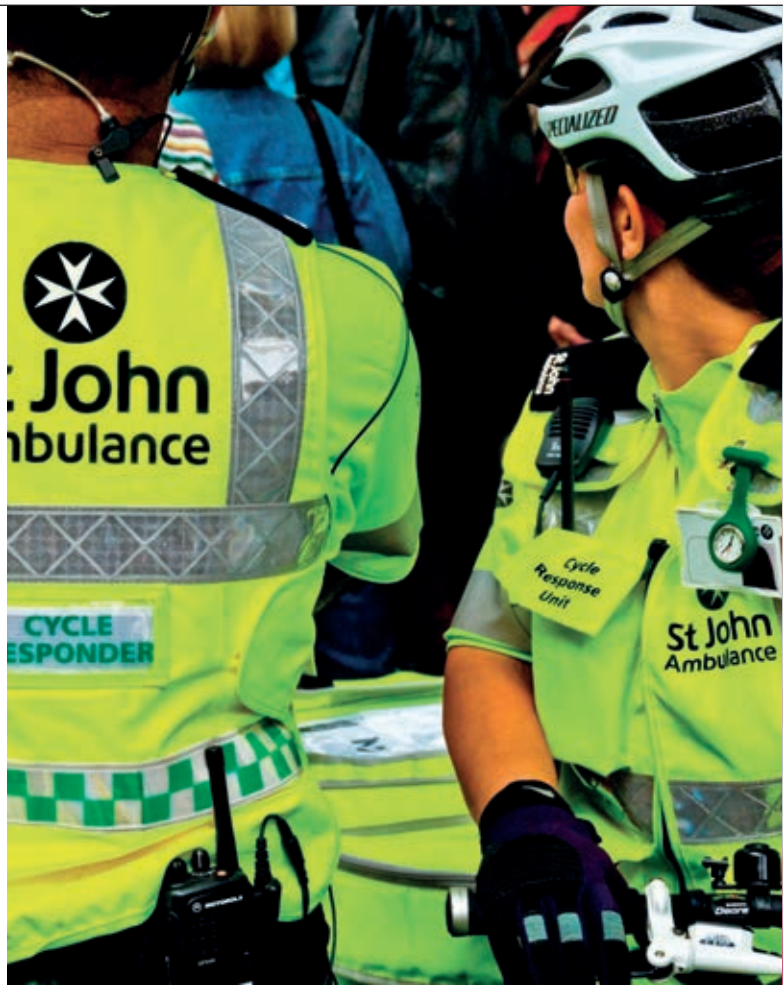
I also regularly discuss this research at public events and am set to be featured in a soon-to-be-announced BBC documentary about how scientists are combatting AMR. BMS



Tina Joshi is a Lecturer in Molecular Microbiology at the University of Plymouth.

HOW TO... MAKE MOST OF PLACEMENTS

Bamidele Farinre, Specialist Biomedical Scientist, advises on how students and employers can get the most out of work placements.



Work experience has been proven many times an important benchmark for employers in recruiting prospective candidates. In a vastly competitive environment, it appears that while having a degree is an investment, it isn't sufficient for students to fast-track their careers.

In today's job market, graduates have to prove their ability to work in an active, motivating and dynamic work environment. Work experience plays a vital role in improving the employability of students and also provides other personal benefits. The additional skills and knowledge gained during a work placement can often be directly applied to studies and, if applied correctly, can potentially lead to better grades. This, in turn, will help the graduate to progress to the next stage of their career.

There are numerous ways that one can gain the experience required to prepare for a career in healthcare. Work placements are an important aspect of an individual's career development. There are many benefits to gaining work experience and it is crucial for candidates to demonstrate that they have found out about the role they are interested in and have some understanding of the work that it involves. Work placements offer the perfect opportunity to gain valuable experience while still studying.

It is advisable to gain experience in the area of health that interests you. However, any experience in healthcare can be useful, because just being in a health environment can give an insight into the work. For those considering a career in the NHS, it is worthwhile gaining experience in an NHS or private hospital, clinic or health centre, a charity or social enterprise (such as one that supports people with long-term health conditions, disabilities or older people, or that provide first aid, for example, St John Ambulance or the Red Cross).

What are some of the benefits of work placement?

A profound advantage for students undertaking a placement is the ability to effectively evidence their experiences on their CV, providing documented appropriate proof for their skills and abilities, coupled with a good character reference. Placements can also provide useful examples to use in competency-based job applications or interviews. Furthermore, an employer seeing any work placements on your CV will be more likely to consider you for the position.

As an ind vidal , work placement helps you:

- **Gain transferable skills**, such as communicating with others, time management, reliability, teamwork and problem-solving, which you can use within a wide range of job roles.

IMAGES: ALAMY

- **Broaden your awareness** of the 350 plus careers available within the NHS.
- **Build your awareness** of NHS trusts as both employers and working cultures, and gain confidence and experience of working with a wide range of patients, visitors and staff.
- **Gain interesting experiences** to draw upon and use for your CV, applications and at interviews, to make you stand out from the crowd.
- **Have an opportunity** to chat to staff about what it is really like to work for the NHS and be trained in a particular role.
- **With future decision-making** about careers, because it aids understanding of your work likes and dislikes.
- **To network with organisations** that could prove very useful when job seeking after graduation.
- **With access to many national employers**, some of whom now recruit directly from their summer work programmes and some of whom even offer sponsorship to students for their final year.

