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Making changes for a more stable workforce and fewer errors: *p.24*

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Seven award recipients outline their grant-supported projects: *p.28*

THE BIOMEDICAL SCIENTIST

THEBIOMEDICALSCIENTIST.NET

DECEMBER 2019

SLIME OF THE TIMES

The search for new antibiotics that took scientists out of the lab and into the veg patch

IBMS Institute of Biomedical Science

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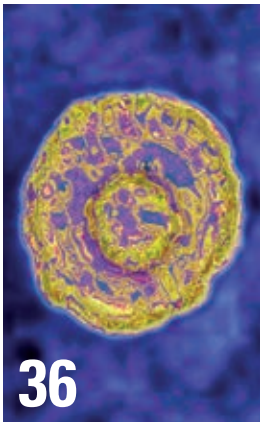

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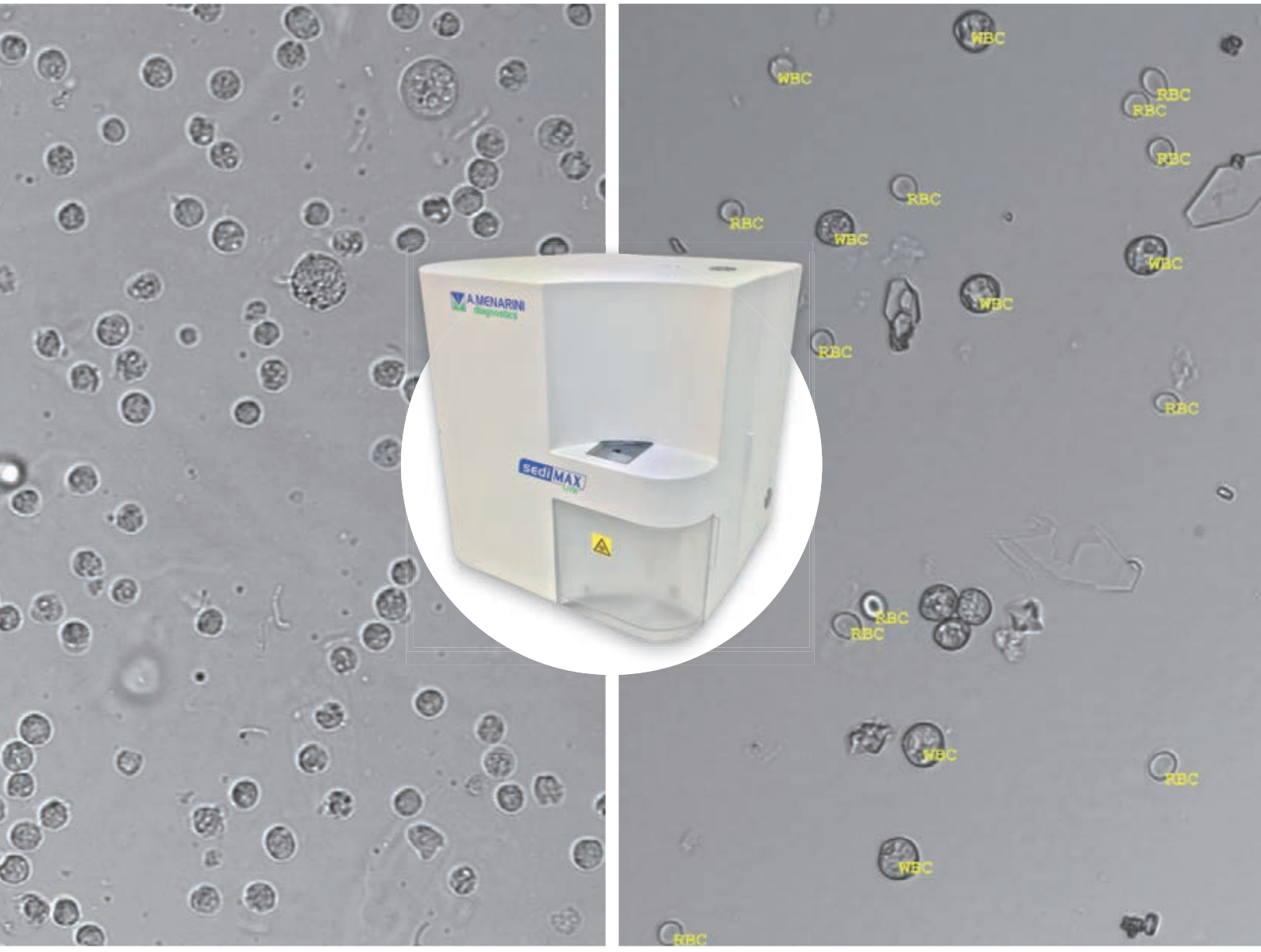
SEMI-AUTOMATED URINE MICROSCOPY

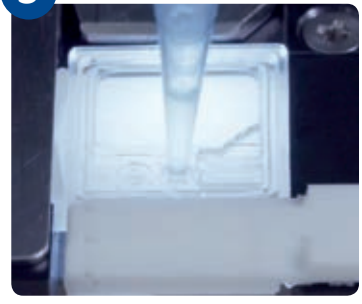


Urine Analysis in 3 Simple Steps

1 Press Start

2 Pipette Urine

3 Fill Cuvette



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CHANGES AHEAD

Role development, workforce strategies and professional qualifications... **Sarah May** looks back at 2019 and forward to the New Year.

Ah, the time of year is upon us when good taste is abandoned in favour of knitwear adorned with reindeers, penguins, Christmas trees and various other festive images, perhaps with even a sequin or two.

It's probably fair to say it's been a year of mixed fortunes for pathology, with cervical screening making its seismic shift from cytology to primary HPV testing, whereas in histopathology the role of the biomedical scientist continues to expand into more diagnostic areas. As part of the histopathology changes, I have been fortunate enough to be invited to be a part of two network discussions to help them to understand the options available for developing their biomedical scientist roles in response to increasing medical workforce pressures.

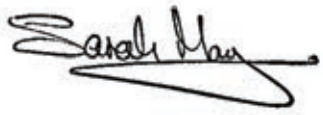
This in itself proves that the Institute has been spot on in its qualification development strategy; I have to confess that at times it's been tough and there is nothing more disheartening than hearing the familiar comment that 'professional qualifications aren't recognised outside the profession'. That is true of all professional qualifications in that they are unique and specific to a profession; the key point here is that our qualifications are at last not only recognised *within* healthcare, they are now in demand.

Biomedical scientists benefit from having a relatively large and financially secure professional body with a very long history of qualification development, which is standing us in very good stead. We now have a solid evidence base that the people who qualify with our exams have the knowledge and skills that our pathology services require; we also have some extremely competent and talented people that are going to be key to helping tackle some of the medical workforce shortages that pathology is experiencing.

The two pathology networks that I have met with do not underestimate the work that will be needed to implement a workforce development strategy for biomedical scientists in histopathology but they can see the benefits of this initiative. Such is the interest in the approach being taken in histopathology that it has even been asked whether a similar initiative could be developed for microbiology and haematology. This is an incredible position for our profession to be facing and I am extremely grateful to be a small part of big changes.

For now, I would like to congratulate all those who have sat and passed Institute qualifications this year, you truly are the future of our profession. You have my utmost respect for undertaking these challenging self-directed learning programmes.

In the meantime, I hope you all are able to take some time out to relax and enjoy the festive season and perhaps to rediscover your inner love for bad taste jumpers. It's amazing what you can hide beneath a capacious white coat. Happy New Year everyone.



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Deputy Chief Executive

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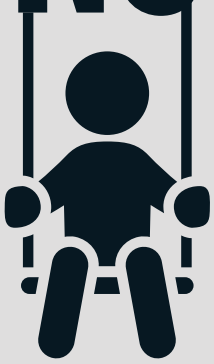
SCIENCE NEWS

IN NUMBERS



8

At age 8 experts might know how our brains will age. Research published in the journal *Neurology* suggests that the ground for strong thinking and memory skills among older adults might have been laid decades earlier.

The UK has

2.8

doctors and

7.8

nurses per 1000 people, which compares with the Organisation for Economic Co-operation and Development (OECD) international averages of **3.5** and **8.8,** respectively. The findings chime with warnings from union and NHS bosses about high vacancy rates in the UK.

3000 is the current number of nursing vacancies that exist in Northern Ireland. Nurses there recently voted to strike over staffing numbers and pay disputes.

30 MINS

Men who regularly walk at least 30 minutes a day after having a heart attack live longer than those who don't stay as active. The biggest survival advantage is found in men who had a high level of physical activity prior to a heart attack and continued the same high level after a heart attack.

165

new antibiotic resistant infections emerge every day in England. Public Health England revealed there were an estimated **61,000** resistant infections in England during 2018 – a **9% rise** from 2017.

10-14 YEARS OLD

Children who are between 10 and 14 years old are more likely to have good cardiovascular health if their mothers had good heart health during pregnancy, according to new research from Northwestern University in Chicago. Children are more likely to become overweight by the **age of 4** if their mothers ate mostly fast foods during the second trimester.

SCIENCE NEWS

PATHOLOGY NETWORKS

Thirteen regions still to agree pathology model

In a second annual update on a scheme to network trusts' pathology services, NHS England/Improvement revealed that 13 out of 29 regions have yet to formally commit to new pathology models.

However, 16 regions have formally agreed new models, which is three more than the 13 which had reached such agreements in September 2018.

NHS England/Improvement wants all proposed networks to agree new pathology models, which are planned to deliver at least £200m in savings by 2020-21.

When the scheme launched in 2017 it was hoped all the networks would achieve formal agreement by January 2018.

The 29 proposed networks range from two to 12 trusts and were given a savings target which the NHS now describes as "conservative."

The plan has proven controversial in some areas, with The Royal College of Pathologists reporting concerns about the impact on staff and lack of investment in new equipment and IT.

→ **bit.ly/2XuXntp**

CERVICAL SCREENING

SMEAR TESTS REPLACED BY DIY HOME KIT?

A non-invasive urine test could be used by women to detect their risk of developing cervical cancer without the need to visit the doctor.

A trial in 600 women showed that the home test was able to identify those with pre-cancerous lesions, meaning those women requiring treatment could be pinpointed faster.

In addition, the "self-sampling" test is likely to improve participation in cervical screening programmes if made widely available.