How can you secure a work placement?

Most universities have links for work experience placements with local NHS hospitals or clinics. It is important to seek careers advisers to see if there's anything like this going on at your university. If not, you can apply yourself. You could also explore opportunities in your local area outside of hospitals, such as nursing homes, GP surgeries, physiotherapy practices and healthcare charities.

Benefits of work placement to the employer

For employers, work experience is about giving back to society and helping the future economy by doing your bit to prepare young people for the world of work. It has become common knowledge that the UK is experiencing a skills shortage and this is acute in some sectors, such as STEM. By creating work placements and giving students and graduates a taster of the industry, you are narrowing that skills gap.

Biomedical scientist education and training has evolved over the years to meet pathology service demands. This has led to the introduction of integrated degrees, which involve a laboratory-based practical placement element within the degree course and allows statutory registration. Graduates of these courses may have practical experience in one or more pathology disciplines (dependent upon the duration and configuration of the placement) and will have theoretical knowledge of all disciplines.

This provides flexibility in securing employment as a registered biomedical scientist in any of the pathology disciplines and would also support any mergers and service reconfiguration involving cross-discipline working.

Placements form an important part of the efforts to build an effective biomedical workforce. Offering placements also plays a vital part in the NHS's corporate social responsibilities and distinctiveness by developing the skills of local students or those that are important to the future of the industry.

Important benefits to employer

- Adds significant value to your business – students on placements who bring new ideas and an additional resource to a business will frequently in turn add significant value to the employing organisation.
- Supporting students to gain employability skills, whilst playing a role in building the future workforce.
- A bigger pool of young talent to choose from.
- As an employer, you benefit from work experience because the morale of your existing team may be boosted.
- Creates opportunities for employees to develop their own supervisory skills, as they look after those on placements. BMS

Bamidele Farinre is a Specialist Biomedical Scientist in Virology, based at Great Ormond Street Hospital.

MY IBMS NEWS

EDUCATION

500 VERIFICATIONS UNDERTAKEN

An IBMS member has now completed 500 portfolio verifications on behalf of the Institute.

Geoffrey Trew, who was a Chief Biomedical Scientist, based at George Eliot Hospital in Nuneaton, was awarded the IBMS 50 Year Medal in 2016 (pictured) for his continuous service.

He said: "Being a portfolio verifier is a time commitment, but a truly rewarding one and a role I cannot recommend enough. It allows the sharing of best practice, encourages consistency of standards and development of the candidate and the assessor."

He added: "I find the process stimulating, especially as I am witnessing the changes in lab technology and I can reflect on those changes from when I started over 50 years ago."

Becoming an IBMS portfolio verifier or examiner is an excellent opportunity for continuing professional development and for engaging with a network of biomedical scientists who share a common interest in training and maintaining professional standards.

→ **For more information, visit www.ibms.org/education/verifiers-and-examiners**

NOMINATIONS NOW OPEN

AWARDS FOR NHS COMPASSION

The Kate Granger Awards for Compassionate Care are now open for nominations. They recognise those individuals, teams and organisations that have made a difference to patient care in the NHS.

The awards are held to honour the memory of Dr Kate Granger MBE, who was inspired by the compassionate care she received from staff during her cancer treatment.

The categories are:

- Individuals working in the NHS or delivering NHS-funded services
- Teams who are part of the NHS or who deliver NHS-funded services
- Organisations that are part of the NHS or deliver NHS-funded services.

There is also a certificate of recognition for seven individuals across seven decades of the NHS who have worked tirelessly and innovatively to provide compassionate care for our patients and those we care for.

The closing date for entries is 15 June 2018.

→ **For more information, visit the NHS England website.**

STAFF AWARDS

IBMS Fellow scoops award for quality

Great Ormond Street Hospital held its annual staff awards on 14 May 2018. There were over 300 nominations for staff across the trust in a range of different roles.

The winner of the Improvement Champion Award went to Cathryn Skea, a Senior Biomedical Scientist and the Quality Lead for Microbiology and Virology. Her nomination described her amazing efforts to make the department transition from CPA accreditation to UKAS ISO15189 accreditation.

The laboratory was successful in obtaining UKAS accreditation and this is credited to Cathryn's hard work.

She has improved quality and designed a reducing harm workshop as a method of preventing errors occurring. Cathryn is an IBMS Fellow and one of the IBMS Virology Panel members.

OFFICIAL NOTICE

ANNUAL GENERAL MEETING

The seventy-sixth annual general meeting of the Institute of Biomedical Science will be held at the Stormont Hotel, Upper Newtownards Road, Belfast, BT4 3LP, Northern Ireland on Saturday 9 June 2018 at 11.30am.

Official notification of the meeting was published in last month's issue of *The Biomedical Scientist* (page 41) and is also featured on the IBMS website.

TEACHING AND RESEARCH

MARKING A MILESTONE

The Heads of University Centres of Biomedical Sciences (HUCBMS) has this year celebrated a milestone anniversary.

In honour of its 25 years of promoting Britain's research and degree programmes in biomedical science, a House of Lords reception was held, sponsored by Lord Rana MBE.

The HUCBMS has been a promoter of biomedical science programmes in the UK since 1993 and prides itself on a tradition of promoting high standards of national and international biomedical science research and education, as well as promoting the interests of its member institutions like the IBMS.

IBMS History Committee member Betty Kyle was present at the ceremony.

She said: "It was a great honour to be invited to the House of Lords to celebrate the 25-year anniversary of HUCBMS. I am very proud of the close partnership between HUCBMS and the Institute to produce and deliver degree programmes that meet the needs of our profession."

GIBRALTAR BRANCH

Member awarded MBE

George Fromow was invested by HRH Prince Charles as a Member of the British Empire (MBE) for Services to Haematology, at Buckingham Palace on 16 November 2017.

Forty years earlier in 1977, his father had been presented with an MBE for charitable acts to the poor.

George started work in 1965 at the Public Health Laboratories in Gibraltar as an Assistant.

After spending time at St Thomas' Hospital in London and North London Blood Transfusion Centre, he moved back to Gibraltar.

In 1990, the IBMS Gibraltar branch was founded and George was elected its first Chairman.

In 2007 Gibraltar held the first International Conference in Biomedical Science and the then IBMS President Gordon Sutehall presented George with the highest honour and he was made an Honorary Fellow (Member in Retirement).

IMAGES: ISTOCK

PROMOTE THE PROFESSION

GET INVOLVED IN BIOMEDICAL SCIENCE DAY

On 19 July the IBMS is encouraging biomedical science staff to promote the vital role they play in healthcare and to showcase their work to patients and the public. We want laboratory staff to celebrate their work in biomedical science, spanning across all disciplines, to help explain what they do and the impact their work has on patients' healthcare.

We've put together a range of resources on our website to help plan and organise events to celebrate Biomedical Science Day, including event ideas and activities, press release and invite templates, free posters and leaflets.

→ **For more information, visit biomedicalscienceday.com**

IBMS REGIONS

BOOK FOR NORTH WEST AGM

The IBMS North West region AGM is due to take place on the evening of 16 July.

It is being hosted by IBMS Isle of Man branch and will be held at Nobles Hospital, The Strang, Braddan on the Isle of Man.

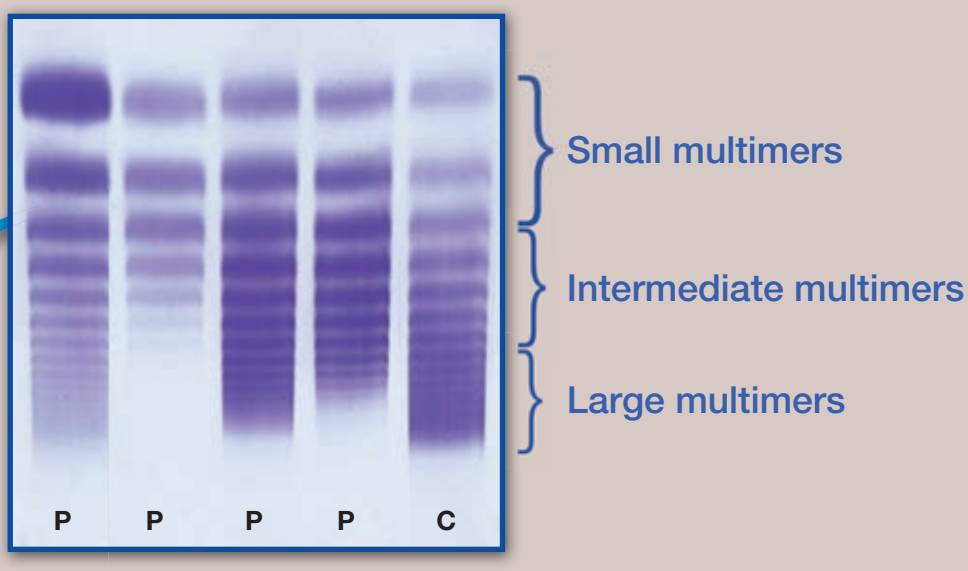
The guest speaker will be Dr Gareth Davies, Emergency Department Consultant, as seen on BBC series *Trauma Uncut* and *An Hour To Save Your Life* with the London Air Ambulance.

Refreshments will be provided and anyone wanting to attend is asked to register by 25 June by emailing **janicelisa.horne@gov.im**