The study "shows it's possible to detect cervical pre-cancer that is at high risk of developing into invasive cancer in urine and vaginal samples collected by women in the comfort and privacy of their own homes", said Manuel Rodriguez-Justo, a consultant pathologist at University College London.

However, a note of caution was struck by Cancer Research UK, which funded the research, and said self-collected urine or vaginal samples are "not ready to be rolled out just yet". Some reports suggested it might be another three years before such tests are available.

→ **wb.md/2K0n27lu5o**

EXERCISE

ANY RUNNING REDUCES EARLY DEATH RISK

Any amount of running is good for you – according to research suggesting it is linked to a similar reduction in the risk of early death no matter how many hours you clock up a week or how fast you go.

Researchers say the latest findings push back against result from other studies, which have hinted benefits increase

with more running, but might drop at very high levels.

The research, published in the *British Journal of Sports Medicine*, focused on 14 previous studies based on six different groups of participants. These totalled more than 230,000 people who were followed over periods ranging from 5.5 to 35 years.

"Any running is probably good for your health and you can achieve those benefits by running even just once a week or running 50 minutes a week," said Dr Zeljko Pedisic, the first author of the research. "But that shouldn't discourage those who run more than that amount – who maybe enjoy running three times a week or six times a week."

→ **bit.ly/32yoMLX**

IMAGES: ISTOCK/SHUTTERSTOCK/SCIENCE PHOTO LIBRARY

VIRTUAL REALITY

WATCHING ICY ARCTIC SCENES EASES BURNING PAIN

Immersion in virtual reality scenes of the Arctic helps to relieve intense pain and could hold hope for the treatment of chronic pain.

Scientists from Imperial College London have found that using virtual reality headsets could combat increased sensitivity to pain by immersing people in scenes of icebergs, oceans and icescapes.

Beyond the distracting effect of the visuals, the researchers think that immersing patients in virtual reality may actually trigger the body's own inbuilt pain-fighting systems – reducing their sensitivity to painful stimuli and the intensity of ongoing pain.

"One of the key features of chronic pain is you get increased sensitivity to painful stimuli," said Dr Sam Hughes from the MSk Lab at Imperial and the first author on the paper. "This means patients' nerves are constantly 'firing' and telling their brain they are in a heightened state of pain. Our work suggests that virtual reality may be interfering with processes in the brain, brainstem and spinal cord, which are known to be key parts of our inbuilt pain-fighting systems."

→ bit.ly/34JfHI2

WHAT'S HOT AND WHAT'S NOT

HOT

SPIDERS

A double-sided tape, designed to stick body tissue together after surgery, has been inspired by the way spiders exude "glue" to catch their prey in the rain.

HOT

CYCLING

A cycling-on-prescription scheme trialled in Yorkshire has been so successful in helping people with long-term medical conditions that it could be rolled out across the UK.

HOT

CANNABIS

Two cannabis-based medicines, used to treat epilepsy and multiple sclerosis, have been approved for use by the NHS in England.

NOT

EVENING EATING

Women who consumed a higher proportion of their daily calories later in the evening are more likely to be at a greater risk of cardiovascular disease than women who do not.

NOT

E-CIGARETTES

A new study shows that electronic nicotine delivery systems, including devices such as e-cigarettes, may be just as harmful to the heart, if not more, than traditional cigarettes.

NOT

TAP WATER

Water supplied to homes in Trecwn, Pembrokeshire has been branded "unfit for consumption" leading to families living off bottled water for eight months.

PHYSIOLOGY

Nobel Prize for British physician-scientist

Sir Peter Ratcliffe has been jointly awarded the Nobel Prize in Physiology or Medicine for discoveries in how cells react to oxygen availability.

Alongside the other prize winners – William Kaelin Jr and Gregg Semenza – Sir Peter discovered how cells sense and adapt to changing oxygen availability and identified molecular machinery that regulates the activity of genes in response to varying levels of oxygen.

Their discoveries have also paved the way for new strategies to fight anaemia, cancer and other diseases.

Thirty-one years ago, Sir Peter qualified as a doctor from St Bartholomew's Hospital Medical School, one of Queen Mary University of London's founding institutions.

Professor Colin Bailey, Queen Mary's Principal and President, said: "It is clear that this work is seminal, and it will have ramifications within and beyond physiology and medical science."

The Nobel Committee announced: "The fundamental importance of oxygen has been understood for centuries, but how cells adapt to changes in levels of oxygen has long been unknown.

"Thanks to the ground-breaking work of these Nobel Laureates, we know much more about how different oxygen levels regulate fundamental physiological processes."

Sir Peter said: "I am honoured and delighted at the news. I have had great support from so many people over the years.

"It's a tribute to the lab, to those who helped me set it up and worked with me on the project over the years, to many others in the field, and not least to my family for their forbearance of all the ups and downs."

The winners were awarded gold medals, diplomas and £740,000 to share.

→ **bit.ly/2Nslju8**

UNDER THE MICROSCOPE

This month: 'Musical paracetamol'

Good grief! Whatever next? Witty cough medicine?
Very funny. It's actually a metaphor for the effect that music can have to lift your mood and improve your mental health and wellbeing.

So, why is this relevant now?
It's been in the news because the first "song surgery" has opened in the Lake District town of Ambleside. An opera singer will tailor songs to the person seeking help and it's hoped the trial will result in an app featuring musical prescriptions for anyone to access.

I hope she doesn't sing Justin Bieber. That could make you feel worse...
Typically, the singer takes very old poems and sets them to classical music. So, if you're feeling depressed, the prescription might be an uplifting poem about spring, set to music by the composer Gabriel Faure. Both the poem and the music aim to tap into something fundamental in the person – something you wouldn't necessarily get with Bieber...

But why pay for an opera singer? I'm a karaoke king.
With the greatest respect, you would never be able to cover the vocal range required to fully encapsulate the wealth of human emotions found in these particular poems. The opera singer's voice also creates an "element of wonder" that can have a dramatic effect on the listener and their emotional needs.

OK. Tell me more.
It's all part of a trend to prescribe arts treatments to people with psychological and cognitive problems. Recently, the world's largest study of the impact of arts intervention on physical and mental health was launched in an attempt to find out whether arts prescriptions can and should be rolled out across the NHS.

Hmm. Not sure a dose of ballet will improve my sciatica...
You might mock but it's been shown that music helps dementia patients. The study will also research movement and music sessions for stroke patients, dance for people with Parkinson's and singing for women with postnatal depression.

IMAGES: ISTOCK/SCIENCE PHOTO LIBRARY

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#UnitedinProgress

A comprehensive menu for anaemia diagnosis

Anaemia is identified by the World Health Organisation (WHO) as a widespread public health problem with major consequences for human health and social and economic development. Affecting approximately two billion individuals, WHO estimates that almost 25% of the global population is affected by anaemia.

Anaemia is one of the most common disorders of the blood, where the number of red blood cells and/or their oxygen carrying capacity is insufficient. This can impair quality of life and potentially lead to additional health complications or life-threatening conditions. There are multiple types of anaemia and a wide variety of causes. Diagnosing this complex disease therefore presents a challenge for clinicians to ensure the correct type and cause can be identified to direct the best treatment path.

The prevalence of anaemia

Global statistics on the prevalence of anaemia are difficult to obtain, however, the most recent report from WHO provides some figures that highlight the number of individuals affected across different regions (Table 1). In general, anaemia tends to affect vulnerable people, namely young children, pregnant women, the elderly, and people with serious and chronic diseases. The highest prevalence is in preschool-age children, while the lowest prevalence is in men.

In developing countries, anaemia affects over half of preschool-age children and pregnant women, and is one of the most common, preventable causes of death within these groups. However, anaemia is a worldwide issue, with figures for industrialised countries reaching 30-40% for these demographics as well.

In developed countries there is a high prevalence of anaemia among the elderly. For individuals aged over 50, a US study showed that anaemia prevalence rates rose rapidly to greater than 20% for those aged 85 and over. As life expectancy continues to increase and the ageing population grows this creates an important health issue. When anaemia reaches a severe level, it is associated with fatigue, weakness, dizziness and drowsiness, and in extreme cases, death. Notably, surgical patients affected by anaemia can experience increased risk of postoperative morbidity and mortality.

Challenges and complexity of anaemia

Despite the global prevalence and seriousness of anaemia, it often remains under recognised and goes undertreated due to its complex nature and the fact that there are multiple specific types, all with different causes, implications and treatment options. Adding to the complexity, many of these different types can often coexist.

There are five main types of anaemia:

- Iron deficiency anaemia (IDA) – the most common globally
- Vitamin deficiency anaemia – e.g. Vitamin B12, folate & Vitamin A
- Anaemia of chronic disease (ACD)
- Anaemia of cancer
- Anaemia of renal failure

As each of these different types of anaemia has a different cause, it is important that clinicians are able to distinguish between them and correctly diagnose the accurate basis of a patient's anaemia for treatment. Patients suffering with anaemia will often present with general and varied symptoms, which a clinician needs to interpret. To combat the complexity of anaemia and the challenges clinicians face reaching a diagnosis, a wealth of information is needed, compiled from a variety of laboratory tests.

Diagnosing anaemia – a comprehensive menu of testing options

Laboratory testing aids clinicians in diagnosing and pinpointing which type of anaemia a patient is affected by in order to direct the correct treatment.

In general, a clinician will first run haematology testing including a complete blood count and haemoglobin levels. These initial results help determine whether or not a patient has anaemia. Following this, additional

testing is available to confirm the cause of anaemia depending on a patient's history, clinical symptoms and results from previous tests.

Valuable anaemia-related diagnostic information can be obtained from a wide variety of laboratory tests. Providing the most comprehensive offering of anaemia tests available, Beckman Coulter supports clinicians with greater insight into their patients' conditions and offers more pathways to improving patient care. This range includes 28 different tools (Figure 1) that cover a variety of laboratory disciplines – haematology, nephelometry, chemistry, and immunoassay. Results from these tests deliver comprehensive, accurate information for effective diagnosis, treatment and monitoring for adjustment of anaemia therapy.

Focus on Active-B12 aka HoloTC

Supporting the diagnosis and monitoring of vitamin deficiency anaemia, the latest addition to Beckman Coulter's range of anaemia testing options is the Access Active B12 assay. Vitamin B12 deficiency is widespread and can heavily influence patient health; it is directly linked with the megaloblastic anaemia known as pernicious anaemia.