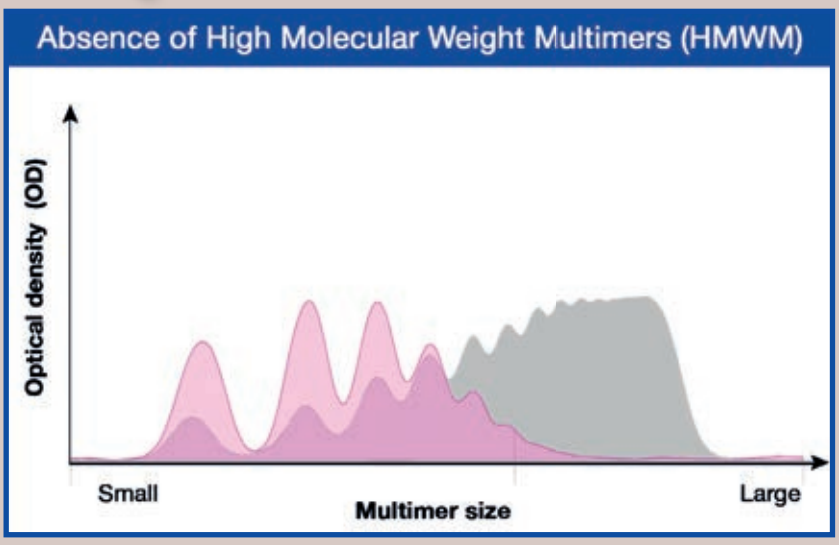
Hydragel von Willebrand Multimers

Within-day results!

Multimers



Densitometry



- Same day results
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JOURNAL-BASED LEARNING EXERCISES

Each article's contents should be read, researched and understood, and you should then come to a decision on each question. The pass mark is 17 out of 20 questions answered correctly. JBL exercises may be completed at any time until the published deadline date. Please select your choice of correct answers and complete the exercises online at: **www.ibms.org/cpd/jbl**

DEADLINE WEDNESDAY 5 SEPTEMBER 2018

West Nile surveillance in Europe: moving towards an integrated animal-human-vector approach. Gossner CM, Marrama L, Carson M *et al. Euro Surveill* 2017; **22** (18): pii: 30526. doi: 10.2807/1560-7917.ES.2017.22.18.30526. Assessment No: 060618

01	West Nile virus can be transmitted vertically.
02	Most West Nile virus infections in birds are asymptomatic.
03	West Nile fever in humans is a notifiable disease in all countries of the UK.
04	The first cases of local transmission in Austria were diagnosed using molecular diagnostic methods.
05	All suspected equine West Nile fever cases in the UK must be reported to the Animal and Plant Health Agency.
06	Around a quarter of horses infected with West Nile virus display neurological symptoms.
07	Data for all five countries considered in the paper show that the highest number of infections in horses was recorded in 2013 in all cases.
08	In Greece, mosquitoes are actively monitored for West Nile virus carriage between June and October.
09	During 2010 and 2015, 55 times more birds were tested for West Nile virus infection in the UK than in France.
10	The mosquito *Culex modestus*, which can act as a vector for West Nile virus, has been identified in the UK in the 21st century.
11	Approximately 1% of the birds surveyed for West Nile virus in Italy had evidence of infection with the virus.
12	Outbreaks of West Nile encephalomyelitis in European Union countries should be reported to the European Commission and the World Organization for Animal Health.
13	Published studies have demonstrated West Nile virus RNA in migratory wild birds in the UK.
14	In Austria, surveillance of birds for West Nile virus is conducted in birds sampled for avian influenza infection.
15	Inactivated and recombinant vaccines are available and can are used to prevent West Nile disease in humans.
16	There is increased vigilance for human cases of neuroinvasive West Nile fever in the Mediterranean region of France during the West Nile season.
17	Neurological disease in horses associated with West Nile fever infection is notifiable across the European Union.
18	There is no risk of transmission of West Nile virus from asymptomatic infection in blood or tissue donors.
19	Between 2009 and 2015 there were 13 confirmed cases of West Nile fever in humans in Austria.
20	Serological surveillance for antibodies to West Nile virus in horses is always useful in identifying places and times where humans would be at risk from the infection.

Pathology networks. See: improvement.nhs.uk/resources/pathology-networks, including embedded PDF document (improvement.nhs.uk/documents/1658/Consolidation_Networks_CEO_Letter_RE11.pdf). Assessment No: 060918

01	To take consolidation forwards there will be a toolkit and support activities.
02	All hospitals will still have local laboratories.
03	London pathology services will be in four networks
04	The Midlands and East 7 will break even, making no savings.
05	The body looking at getting better deals out of services is NHSI.
06	Future efficiency savings could be as high as £2.2billion.
07	The data collected allow for a comparison overall, regional and local performance on an annual recurrent basis.
08	Network South 2 will make proportionally the highest savings.
09	It is deemed unlikely that staff career opportunities will be improved under the new plans.
10	Laboratories are included in the networks even if outsourced.
11	The Isle of Man, Channel Islands and Isle of Wight are not included.
12	Other than Midlands and East 7, all networks are expected to make savings of at least 3%.
13	NHSI has mandated the establishment of 29 pathology networks in the United Kingdom.
14	We can be fully confident that all savings will be achieved.
15	NHSI is keen to see patient engagement in this process, which is designed for patient benefit as well as generating savings.
16	North 1, North 5 and Midlands and East 2 all have two hubs.
17	Centralising pathology services will mean patients will probably have to travel further for services.
18	According to NHSI figures, the average cost of a pathology test is £1.96.
19	The changes aim to cover better screening and new genetic testing.
20	Networks are aimed at bringing together clinical expertise.

REFLECTIVE LEARNING

01	Discuss whether serological testing for anti-West Nile virus antibody is suitable for screening blood and tissue from asymptomatic donors.
02	Evaluate the risk to human health from other vector-borne viruses emerging in Europe.

01	If you were to undertake this exercise, what criteria would you use for deciding the number and location of hubs and networks, taking into account emergency and contingency planning?
02	What would be the major hurdles that need to be overcome in order to maximise efficiencies and patient benefits?

EVENTS AND TRAINING COURSES

A wide range of training courses, CPD and local events and activities is listed below. Members are advised to contact organisers for further information. A full list is available on the IBMS website.

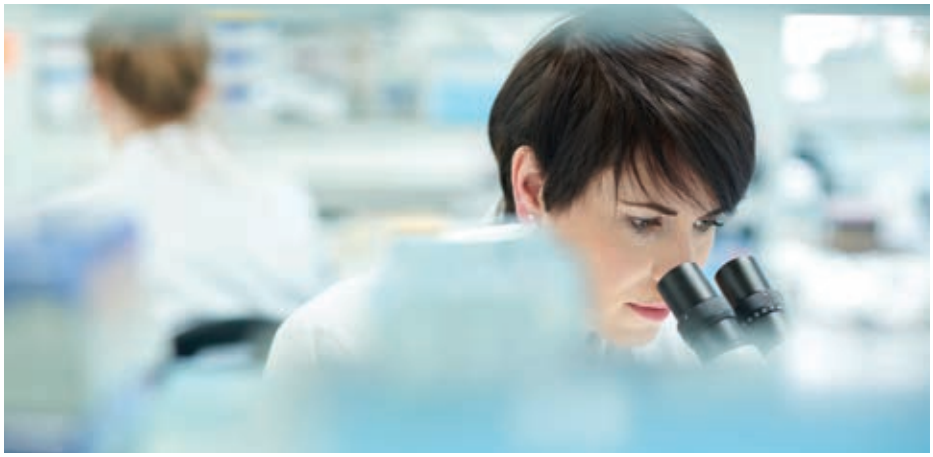
DATE	TITLE	VENUE CONTACT
June		
4 Jun	**HPLC method development**	Reading, York, Scotland, London and Manchester I jsumner@hichrom.com
6 Jun	**Cervical histology for technical staff**	Bristol I SWRCTC@nbt.nhs.uk
6 – 7 Jun	**Your role as a cervical screening provider/lead hospital-based programme coordinator**	Wakefield I kathryn.hawke@nhs.net
6 – 7 Jun	**Update in cervical cytology – Scottish Cytology Training School**	Glasgow I scts@nhslothian.scot.nhs.uk
11 – 12 Jun	**SoGAT workshop**	London I NIBSC
11 – 12 Jun	**Laboratory diagnosis of faecal parasites**	Liverpool I susan.reilly@lstmed.ac.uk
11 – 12 Jun	**Laboratory diagnosis of blood parasites**	Liverpool I susan.reilly@lstmed.ac.uk
11 – 14 Jun	**Laboratory diagnosis of faecal and blood parasites**	Liverpool I susan.reilly@lstmed.ac.uk
12 Jun	**HPLC troubleshooting**	Reading, Scotland, Manchester I jsumner@hichrom.com
12 Jun	**One-day update course in SurePath gynaecological cytology – negative versus high grade**	Wakefield I kathryn.hawke@nhs.net
12 – 14 Jun	**Three-day update for cervical cytology**	Bristol I SWRCTC@nbt.nhs.uk
13 Jun	**Quality, audit and improvement workshop**	Croydon I sue.alexander@rmh.nhs.uk
13 – 14 Jun	**Clinical and laboratory haemostasis 2018; UK NEQAS for Blood Coagulation Annual Scientific Meeting (incorporating the Annual Participants Meeting)**	Sheffield I tim.woods@sth.nhs.uk
13 – 14 Jun	**UK NEQAS Cellular Pathology Technique muscle/neuropathology and electron microscopy introduction workshop**	Liverpool I chantell.hodgson@nhs.net
13 – 15 Jun	**The laboratory diagnosis of malaria**	London I claire.rogers@lshtm.ac.uk
14 Jun	**UK NEQAS Immunology, Immunochemistry and Allergy quality assurance masterclass**	Sheffield I ukneqas@immqas.org.uk
14 – 15 Jun	**Practical and clinical microbiology of anaerobes (P&CMAn)**	Cardiff I deborah_robinson@dwscientific.co.uk
15 Jun	**Blood sciences for specialist diplomas short course**	London I c.ferrier@westminster.ac.uk
15 Jun	**UK NEQAS Immunology, Immunochemistry and Allergy annual participants' meeting EQA 2018: maximising quality for patient care**	Sheffield I ukneqas@immqas.org.uk
18 – 22 Jun	**The laboratory diagnosis of parasites**	London I claire.rogers@lshtm.ac.uk
21 Jun	**UK NEQAS Cellular Pathology Technique specialist workshop**	Newcastle I chantell.hodgson@nhs.net
22 Jun	**Blood sciences for specialist diplomas short course**	London I c.ferrier@westminster.ac.uk
27 Jun	**Update course in gynaecological cytology – HPV update and glandular lesions**	Birmingham I amanda.lugg@bwnft.nhs.uk