Vitamin B12 itself – also known as cobalamin – is an essential nutrient found in people's diets in meat, fish, and dairy. Deficiency in vitamin B12 is therefore often seen in individuals who consume little or no animal products. It is also prevalent in the elderly, pregnant women and patients with renal or intestinal conditions. As the neurological symptoms of vitamin B12 deficiency can be unspecific and irreversible, it is crucial to detect it early.

The transportation of vitamin B12 around the body involves three binding proteins – Intrinsic Factor (IF), transcobalamin (TC) and haptocorrin (HC) – which enable the efficient uptake of the small amounts of vitamin B12 available from an individual's diet. When TC and HC bind with vitamin B12, the resulting complexes are known as holotranscobalamin (HoloTC) and holohaptocorrin (HoloHC). HoloHC accounts for the major fraction of vitamin B12 in the circulation, representing 70-90% of vitamin B12 in the blood. However, it is biologically inert. HoloTC is the only active form of vitamin B12 that can be taken up by cells, but only accounts for 10-30% of vitamin B12 in the blood. It is therefore often termed Active-B12.

Traditionally, serum B12 testing measures total circulating B12 (HoloTC plus HoloHC). It therefore doesn't provide a totally accurate representation of the vitamin B12 available to the cells in the body. The Active-B12 assay measures the critical form (HoloTC), and can be used either as a first line test for screening patients and determining their vitamin B12 status, or as a resolving test. In this case, clinicians may choose to continue using total B12 testing initially and then follow this up with Active-B12 testing should the results be indeterminate – a common occurrence with total B12 testing. In both situations, studies have shown that using the Active-B12 test provides a more reliable and earlier indicator of B12 deficiency. The test runs on a routine analyser and so it is easy to implement, and simple to operate. Fewer indeterminate results were also seen, as well as superior sensitivity and specificity compared to total serum B12 testing.

Another key reason for using Active-B12 as a first-line screen is because this metabolically active portion of vitamin B12 is the earliest laboratory

TABLE 1. ANAEMIA PREVALENCE AND NUMBER OF INDIVIDUALS AFFECTED IN PRESCHOOL-AGE CHILDREN, PREGNANT WOMEN AND NON-PREGNANT WOMEN IN EACH WHO REGION. TABLE ADAPTED FROM WORLDWIDE PREVALENCE OF ANAEMIA 1993-2005 WHO GLOBAL DATABASE ON ANAEMIA 2008.

WHO Region	Preschool-age Children*		Pregnant Women*		Non-pregnant Women*	
	Prevalence (%)	No. Affected (millions)	Prevalence (%)	No. Affected (millions)	Prevalence (%)	No. Affected (millions)
Africa	67.6	83.5	57.1	17.2	47.5	69.9
Americas	29.3	23.1	24.1	3.9	17.8	39
South-East Asia	65.5	115.3	48.2	18.1	45.7	182
Europe	21.7	11.1	25.1	2.6	19	40.8
Eastern Mediterranean	46.7	0.08	44.2	7.1	32.4	39.8
Western Pacific	23.1	27.4	30.7	7.6	21.5	97
Global	**47.4**	**293.1**	**41.8**	**56.4**	**30.2**	**468.4**

*Population subgroups: Preschool-age children (0.00-4.99 yrs); Pregnant women (no age range defined); Non-pregnant women (15.00-49.99 yrs).

parameter to become decreased if there is depletion due to negative balance of this crucial vitamin. Clinical or haematological symptoms may not yet be present. Other biomarkers can be used to assess Vitamin B12 status - methylmalonic acid (MMA) and homocysteine (tHcy) - which are functional vitamin B12 markers that increase due to metabolic processes as vitamin B12 stores are depleted. However, these are indirect markers of vitamin B12 and will therefore show depletion at a later stage than Active-B12, which is a direct marker and therefore more effective.

Studies have also demonstrated the effectiveness of Active-B12 (HoloTC) when compared to MMA and tHcy. For example, in a study of Vitamin B12 status in the elderly it was concluded that HoloTC performed significantly better than other indicators. Not only is Active-B12 proven to be a sensitive and specific direct marker of Vitamin B12 deficiency, it is easy to use and can be performed on a routine clinical chemistry analyser. Analysis of MMA and tHcy involve more specialised analyses, with MMA requiring mass spectrometry, which is a complex and manual method that often requires samples to be sent to specialized centres for analysis.

Summary

With the worldwide prevalence of anaemia so high, the development and adoption of Active-B12 testing is key. Moving to Active-B12 testing helps to simplify the testing process, aiding in patient diagnosis to initiate treatment faster. In addition, the results from Active-B12 testing present a more accurate representation of vitamin B12 deficiency and anaemia status compared to other tests available, including total serum B12.

Commenting on the new Beckman Coulter Access Active-B12 assay for vitamin deficient anaemia Heather Read-Harper – Senior Marketing Manager, Beckman Coulter observed: "This new addition to our anaemia testing portfolio highlights the Company's commitment to improving patient care. With the largest measuring range on the market, fastest time to first result and standardisation to WHO International Standard (IS) 03/178, the Access Active-B12 assay provides the final piece in the puzzle for anaemia disease-state management. The comprehensive menu of testing options we provide helps our customers to tackle the complex challenge of anaemia diagnosis. And with proven expertise in analysing laboratory test processes, we work together to understand requirements and create flexible solutions that meet the evolving needs of our customer."

FIGURE 1. COMPREHENSIVE MENU OF ROUTINE AND SPECIALITY ANAEMIA TESTING OPTIONS OFFERED BY BECKMAN COULTER.

	Diagnostic Tool	Routine	Specialty
IMMUNOASSAY	EPO		✔
	Ferritin	✔	
	Folate/RBC Folate	✔	
	IL-6*		✔
	Instrinsic Factor Ab		✔
	Soluble Transferrin Receptor (sTfR)		✔
	Vitamin B12	✔	
CHEMISTRY	ALT	✔	
	Bilirubin	✔	
	BUN	✔	
	C-Reactive Protein	✔	
	Creatinine	✔	
	Crystatin C	✔	
	Ferritin	✔	
	Gamma-Glutamyl Transfearse (GGT)	✔	
	Haptoglobin	✔	
	Iron	✔	
	Total Iron Binding Capacity	✔	
	Transferrin	✔	
NEPHELOMETRY	C-Reactive Protein	✔	
	Crystatin C	✔	
	Ferritin	✔	
	Haptoglobin	✔	
	Transferrin	✔	
HEMATOLOGY	Complete Blood Count (CBC)	✔	
	Haemoglobin	✔	
	Mean Cell Volume (MCV)	✔	
	Mean Corpuscular Haemoglobin	✔	
	Concentartion (MCHC)	✔	
	Reticulocyte Count and Indices**	✔	

* For Research Use Only (RUO) in the U.S
** Mean reticulocyte volume; immature reticulocyte fraction

References at: thebiomedicalscientist.net/resources/anaemia-beckman-coulter-whitepaper

TECH NEWS

LYTIX BIOPHARMA

COLLABORATION

Lytix Biopharma, a Norwegian clinical-stage immunoncology company, has announced a clinical collaboration with the US-based company Iovance Biotherapeutics – a late-stage biotechnology company developing novel cancer immunotherapies based on tumour infiltrating lymphocyte technology.

It will evaluate Lytix's first-in-class oncolytic peptide, LTX-315, in combination with Iovance's autologous ready-to-infuse T-cell therapy. The collaboration is non-exclusive and both parties will maintain ownership of their own assets.

→ **lytixbiopharma.com**

OLYMPUS

SLIDE SCANNER

The new Olympus SLIDEVIEW VS200 slide scanner captures high-quality virtual slide images and offers flexibility to empower advanced quantitative image analysis for brain, cancer and stem cell research, as well as drug discovery. Simple to use, its intuitive workflows enable users to start scanning a slide in as few as two clicks.

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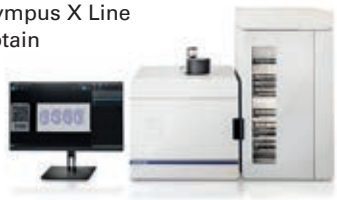


FLUIDIC ANALYTICS

PROTEIN INTERACTION

Fluidic Analytics, a pioneer in protein analysis and the company behind in-solution diffusional sizing, is inviting scientists to participate in a competition for a chance to use the new Fluidity One-W to investigate a protein interaction of their choice.

This latest instrument from Fluidic Analytics was launched in November at the PEGS Europe Protein and Antibody Engineering Summit in Lisbon, Portugal.

The winning researcher will receive a three-month instrument placement, as well as consumables and training to help study their proposed protein interaction with this groundbreaking new technique.

→ **For details and to enter, outline your proposed study at fluidic.com/win2019**

GROUNDBREAKING NEW CANCER TESTS?

Dr Susie Cooke leads a team that has developed cancer tests, which could lead to a breakthrough in understanding the deadly disease.

How do you produce an inexpensive and easy-to-use assay that permits laboratory scientists to extract the maximum information possible from just a small sample of cancerous material? This, says Dr Susie Cooke, Head of Medical Genomics at the Glasgow Precision Oncology Laboratory (GPOL) at the University of Glasgow, was the fundamental challenge for the team that has spent the past five years developing what have become known as Glasgow Cancer Assays.

In helping to match patients more closely with suitable emerging therapies and the latest clinical trials, this new suite of tests could help to change the way the disease is treated and managed. The outlook is good: the assays are already being evaluated by NHS laboratories in England and Scotland.

Key elements

Technically, the major benefit of the tests is that they have been engineered to be suitable for any solid tumour and to set out the genomic events behind the cancer. "The Glasgow Cancer Assays are large panels," says Cooke, "so they use standard sequence-capture and next-generation sequencing methodologies. But two key elements set them apart.

"Firstly, the regions of the genome we selected for targeting are based on an objective and rigorous meta-analysis of publicly available genomic data for all solid tumour types, plus literature rescue of biologically important features for rarer tumour types. When you look at other panels there's surprisingly little consensus on which genes are included – we surveyed eight existing large cancer panels and only 15% of genes tested were common to them. All included genes for which there is no robust evidence of a role in cancer, likely due to the high false positive rate in statistical predictions. This wastes sequencing capacity on irrelevant regions and makes interpretation difficult. We reviewed over 2000 genes and whittled them down to a set of 555 with convincing evidence for a role in solid tumour carcinogenesis.