DATE	TITLE	VENUE CONTACT
28 Jun	**One-day update course in SurePath gynaecological cytology – negative versus high grade**	Wakefield I kathryn.hawke@nhs.net
28 Jun	**Biomed analysis of nucleic acids course**	Online I biomed@gre.ac.uk
29 Jun	**Blood sciences for specialist diplomas short course**	London I c.ferrier@westminster.ac.uk
July		
2 – 5 Jul	**Identification of pathogenic fungi**	Bristol I michael.palmer@phe.gov.uk
4 Jul	**HPLC method development**	Reading, York, Scotland, London and Manchester I jsumner@hichrom.com
4 Jul	**Urinary cytology**	Bristol I SWRCTC@nbt.nhs.uk
8 – 11 Jul	**Light microscopy summer school**	York I katejermey@rms.org.uk
11 – 12 Jul	**Essentials in microscopy**	Southend on Sea I debby.dawson@olympus.co.uk
12 July	**SHOT Symposium 2018**	Manchester I SHOT@NHSBT.NHS.UK
12 – 13 Jul	**Getting the most from your confocal course 2018**	York I katejermey@rms.org.uk
13 Jul	**Northern autoimmunity education and quality assurance group**	Preston I fiona.nash@lthtr.nhs.uk
15 – 20 Jul	**Electron microscopy summer school**	Leeds I katejermey@rms.org.uk
18 – 20 Jul	**Flow cytometry course**	Edinburgh I katejermey@rms.org.uk
27 Jul	**Train the trainer**	London I fstshortcourses@westminster.ac.uk
August		
1 Aug – 17 Sep	**UK NEQAS Cellular Pathology Technique tissue morphology and recognition workshop**	Gateshead I chantell.hodgson@nhs.net
21 – 23 Aug	**Standardized susceptibility testing – residential workshop 2018**	Cardiff I dirwin@bsac.org.uk
September		
4 – 6 Sep	**Three-day update for cervical cytology**	Bristol I SWRCTC@nbt.nhs.uk
11 Sep	**Mycology teaching workshop**	London I organiser@ukneqasmicro.org.uk
12 Sep	**Mycology teaching workshop**	London I organiser@ukneqasmicro.org.uk
12 – 13 Sep	**UK NEQAS Cellular Pathology Technique Mohs/BMT/renal workshop**	Gateshead I chantell.hodgson@nhs.net
13 Sep	**Mycology teaching workshop**	London I organiser@ukneqasmicro.org.uk
21 – 22 Sep	**Advanced course in EBUS/mediastinal EUS and rapid on-site evaluation for chest physicians and cytopathology teams**	Watford I winnie.tang@whht.nhs.uk
28 Sep	**Update course in gynaecological cytology – MDT cases and squamous lesions**	Birmingham I amanda.lugg@bwnft.nhs.uk
October		
8 – 12 Oct	**Introduction to the principles and practices of working safely at ACDP containment Level 3**	Porton Down I nadp.training@phe.gov.uk
9 Oct	**HPLC troubleshooting**	Reading, Scotland, Manchester I jsumner@hichrom.com
10 Oct	**HPLC method development**	Reading, York, Scotland, London, Manchester I jsumner@hichrom.com
17 Oct	**One-day update in cervical cytology audit**	Bristol I SWRCTC@nbt.nhs.uk
17 Oct	**UK NEQAS Cellular Pathology Technique tissue morphology and recognition workshop**	Gateshead I chantell.hodgson@nhs.net
22 Oct	**Update course in gynaecological cytology – HPV update and glandular lesions**	Birmingham I amanda.lugg@bwnft.nhs.uk
November		
7 Nov	**Update in cervical cytology for pathologists, consultant BMS and holders of the Advanced Specialist Diploma in Cervical Cytology**	Bristol I SWRCTC@nbt.nhs.uk
7 – 8 Nov	**Essentials in microscopy**	Southend on Sea I debby.dawson@olympus.co.uk
7 – 8 Nov	**Update in Cervical Cytology – Scottish Cytology Training School**	Glasgow I scts@nhslothian.scot.nhs.uk
12 – 16 Nov	**Biosafety practitioner Level 1 (ISTR accredited)**	Porton Down I nadp.training@phe.gov.uk

HERE TO HELP

SPECIALIST PORTFOLIO UPDATE

Following a review to update the various Specialist Portfolios, Version 4 will be available from July, writes **Alan Wainwright**, IBMS Executive Head of Education.



As this was an interim currency review, there are no significant changes to the structure or content of the portfolios and consultations around the future of the Specialist Portfolios in their current form will continue as part of the strategic review of qualifications.

In response to feedback, the Diploma of Biomedical Sciences has been re-named the Specialist Diploma in Blood Sciences, and there is an optional Molecular Pathology module for Cellular Pathology. This will be available as a standalone module for those who have already completed their Specialist Portfolio, and in time will be developed and offered as an optional module for other disciplines.

We are often asked to clarify the entry criteria. Applicants must be in a corporate class of IBMS membership, working in a laboratory with Institute approval for post-registration training and must retain IBMS membership throughout study of the Specialist Portfolio. The portfolio is not available to Associate members of the Institute or individuals undertaking pre-registration training and should be completed in the spirit in which it has been developed, as an artefact of a period of immersion in their laboratory rather than a workbook where evidence is created merely to "tick each box".