"Secondly, our assays are designed to capture all genomic feature types – coding and non-coding, substitutions and indels, copy number changes, structural variants, fusions and mutational signatures. Our analyses of whole-genome sequences showed that there are as many copy number driver events in cancers as there are mutations, and that inactivating structural variants are a common mechanism for losing function of key tumour suppressor genes, such as *RB1* and *PTEN*. Both of these genes are potential biomarkers and are being investigated in clinical trials, so missing any events in them would risk seriously confounding the trial results."

DR SUSIE COOKE

- ✔ PhD in cancer genomics
- ✔ 2007, Research Fellow at Cancer Research UK's Cambridge Institute
- ✔ 2011, Research Fellowship in the Cancer Genome Project at the Wellcome Sanger Institute
- ✔ 2016, joined the Glasgow Precision Oncology Laboratory as Head of Medical Genomics.

Routine healthcare

In addition, the great promise of the Glasgow Cancer Assays is that they can be used in routine healthcare settings, potentially making life easier for clinicians and testing laboratories.

"The advantage of having a comprehensive pan-cancer assay is that samples from different tumour types can be processed together," says Cooke. "This really simplifies delivery for genetics laboratories, as they don't have to run small numbers of lots of different assays for different indications. Batching in this

"Our assays are designed to capture all genomic feature types"

way also delivers economies of scale and is amenable to automation. For clinicians, the comprehensive nature of the assays means they don't have to iteratively order lots of different lines of testing. They get all the information up front and this allows forward planning of the patient's treatment pathway. We've seen genomic profiles using these tests that support a choice of first-line approved therapies and a choice of back-up trial options in case first-line treatment fails."

During the course of its work on the assays, the team focused intently on the everyday challenges of "real-world" oncology. "We wanted the assays to be suitable for as many patients as possible, and to us that meant working on FFPE material, working on small biopsies from which only small amounts of DNA are available and working on tumour types, such as pancreatic cancer, which have a very high percentage of normal stroma intercalated with the tumour, and therefore require deeper sequencing to get enough data from the tumour cells.

"We also wanted them to be feasible for resource-limited public healthcare systems, in terms of delivery costs and making sure that the data generated could be processed and stored with minimal specialist infrastructure. Sequence capture technology allows us to meet all of these requirements while still capturing a large enough genomic footprint to deliver virtually all the biologically and clinically relevant information contained in a cancer genome."

The challenges

Work like this is hugely time-consuming, demanding a lot of planning, patience and perseverance from everyone involved. Several large hurdles required leaping, says Cooke. "The main challenge was identifying what genomic features are truly important in cancers. The curation of existing genomic data to identify *bona fide* cancer genes was labour-intensive but investing up front in understanding the evidence for a gene's role in cancer does make interpretation easier when you detect variants in those genes. The other aspect that took time was working up a capture strategy for each element and then finding appropriate samples with orthogonal data for testing and validation."

NHS laboratories are now testing the Glasgow Cancer Assays to see if they can withstand the rigours of frontline work and deliver all they promise. "There are regulatory processes to work through," says Cooke. "I can't speak for the decisions the NHS will make based on their evaluations, but from a technology perspective there's no reason why they couldn't be available within the next year or two."

And following this breakthrough, what will GPOL be turning its attention to next? "We'll be keeping the assays up to date and also pushing the boundaries even further in terms of what kinds of genomic features we can capture. Our other big focus is software development. We've developed a pipeline alongside the assays to really extract the maximum amount of information from the data, so we'll be looking to get that out as well." BMS

"The soil microbiome is enormously diverse and contains many organisms that could be pathogenic to animals living within it"

SLIME OF THE TIMES

Sarah J Pitt and **Alan Gunn** write about their search for new antibiotics, which has taken them out of the laboratory and into the vegetable patch.

The quest for antimicrobial agents has taken researchers to some interesting places, both geographically and conceptually. The first synthetic antibiotics used in human medicine were the sulphonamides. These were developed by chemists in Germany in the 1930s who had been thinking about the observation that certain dyes were used in staining bacteria and parasites for diagnostic identification. They wondered whether specific binding of dyes could be used to prevent the growth of microorganisms inside the human body. Through trial and error and gradual alterations to chemical structure of the original compound, an effective antibacterial agent called Prontosil was produced. It was used successfully to treat streptococcal and staphylococcal infections in humans before the outbreak of the Second World War. The discovery that a common soil fungus, *Penicillium chrysogenum*, produces a substance which also has an inhibitory effect on *Staphylococcus* and *Streptococcus* spp. was made a few years earlier. However, Fleming's discovery remained an interesting laboratory finding with potential. It was not until the 1940s that Florey and Chain developed the technique for producing penicillin in large quantities which then made it available for use in patients.

Natural sources of antibiotics

Scientists often follow up reports of "natural" antibiotics to establish whether

they really work (and if so, what is the mechanism of action) and some traditional remedies have turned into commercial products. For example, Manuka honey has been long recognised as having skin healing properties and clinical trials have confirmed this. Since it is feasible to produce honey in large quantities, this is now available as a "medical grade" format, used to treat chronic wound infections. Another strategy is to identify animals, fungi, and plants that produce antimicrobials. For example, marine sponges are a rich source of bioactive chemicals, including antibiotics. This is not particularly surprising because sponges must defend themselves chemically since they cannot move away from or actively defend themselves against attack. However, as is the case with many natural substances, translating laboratory findings into clinical treatments is proving difficult, because isolating chemicals and scaling up production is not easy.

Antimicrobial protection in soil invertebrates

The soil microbiome is enormously diverse and contains many organisms that could be pathogenic to animals living within it. Thus, invertebrates living in or on soil, such as worms, slugs and snails are likely to have strategies to protect themselves against infection. Could these be exploited to find new antimicrobials? Advances in immunology have demonstrated that invertebrates have a well-developed innate immune system, with some components analogous to those found in mammals (including humans). A key feature of this immunity are the antimicrobial peptides (AMPs), which are small proteins (usually <100 kDa). In humans, examples of AMPs include lysozyme and defensins. Molluscan AMPs, mostly occur within the haemolymph or in association with the haemocytes. Laboratory experiments have demonstrated that some mollusc AMPs can inhibit the growth of common bacteria and yeasts. However, to date, research is mainly focussed on their role in mollusc biology (particularly commercial marine species, such as mussels and oysters). Translation of this information into producing new types of antimicrobial agents with widespread applications is rather limited.

Mucus as protection against the soil environment

As well as internal protection, slugs and snails also produce mucus both to help them move across surfaces and to defend themselves against predators. Mucus production helps to prevent bacteria from establishing biofilms on the mollusc skin and then entering the animal's body. Since mucus is made continually, this also helps to ensure that any potential pathogenic organisms are sloughed off as the slug or snail moves through the soil.

37 kDa

WE HAVE USED **BIOCHEMICAL** AND **MOLECULAR BIOLOGICAL TECHNIQUES** TO IDENTIFY **INDIVIDUAL ANTI-BACTERIAL PROTEINS**. SO FAR, WE HAVE FOUND **THREE** AND THE ONE OF MOST INTEREST IS A **37 KDA PROTEIN** CALLED **ASPERNIN**.

However, the constant production of mucus is clearly not enough on its own and so the possibility that it might have actively anti-microbial constituents led a research team in Japan to investigate this in the 1980s and 1990s. They collected and analysed mucus from the Giant African Land Snail, *Achatina fulica*. They reported finding a relatively large (160 kDa) protein, called Achacin, which inhibited the growth of *Escherichia coli*, *Bacillus subtilis*, *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Using these organisms as examples of Gram-positive and Gram-negative bacteria, they suggested that Achacin had broad spectrum activity. A Chinese team subsequently isolated and characterised a 9 kDa protein from *Achatina fulica* mucus which they showed had antibacterial activity and was also effective against the yeast *Candida albicans*. There is virtually no information on the presence of antiviral substances in mollusc mucus but molluscs, like all other organisms, suffer from viral diseases so they are likely to exist. For example, researchers in Brazil identified a fatty acid-based substance in the mucus of the slug *Phyllocaulis boraceiensis* which appeared to prevent the replication of measles virus in monkey kidney cells.

Antibacterial proteins in mucus from the garden snail

In our work, we have shown that the mucus from the brown garden snail, *Cornu aspersum* (also called *Helix aspersa*) has antibacterial properties. In preparations of whole mucus we found a repeatable, specific activity against *Pseudomonas aeruginosa*. It does not seem to have the broad spectrum effect which was reported for the Giant African Land Snail mucus. However, the mucus preparations have activity against all the type culture collection strains and all the clinical isolates of this bacterium that we have tested it against. It is not clear why this might be the case. *Ps. aeruginosa* is a key soil organism as well as an important opportunistic pathogen. Guides to keeping snails as pets list pseudomonal infection as a particular hazard, while experiments on *C. aspersum* in the 1980s showed that challenge with *Ps. aeruginosa* elicited a strong immune response and high doses were potentially fatal. This suggests that the very specific antibacterial effect that we observed is due to a natural requirement for the snail to protect against this bacterium. We have used biochemical and molecular biological techniques to identify individual anti-bacterial proteins. So far, we have found three and the one of most interest is a 37 kDa protein called Aspernin. Since *Ps. aeruginosa* is found in chronic wound infections and is an important cause of respiratory infections in patients with cystic fibrosis, it is hoped that Aspernin could be incorporated into a topical cream or an aerosol preparation. Cosmetic preparations (anti-wrinkle creams, face masks) containing *C. aspersum/H. aspersa* mucus are already widely available. It is claimed that they reduce the appearance of wrinkles, blemishes and scars. Although they contain extracts of whole mucus, rather than identifiable individual components, this means that it is possible to scale up the production of the mucus from snails and incorporate it safely into marketable products. It should therefore be feasible to produce clinically useful quantities of an antibacterial formulation.

CORNU ASPERSUM

Disseminated into many parts of the world intentionally as a food delicacy, and accidentally by the movement of plants.

Distribution

This snail is found in the UK, western Europe and along borders of the Mediterranean and Black Seas. It has also been introduced into the Atlantic Islands, South Africa, Haiti, New Zealand, Australia, Mexico, Chile and Argentina.