Where a particular analysis is not performed in the candidate's laboratory, knowledge of the principles and practice must still be demonstrated. We are reliant on the professional integrity of the training staff and management to assess whether they are able to facilitate the opportunities that Specialist Portfolio candidates need to be able to complete a meaningful portfolio of evidence. If a laboratory can only provide a small range of tests and is reliant on other specialist facilities to provide opportunities, then we expect to see this evidenced in the laboratory approval documentation.

If the laboratory cannot provide the majority of tests expected and cannot meet this expectation, they must consider if they are in a position to fully support the candidate.

Completion time may vary, but it is expected to take about 24 months. Whilst there is currently no time limit for completion of the portfolio, there is a requirement for evidence to be current and within three years of the external examination. In line with our other portfolios, the introduction of Version 4 will trigger an expiry limit of three years on any superseded version of a portfolio, from the date a new version is introduced.

Following completion of the portfolio and successful examination of the knowledge, the candidate will be eligible for the award of a discipline-specific Specialist Diploma. In order to be awarded an Institute Specialist Diploma, the individual must be a current member of the Institute and have held corporate membership for at least one year.

The end-point examination for the optional Molecular Pathology module will take place in an external location, not the candidate's employing laboratory. This will usually be the Institute's London office, but may be an alternative location that is more convenient to both candidate and examiners.

This applies irrespective of whether the module has been completed as part of the Cellular Pathology Specialist Portfolio or as a standalone module. Where the module has been completed as part of the Cellular Pathology Specialist Portfolio, the Molecular Pathology module will be examined in a second, separate assessment.

Raigmore Hospital, Inverness

NHS Highland

Clinical Services Division
Blood Sciences Department

Head Biomedical Scientist (Lab Manager) – Band 8b

Full-time, Permanent

Salary scale: £47,562 - £58,799

A rare and exciting opportunity has risen for an experienced and enthusiastic individual to join us to help further develop and widen our multi-site laboratory network in the visually stunning Highlands. Recently accredited to ISO15189 by UKAS as a 3-site Blood Sciences service we are looking to expand the use of Point of Care Testing and also to integrate a fourth Highland site into our network, and you will be expected to work with clinicians, management and your teams to facilitate this while at the same time ensuring provision of a safe, effective and efficient service.

For informal enquiries or to arrange a visit to the department: Mr. Alex Javed – telephone 01463 704088 or email alex.javed@nhs.net

Application Forms and Job Descriptions can be downloaded via our website www.jobs.scot.nhs.uk or available from, and to be returned to the Employment Services Section, Assynt House, Beechwood Business Park, Inverness IV2 3BW or by emailing your name and address to nhshighland.recruitment@nhs.net.

Short-listed applicants will normally be contacted by email, unless otherwise stated. Please check your emails regularly, including your junk/spam folder.

Please quote reference: IM9_18_38

Closing date for completed applications: Friday 29th June 2018.

NHS Highland is committed to being an equal opportunities employer and welcomes applications irrespective of race, gender, age, disability or sexual orientation.

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THE DOCTORS LABORATORY

MICROBIOLOGY SERVICE / TRAINING LEAD
- NORTHWICK PARK HOSPITAL -

TDL have an exciting vacancy for an enthusiastic, self-motivated operational service lead that will additionally organise and monitor the development and training of staff in the department.

The successful applicant will have post graduate qualifications in Biomedical or Life Sciences and have experience of working in a clinical microbiology laboratory as a registered biomedical scientist at a senior level or above. They will be a key member of our microbiology department contributing significantly to the operational organisation of the clinical diagnostic service whilst ensuring we have a suitably trained and competent workforce.

We have IBMS training approval for both pre and post registration training and the post holder will maintain strong links with our national Education and Training Faculty via the Infection Sciences Training Committee.

Visit www.tdlpathology.com for further information, or to register your interest email: charles.tilsed@tdlpathology.com

(Please quote Job Ref: NWPMI3002)

Closing Deadline: Sunday 24th June 2018

THE DOCTORS LABORATORY

A FRESH CHALLENGE WITH THE DOCTORS LABORATORY?

Both day and night vacancies have arisen for a full time HCPC registered biomedical scientist in the Haematology & Blood Transfusion department based at our Northwick Park & Central Middlesex Hospital sites.

Duties will include regular rotation through all areas of the department and the routine operation, maintenance and troubleshooting of various analysers including Diamed IH1000s in Blood Transfusion, Sysmex HST line in Haematology, XE2100/XE5000 FBC analysers, Starrsed Interrliners and Sysmex CS5100 analysers for coagulation. The role will also include technical validation, stock control and ordering supplies. For "day-time" applicants, some biochemistry experience would be beneficial as there will be the opportunity to work multi-disciplinary shifts at Central Middlesex Hospital.

The department is committed to training and education, offering exciting opportunities for development and career progression. Applications from candidates with all levels of experience are welcome.

For further information about this position, contact: **Victoria Moyse: victoria.moyse@tdlpathology.com** quoting ref: '***NWNSHM2856***' for the night-duty role or '***NWNSHM2857***' for the day-time role.