Description

The shell is large, globose, moderately glossy and sculptured with fine wrinkles. Adult shells (four to five whorls) measure 28 to 32mm in diameter

Reproduction

Mating requires four to 12 hours. Oviposition occurs three to six days after fertilisation The number of eggs deposited at one time varies from 30 to 120.

"We have shown that the mucus from the brown garden snail has antibacterial properties"

Conclusion

Antimicrobial resistance is a major public health problem. It is important to ensure that the drugs which are clinically useful at the moment are used wisely and sparingly. However, there are already strains of microorganisms that are resistant to most, if not all, of the antibacterial agents available to treat them. Thus, there is a pressing need for new antimicrobial agents, but these may come from surprising places. So next time you see a slug or snail in the garden – even if it is munching on your prize cabbages – you might see it in a different light. BMS

Sarah J. Pitt is Principal Lecturer at the School of Pharmacy and Biomolecular Sciences at Brighton University. **Alan Gunn** is Subject Leader for Biology at the School of Biological and Environmental Sciences at Liverpool John Moores University. For further reading recommendations, read the article at **thebiomedicalscientist.net**.

Sarah features on the latest IBMS podcast, which can be streamed at ibms.org/resources/podcasts

IMAGES: SHUTTERSTOCK

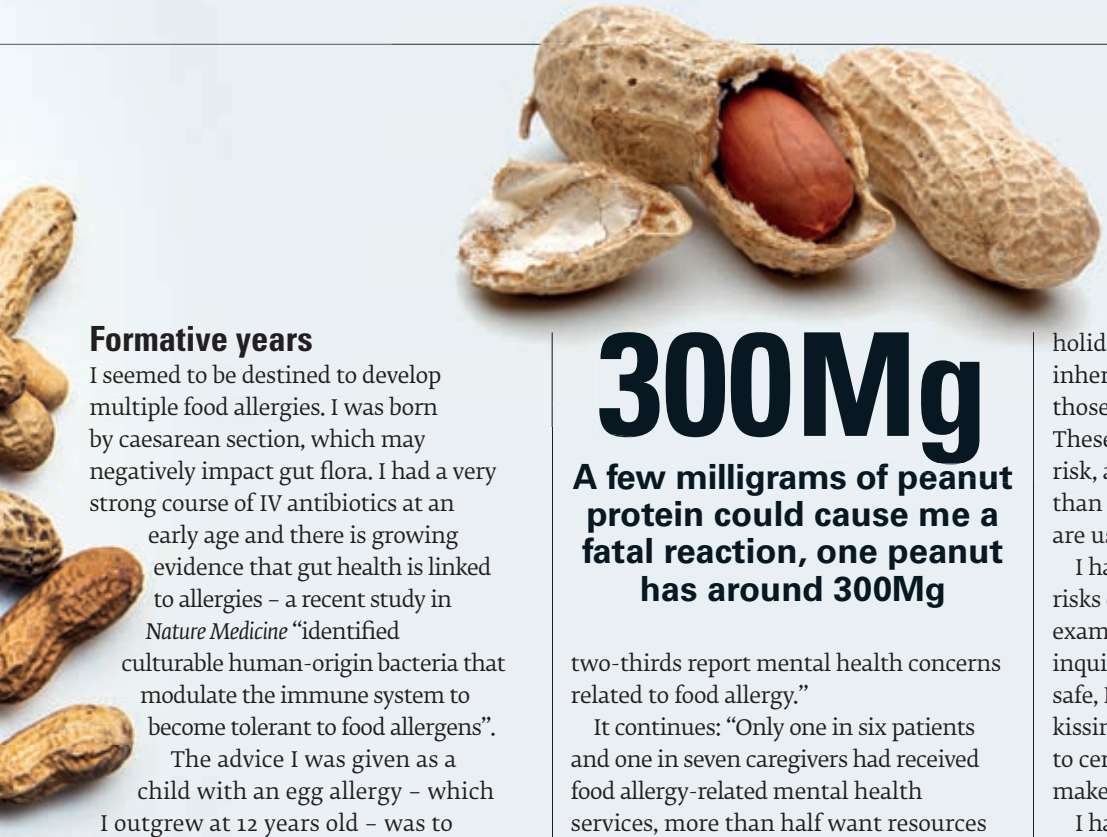
ANAPHYLAXIS
A personal account

Have you ever associated food with fatality? Have you ever felt anxious, as if you could be eating your Last Supper? **Oli Weatherall** has.

Anaphylaxis is a severe and often sudden allergic reaction. It can occur when someone with allergies is exposed to something to which they are allergic. Reactions usually begin within minutes and rapidly progress, but can occur up to three hours later. Anaphylaxis is potentially life-threatening, and always requires an immediate emergency response.

Around one third of the UK population (approximately 19 million people) will develop an allergy at some time in their lives. A significant proportion of these, around a million people, suffer severe symptoms.

I have had multiple severe reactions to peanuts and sesame – but it is possible to have an anaphylactic reaction to almost anything, not just food.



Formative years

I seemed to be destined to develop multiple food allergies. I was born by caesarean section, which may negatively impact gut flora. I had a very strong course of IV antibiotics at an early age and there is growing evidence that gut health is linked to allergies – a recent study in *Nature Medicine* "identified culturable human-origin bacteria that modulate the immune system to become tolerant to food allergens".

The advice I was given as a child with an egg allergy – which I outgrew at 12 years old – was to avoid peanuts. This advice would no longer be given by clinicians.

I did not build up a tolerance to peanuts, therefore, it is unsurprising that my body's immune response treated the harmless peanut protein as if it were a threat. I had eczema as a child, which is known to increase the likelihood of developing food allergies.

My mum has asthma and allergies to certain animals, which increases propensity of developing allergies. The only favourable thing was I spent a huge amount of time outside as a child, an absence is proposed to contribute to the allergy epidemic.

Anxiety

There have been several studies to quantify the impact of food allergies on quality of life, and they have consistently shown a negative impact. Food Allergy Research and Education is the world's largest non-profit organisation dedicated to food allergy awareness. It has published research that states of food allergy centres surveyed: "More than 90% serve patients and parents who have anxiety related to food allergy. Nearly 70% treat patients who suffer food allergy-related panic attacks. More than 70% treat patients who report food allergy bullying. Of 500 patients and caregivers surveyed, two-thirds report mental health concerns related to food allergy."

It continues: "Only one in six patients and one in seven caregivers had received food allergy-related mental health services, more than half want resources to help them cope with food allergy stress and anxiety."

Food allergy anxiety is hard to cope with, I believe it is not "curable" – it is a biological response. Those of us living with anaphylaxis are aware that a miniscule amount of our allergen could kill us – even a few milligrams of peanut protein could cause me a fatal reaction, one peanut has around 300 milligrams.

Living with food allergies constitutes a unique stressor, which is chronic and acute – after a decade of this and multiple severe allergic reactions, it can be hard to approach life the same way as before. My behaviour has altered, I am more risk-adverse in an attempt to avoid reliving these traumatic experiences.

300Mg

A few milligrams of peanut protein could cause me a fatal reaction, one peanut has around 300Mg

High-risk activities

Sharing and connection are innate drives we have. However, due to the danger certain forms of sharing and connection may present we can become isolated and live in fear, while simultaneously craving these exact things. Sharing drinks, food or a kiss can be seen as threats, rather than opportunities. We battle against our innate drives to keep ourselves safe.

Many things that people may take for granted, such as eating out, travelling, holidays and intimate relationships, are inherently harder and more stressful for those of us living with food allergies. These activities can be viewed as high-risk, anxiety provoking scenarios rather than fun, exciting and relaxing as they are usually perceived.

I have found that taking unnecessary risks caused me crippling anxiety, for example, I used to eat out without inquiring about whether the food was safe, I followed the same approach when kissing someone. I have learned saying no to certain things reduces my anxiety and makes life easier to deal with.

I have finally become fully cognisant of the wisdom of my gut in keeping me safe, I trust it without fail, it knows more than my limited consciousness does.

I have not eaten out for two years due to negative experiences. I only feel truly safe to eat and prepare food at home. Due to this and after finding it difficult to find suitable recipes that I did not have to significantly alter, I started Free From Fourteen Vegan, where I post recipes online that are free from the EU's fourteen major food allergens and animals products – the recipes can be eaten by most people without having to be altered to be safe for them to eat.

As a result of the widespread use of peanuts in pubs/bars and having a reaction in a pub where loose peanuts are served, my mum and I started a campaign to encourage pubs to remove all peanuts from the bar/drinking areas of their establishment. We already have commitment from a chain of pubs and hope more follow suit. Empathy, awareness and education are the keys to improving the lives of those with anaphylaxis. BMS

Oli Weatherall is completing a BA in Business Management. Read this article with references, at **thebiomedicalscientist.net**
Visit Oli's webpage at **instagram.com/freefromfourteenvegan**

A NEW FUTURE FOR SAMPLE RECEPTION?

David Ricketts, Head of Laboratory Process Improvement at Health Service Laboratories, explains how reviewing and redefining a role led to a more stable workforce and a reduction in errors.

Increasing workloads, slow adaptation of technology within trusts and other healthcare providers, high staff turnover and staff joining sample reception as a springboard for a career as a biomedical scientist is a familiar story across the country.

It is acknowledged that the sample reception area [SRA] is the engine room of any pathology service and an error made in reception can lead to a misdiagnosis and that may take many senior management hours to resolve.

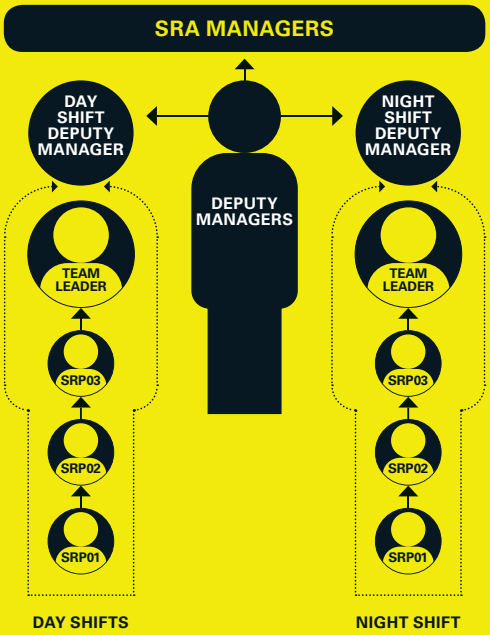
The SRA at the Halo building, in the heart of London, supports The Doctors Laboratory arm of the Sonic Healthcare UK pathology service. The Halo building is a state-of-the-art pathology facility, spanning 14 floors. The SRA department has just under 100 staff and provides a multidisciplinary service processing over 6,000 samples per day. The SRA covers a 24/7 service across all disciplines.