See ALL of our vacancies at: www.tdlpathology.com/jobs

Closing Date: **17th June 2018**

The closing date may be earlier where there is high interest.

TDL is a committed equal opportunities employer and does not unlawfully discriminate on the basis of any status or condition protected by applicable UK employment law.

CHIEF BIOMEDICAL SCIENTIST

Salary Scale £52,906 - £65,305

Ref: DOH&-007090

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- High rates of personal allowances
- High quality of family life and individual life
- Excellent education
- Superb countryside and leisure facilities
- Attractive relocation package
- Cost of living benefits - low cost insurance etc.

The position will be based at Noble's Hospital. We have an exciting opportunity for an experienced manager to lead the Isle of Man Biochemistry Services based at Noble's Hospital. Applications are invited from highly qualified, experienced and motivated scientists to join the team in this beautiful island setting.

This is a great opportunity for a dynamic and forward-thinking Biomedical Sciences Manager who would like to develop their career further as the most senior leader for Biochemistry Services on the Island. The role will shape the strategic direction for the service and will have operational responsibility for managing this small department.

As a member of the pathology management team you will be responsible to the Pathology Manager, but will also work closely with the Clinical Director and Heads of Service of the other pathology specialties. Your ability and experience of driving and successfully achieving change will enable you to provide the leadership and strategic direction required to bring together our teams in the delivery of a patient-focused, cost-effective and high-quality service.

You will hold HCPC registration as a biomedical scientist and will have successfully managed within an acute NHS setting. You should have the ability to be creative and innovative to generate opportunities for the service, be able to demonstrate a solid understanding of commercial and business principles and have experience of involvement with strategic planning processes.

You will be responsible for providing an efficient and accurate, quality assured diagnostic laboratory service to all users, facilitating staff training and developments, ensuring relevant competencies are achieved to meet service requirements and turnaround times.

Interview expenses and a relocation package of up to £7,000 based on receipts is available for this role. For further information about living in the Isle of Man and the Island's lifestyle visit www.locate.im.

How to Apply

For further information about the vacancy contact **Stephen Doyle, Pathology Manager, Diagnostics Division, on 01624 650642.**

To apply online and to read the full job description please visit **www.gov.im/jobs**

The closing date for applications is 30 June 2018.

Isle of Man Government
Reiltys Ellan Vannin

Department of Health and Social Care

Rheynn Slaynt as Kiarail y Theay

MY LAB

AWARD-WINNING MICROBIOLOGY LAB

Professional Manager for Quality and Training, **Mairiead MacLennan**, gives a guided tour of her microbiology lab in Fife, Scotland.

NHS Fife serves the people of the county of Fife, a peninsula between the firths of Tay and Forth, still known as the Kingdom of Fife from when it was an historical seat of Pictish Kings. The laboratory services are centralised in the town of Kirkcaldy, one of the four main towns in Fife. The other three being Dunfermline in the west, Glenrothes centrally and the best known across the world, St Andrews on the north-east coast of Fife.

The county has approximately 370,000 residents and is one of the geographically smallest health board areas of Scotland. The main acute services, which include laboratory services, are delivered from the newly built, extended district general, Victoria Hospital. In 2012 the site more than doubled in size and a new laboratory was built with the intention of rationalising all disciplines under one roof and extending floor space to accommodate an automated blood sciences service.

The original plan, for a modular build with Blood Sciences on the ground floor and Cell Sciences (Microbiology and Infection Control and Cell Pathology) on the second floor, did not go according to plan. Although Blood Sciences is fully functional with a fully-automated track, the second floor was not built and Cell Sciences remains in the old building, having had some refurbishment.

The plan still is to eventually have one building, but in the meantime we have the new "South Laboratory" and the old renamed "North Laboratory" separated by a large car park – this means that we have to work constantly to address resultant logistical problems.

Nonetheless, despite obvious problems with the aged building, my department has achieved amazing successes, particularly in recent years. We have not only embraced new developments, but have also driven advances. From the installation of an automated plate organisation platform in 2009 (unusual for a department of our size) and the phased repatriation from the large central laboratories in Edinburgh and Glasgow and local introduction of molecular testing, to research partnerships with the University of St Andrews, we have demonstrated how we can push boundaries.

Our team comprises four Microbiology Consultants, six Senior Specialist and 16 Specialist Biomedical Scientists, two Medical Secretaries, 10 Clinical Support Workers and four Managers. We deliver a 24-7 service, performing almost 300,000 tests per year, with up-to-date bacteriology techniques, recognised expertise in antimicrobial resistance monitoring and antibiotic stewardship, top-quality containment level 3 facilities and an impressive repertoire of molecular testing, with recent innovative consolidation to a single-platform solution.

Recently, the department was awarded the Scottish Government Advancing Health Care Award for driving improvement, delivering results. The award was for our speedy and highly effective implementation of a near-patient molecular flu testing system in the emergency department, during a time of urgent need, helping to avert a patient management crisis, in the severe flu outbreak this past winter.

The skills, experience and "can-do" attitude of the whole department was typified by this discreet project. We are proud of each other as individuals and of our team. BMS

Amplidiag® Product Family

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C. difficile+027
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Viral GE
Stool Parasites

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For more information contact Mobidiag or visit www.mobidiag.com

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