At the end of October 2017, the SRA department moved into the Halo. After a period of adjustment, the processes within the department were reviewed to look for opportunities to improve the workflow and service. This review revealed several issues that are common to all SRA departments. The staff were working incredibly hard, however, despite these efforts, targets were not always being achieved. There was a high staff turnover, which meant the department was managing a high workload while constantly recruiting and training new staff.

The review took the processes back to basics and removed some working practices that had been historic, streamlining others and looked at how technology could support the service. This improved performance, but the key issue of high turnover continued to frustrate the service and impose a significant training burden on SRA. Morale was being negatively impacted by many of the new staff and some of the existing staff focusing on how to get a job in the analytical laboratories to progress their aspirations to become biomedical scientists.

The executive team was meeting weekly looking at SRA and there was a real top down commitment to understand how we could address recruitment and retention. A small group was tasked to come up with a plan.

The challenge was to find a way for getting staff into reception with the skills we need, engage with them and to have SRA as a career choice, rather than a stepping stone to elsewhere. The solution to this was to propose putting a professional career pathway in place for the SRA department. This had to be attractive in terms of remuneration,



FEEDBACK IN QUOTES

John Zapata, SRA manager

"The new structure helps me to allocate tasks and rosters with a clear understanding of skill sets. It allows me to implement more effective training"

Nermeen Yassein, SRA Team leader

"The new career pathway helps with staff retention, I am no longer spending all my time training new starters but can focus on my team's needs"

Oznur Sakar, SRP03

" I feel like I have more career progression, this opens up training opportunities, I am able to make this my long term career pathway"

development and stability. The end goal was to produce a career pathway which enabled the business to recruit staff that see SRA as their main career and reduce turnover and allow a more focused training plan, rather than a reactive one.

The first challenge was, what job title is representative of this important function. The term Medical Laboratory Assistant (MLA) already describes a wide cross section of highly valued laboratory staff, which lacked the sense of identity needed for SRA as the objective was to redefine it as a specialist service in its own right.

The term decided on was Sample Reception Processing Officer (SRPO), which was in part looking at the old MLSO title and captured the role and responsibility of the department.

Once the title was agreed, there was discussion around what a career pathway would look like. There needed to be progression and this progression had to be measurable. The pathway would require funding so there had to be a benefit to the organisation for supporting this. The current departmental structure was MLA staff, team leaders a deputy manager and the overall manager. The thought was to expand this to a six-stage pathway, with the first three levels having automatic progression once set criteria have been met and the last three levels requiring suitable skills and competitive interviews to obtain.

The first level allowed for recruiting staff, using a competency assessment which had the skill-sets needed for a career in SRA. The training in the first year focused on becoming competent in one area of SRA and fulfilling mandatory training requirements as well as supporting cooperate objectives. This also allows an assessment if the member of staff is suitable for the job and the job is suitable for them. Once the staff member has met the requirements to progress, normally at the one year mark, then they become SRPO2, which is recognised with increased remuneration. The level 2 staff are expected to complete part 1 of the certificate of achievement, focusing on the SRA modules. They will also begin to expand their competence across more than one work cell within SRA. Once this is complete, normally at the second year mark, then they progress to SRPO3 with increase remuneration. The objective is that by level 3 the staff are well-rounded and experienced and can move to any task in SRA. Training now focused on individual needs. To progress to management roles, staff will need to compete for vacancies and further training is a combination of business and personal needs.

> *Once the title was agreed, there was discussion around what a career pathway would look like*

The project is now a year in, turnaround times have vastly improved, meeting the client-focused goals. The pilot training for level 2 certificate of achievement portfolios has now started, which will be rolled out fully once the department has understood the requirements to train the SRPO2.

Importantly, staff turnover has reduced by 94% (Six staff in nine months) allowing for a stable workforce and a subsequent reduction in errors. The staff are happy, the executive is happy and the clients are much happier with the service. The system will now be monitored to ensure sustained success before being rolled out to other SRAs within the business. BMS

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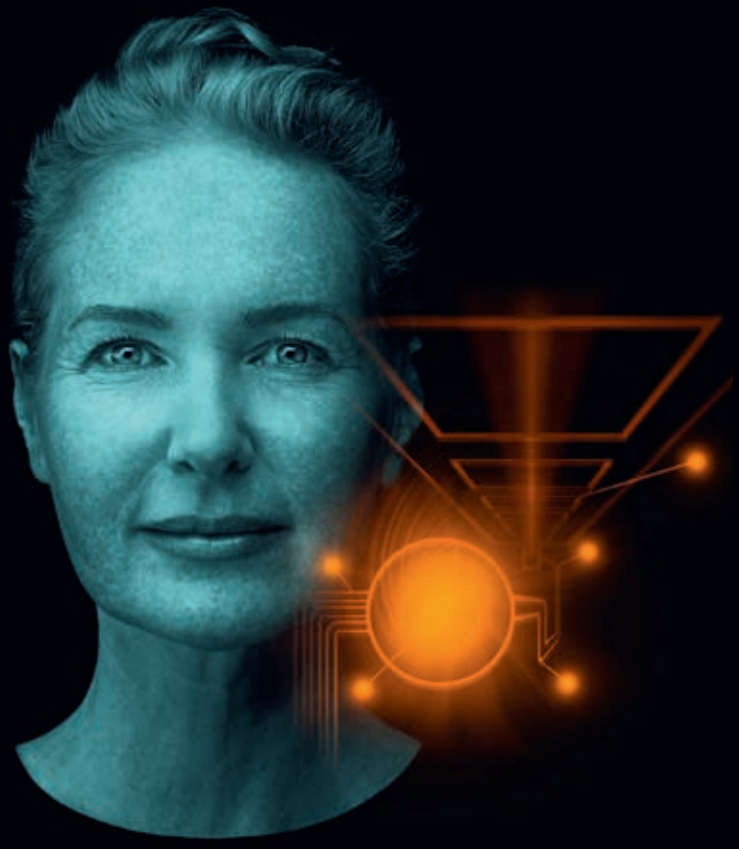

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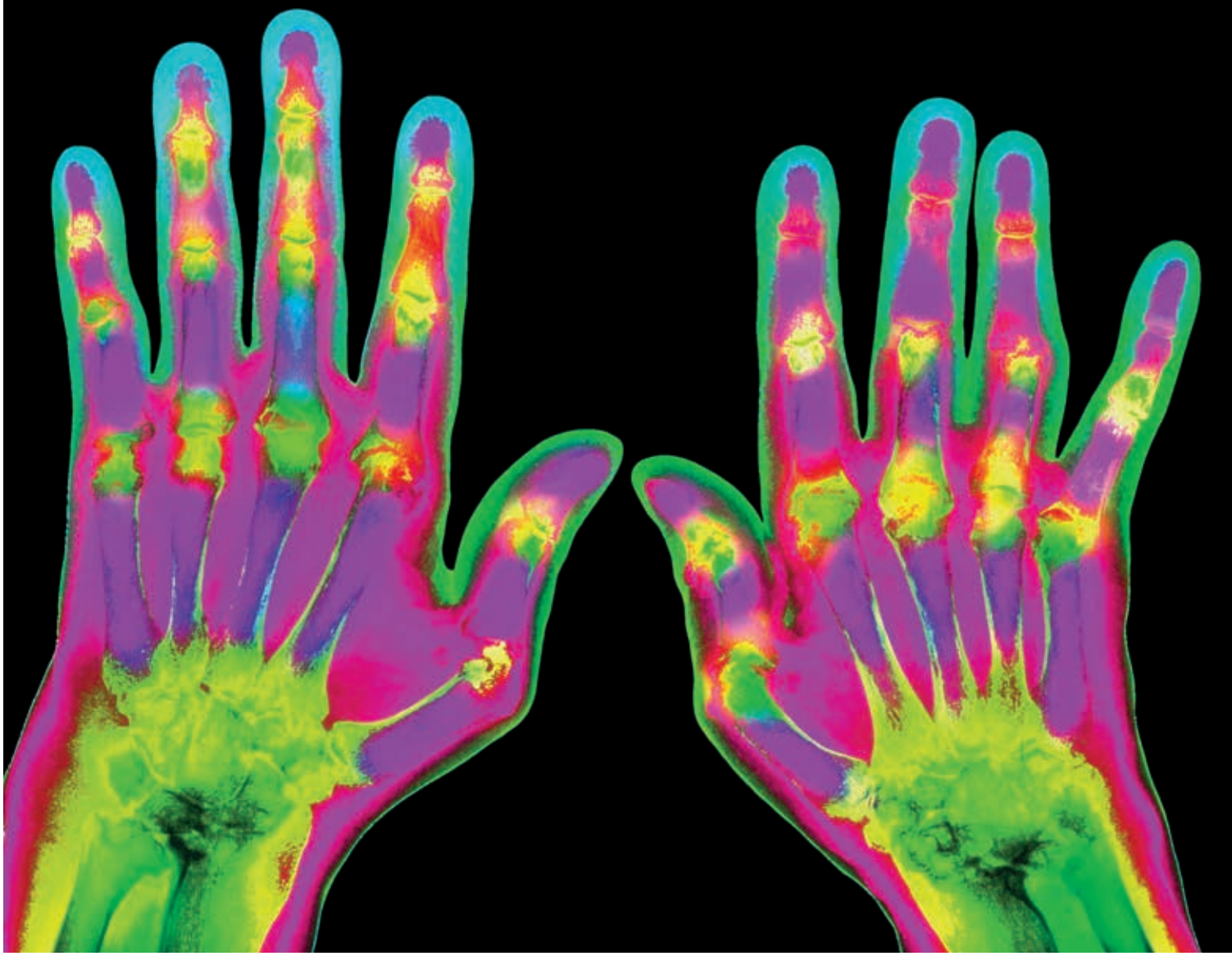
SUPPORTING BIOMEDICAL RESEARCH

In 2019, the IBMS awarded research grants totalling almost £27,000. Here, the seven recipients explain their grant-supported projects.



STEPHEN FÔN HUGHES

Head of the Betsi Cadwaladr University Health Board North Wales Clinical Research Centre
Pilot study of adjunctive therapy with Losartan and Allopurinol in Patients with Rheumatoid Arthritis and Interstitial Lung Disease

The North Wales Clinical Research Centre (NWCRC), based at Wrexham, led by Professor Stephen Fôn Hughes, initiative by the Betsi Cadwaladr University Health Board (BCUHB) Research and Development Department, was designed to encourage and support research within the health board and to promote clinical research across North Wales and beyond.

The proposed study has provided an exciting opportunity to work with Professor Mark Garton, a consultant rheumatologist, based at Wrexham Maelor Hospital, North Wales.

Rheumatoid arthritis (RA) carries a 10% lifetime risk of interstitial lung disease (RA-ILD), with median survival of two to three years. RA-ILD causes fibrosis (thickening) of lung tissue, variable inflammation and impaired gas exchange. Patients report dry cough/exertional breathlessness, often refractory to (or aggravated by) conventional therapies.

RA also increases cardiovascular risk, reflecting systemic inflammation, higher rates of traditional cardiovascular risk factors, and side-effects of corticosteroids and non-steroidal anti-inflammatory drugs.

Due to the lack of novel studies in this area, this research promises to increase subject knowledge in this field. Patients with RA-ILD will benefit from better ascertainment of early ILD and targeted medication, which should definitely reduce vascular morbidity while possibly slowing ILD progression.

IMAGES: SCIENCE PHOTO LIBRARY/ISTOCK

AMY CHERRY

Senior Lecturer in Biochemistry, University of Worcester
Markers for Alternative Treatment Strategies for Acute Myeloid Leukaemia

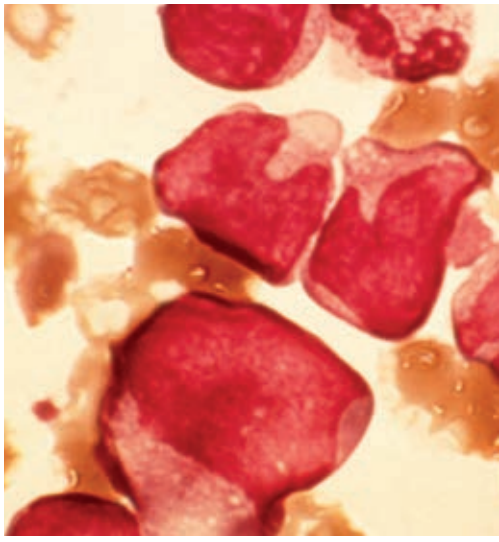
This work is about understanding how heamatopoietic stem cells develop and on determining the biological events which occur when stem cell development goes wrong, causing leukaemia. This project focusses on acute myeloid leukaemia (AML) – the most common acute blood cancer in adults. The disease is genetically very heterogeneous and prognosis varies according to particular genetic abnormalities. The standard treatment for AML has evolved little in the last four decades and many patients relapse following therapy.

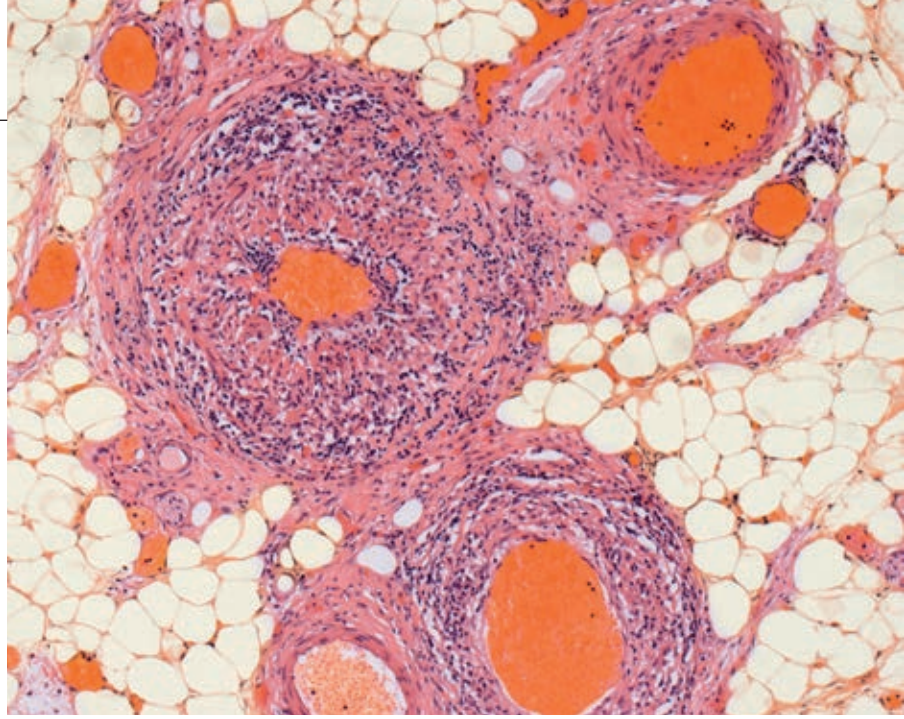
The aim of this study is to determine whether inhibition of the Hedgehog signalling pathway is a viable treatment strategy for different forms of AML. The hedgehog signalling pathway drives cell proliferation and its components are well established as targets for anti-cancer therapeutics. Leukaemic cell lines will be screened for hedgehog signalling markers and monitoring cell proliferation and apoptosis in cells treated with hedgehog pathway inhibitors to determine whether this treatment strategy is applicable to some or all forms of AML.

One negative prognostic marker for AML is expression of myeloid leukaemia factor 1 (MLF1). Since little is known about the protein, it is not a primary choice of drug target. However, research indicates that there is cross-talk between MLF1 and the tumour suppressor protein SUFU, a negative regulator of the hedgehog signalling pathway. This pathway, which is highly active during embryogenesis, is largely quiescent in healthy adult cells and its abnormal activity is associated with many different forms of cancer. In brief, the pathway is activated by binding of the hedgehog ligand to a receptor, Patched, which then relieves its inhibition of another transmembrane receptor, Smoothened. This results in the release of the GLI transcription factor by the tumour suppressor SUFU leading to upregulation of transcription of genes involved in cell proliferation, differentiation and survival.

Components of the hedgehog signalling pathway are well-established as targets for anti-cancer therapeutics. Recent *in vitro* and *in vivo* studies have demonstrated that targeting hedgehog signalling may be an effective anti-AML strategy including in cases of drug-resistant AML. However, undesirable side-effects have been associated with hedgehog pathway inhibitors.

The aim of the study is to determine the relationship between MLF1 expression and hedgehog pathway activity in leukaemic cell lines, to determine whether MLF1 screening provides a rationale for selective use of hedgehog pathway inhibitors in AML patients.





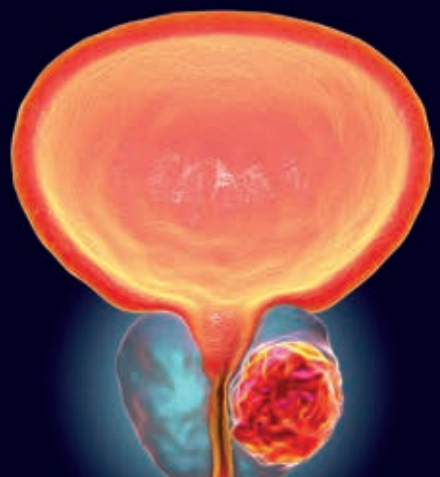
NANA YAA SNYPER

PhD student, North Wales Clinical Research Centre

The role of routine and novel biomarkers and their correlation with clinical outcome measures in patients undergoing surgical interventions for benign and malignant disorders of the prostate

The management of prostate disorders presents an increasing demand on already strained healthcare systems in many countries. Although safety for patients undergoing urological surgical procedures is improving, development of post-operative complications remains a serious concern. The aim of this study is to investigate the changes in selected biomarkers after prostate surgeries to test the hypothesis that post-operative changes in biomarkers are associated with the development of post-operative complications. This innovative research will provide additional knowledge to an area that has not been well established and provide predictive markers for post-operative complications.

Findings from this study will provide a single or a panel of blood/urine tests to predict the risk of patients developing post-operative complications. Specific changes to their management could then be instituted to improve patients' outcomes. This intervention will be beneficial for patients, through timely recognition and management, as well as offer benefits to healthcare providers by reducing treatment costs and readmissions due to post-operative complications.



ANTHONY RHODES

Professor at the School of Medicine, Faculty of Health & Medical Science, Taylors University, Dr Soo Ching Lee the University of Malaya's Department of Parasitology.

The microbiome diversity of the Malaysian long house of Borneo and inflammatory bowel disease.

The mammalian gut houses trillions of micro-organisms and there is evidence that exposure to a wide range of microbiota throughout life is essential for the development of a competent immune system.

It has been proposed that the incidence of inflammatory bowel disease (IBD) is linked to a lack of biodiversity in modern urbanised environments. An Asia–Pacific study group recently reported on the increasing incidence of IBD in developing Asian countries, to include Malaysia. Consequently, the changing environment has a profound effect on the incidence of both microbiome diversity and diseases of the post-modern era such as IBD.

Malaysia comprises the Malay Peninsula (West Malaysia), and the states of Sarawak and Sabah (East Malaysia), on the island of Borneo. West Malaysia houses the capital city of Kuala Lumpur and has the greatest level of urbanisation. In contrast, much of Borneo comprises natural rain forest housing an abundant biodiversity which greatly influences the natural eco-systems, and which in turn shapes the lives of its people. Sarawak has a population of less than 3 million, with the majority Dayak indigenous communities accounting for 40% of the population. Traditionally, the Dayaks have lived in long houses in the rain forests. Whilst modern day long houses are sometimes comprised of modern building materials, the basic communal concept is retained comprising a long continuous corridor sometimes up to 200 metres long from which individual family compartments shoot.

This research hypothesises that we will see significant differences in the balance of symbiotic and potentially pathogenic microbiota, when comparing the profiles of residents of the rural long house, urban Kuala Lumpur and patients with IBD. With the incidence of IBD rising in the region, it is important to define microbiome profiles of patients with IBD, while at the same identifying elements of the rural microbiome that may protect against the disease.

DR PARASKEVI GOGGOLIDOU

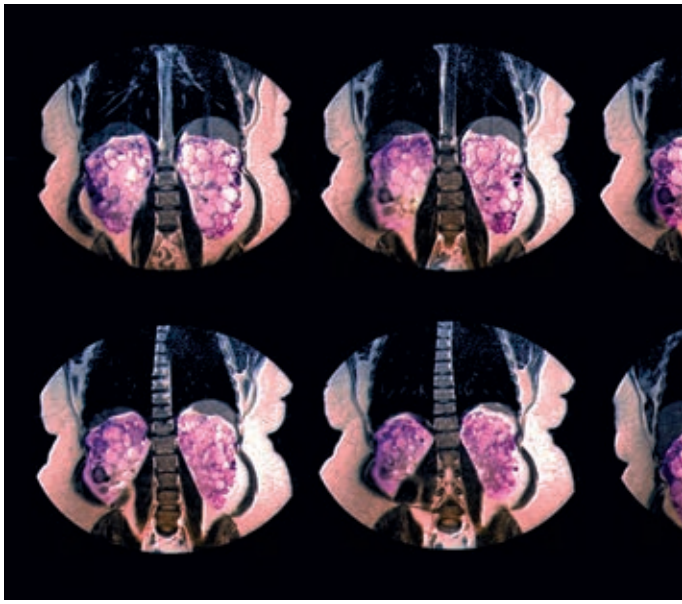
Course Director for the BSc Biomedical Science, University of Wolverhampton

Assessing a novel CRISPR/Cas9 mouse line as a useful tool for autosomal recessive polycystic kidney disease (ARPKD)

Inherited autosomal polycystic kidney diseases are a large burden on the NHS, as they account for 10% of patients receiving dialysis in the UK; many of these patients will require transplantation. To date, there is only NICE-approved pharmacological treatment, tolvaptan, a vasopressin-receptor antagonist approved for adults with autosomal dominant polycystic kidney disease (ADPKD). The mechanism of action of this agent targets cystic expansion in typically mid-life adult patients with relatively slowly progressive disease. Autosomal recessive polycystic kidney disease (ARPKD) affects predominantly children and is rapidly progressive, but no pharmacological interventions have been targeted or tested.

ARPKD manifests as extreme bilateral enlargement of cystic kidneys and pulmonary hypoplasia in the womb, with simultaneous liver abnormalities associated with the development of liver fibrosis. In those patients who survive the perinatal period, the majority will require renal replacement therapy (dialysis/transplantation) within the first decade of life and many require both kidney and liver transplants. ARPKD is caused by mutations in *PKHD1*, which encodes the large membrane protein fibrocystin that is required for normal branching morphogenesis of the ureteric bud during embryonic kidney development. Although various mouse models of ARPKD exist, none of them accurately reflects human ARPKD, making it difficult to dissect how mutations in *PKHD1* cause both kidney and liver defects and result in a wide range of disease severity.

This project has created a clustered regularly interspaced short palindromic repeats (CRISPR)/Cas9 mouse line with a T36M mutation that will be used to determine how kidney function is perturbed in paediatric mice, and investigate how the T36M mutation impacts kidney and lung morphogenesis. This could provide a novel pre-clinical ARPKD model and it will generate knowledge on the molecular and genetic mechanisms of ARPKD.



DR SARAH PITT

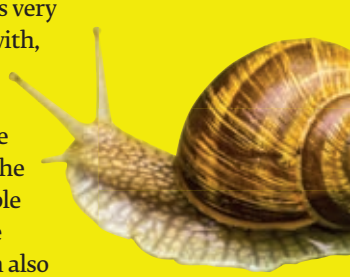
Principal Lecturer, School of Pharmacy and Biomolecular Sciences, University of Brighton

Investigation of the mode of action of aspernin, a novel antimicrobial protein identified in the mucus of the brown garden snail *Cornu aspersum (Helix aspersa)*

Working with her husband, Dr Alan Gunn of Liverpool John Moores University and other colleagues, Sarah's research reveals that the defensive mucus produced by the brown garden snail, *Cornu aspersum* (also called *Helix aspersa*) has antimicrobial properties. Samples of the mucus were tested against a range of microorganisms, but a consistent, reproducible effect was only observed against *Pseudomonas aeruginosa*.

In disc diffusion plate antimicrobial assays, the mucus inhibited the growth of several type culture collection strains and clinical isolates of the bacterium. This is interesting because *P. aeruginosa* is a ubiquitous opportunistic pathogen. It infects a range of sites, including deep wounds and it is also an important cause of respiratory disease in patients with cystic fibrosis. Drug resistant strains are increasingly being reported, so a novel antimicrobial treatment would be valuable.

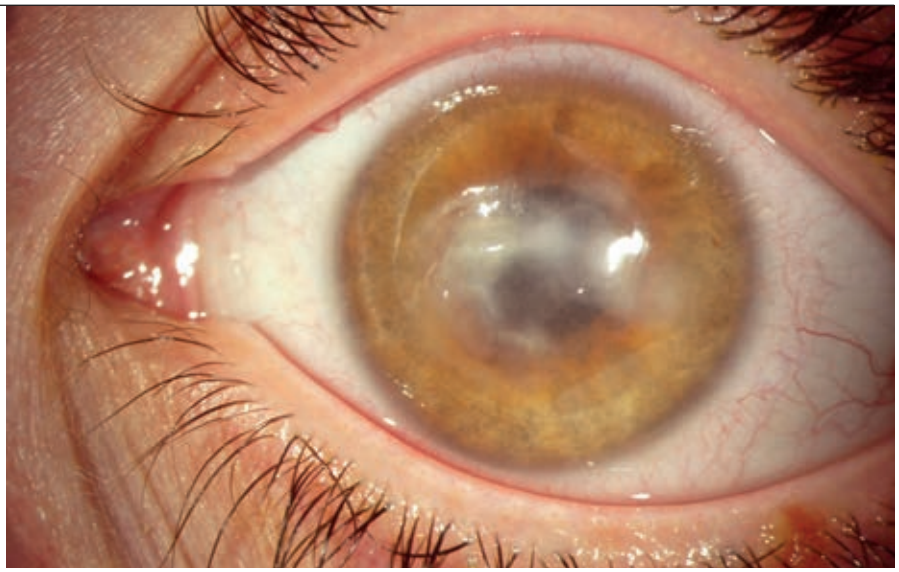
Using HPLC and mass spectroscopy the scientists were able to find partial sequences for three proteins with antibacterial activity. They have obtained the RNA transcriptome for the whole snail and used this to identify the full sequences for these three proteins. The one potentially of most interested in is a 37kDa protein, which they have named aspernin. The IBMS research grant will be used for the investigation of the structure, function and mechanism of antibacterial action of aspernin. Mucus is very difficult to work with, but now that they have the sequence, it will be possible to make the protein in a suitable vector. Having the protein on its own also



allows quantitative assays, in particular the minimum inhibitory concentration of aspernin with respect to *P. aeruginosa*. The bacterium will also be grown in the presence of aspernin and the effect it has on the cell wall integrity, size and shape of the cells, will be examined using electron microscopy. Fluorescent-labelled amino acids will be used to see whether it affects protein synthesis.

A key experiment will be to test the effect of aspernin on mammalian cells using an *in vitro* cytotoxicity assay, to ensure that the protein could be suitable for use in human medicine. With results indicating the site and possible mechanism of action, it is hoped that aspernin could be used to develop a novel, clinically useful antibacterial treatment. It is envisaged as being used in combination therapies with existing antibiotics, in the form of a cream as a topical application for deep wound infections or an aerosol to treat respiratory infections.

For more information on Sarah Pitt's research, **turn to page 18**.



DR WAYNE HEASELGRAVE

Senior Lecturer at the University of Wolverhampton (BSc and MSc biomedical science degrees programmes).

Besides my teaching commitments, I run a laboratory developing improved treatments, disinfectants and diagnostic tests for *Acanthamoeba* keratitis (AK).

This is a potentially blinding infection of the cornea that is usually seen in contact lens wearers. The infection is caused by *Acanthamoeba* which is a protozoan organism that is widely spread in the environment and can be routinely isolated from sites around the home including tap water, garden soil and household dust.

Although a rare infection, AK is one of the most difficult infections to manage due to the absence of an effective monotherapy. Currently treatment times are protracted and range from six to 30 months, with up to 25% of patients requiring a corneal transplant and 5% requiring surgical removal of the eye.

Early diagnosis and instigation of treatment is required for a good prognosis and visual acuity post infection. However, no commercial diagnostic test exists for AK and currently diagnosis involves culturing corneal scrapes on non-nutrient agar plates seeded with an *Escherichia coli* food source. Unfortunately, this method takes 1-2 weeks and has poor sensitivity with a negative result in up to 50% of patients that actually have the infection.

Therefore, there is an urgent need for the development of a rapid and sensitive diagnostic test for AK that can be performed in diagnostic laboratories around the world. The project will be a collaboration between the University of Wolverhampton and Dr Steven Coles and Dr Gary Keane from the University of Worcester. On a previous project funded by the IBMS, the team produced the first monoclonal antibody for the detection of *Acanthamoeba*.

On this current project, the team is now going to incorporate the antibody into a lateral flow device (LFD) similar to a home pregnancy test, which will give a visual colorimetric result in two to five minutes. Initial evaluation of the LFD will then be performed using different strains of *Acanthamoeba* and fresh clinical isolates. If successful, this diagnostic test has the potential to dramatically speed up the diagnosis of AK, resulting in an increased benefit to patients through reduced corneal damage and shorter treatment times.

Further information about IBMS research grants can be found on the IBMS website. The deadline for applications is 31 March in the year of application. To apply for an IBMS research grant download and complete the application form that can be found on the IBMS website.

A CASE STUDY

TRANSPORT PERFUSION FLUID

Daniel Weiand, Consultant Microbiologist and Educational Lead, reflects on the role of abdominal organ transport perfusion fluid culture.

A male in his 30s, with background of end-stage renal failure (ESRF) secondary to chronic glomerulonephritis (GN), underwent uneventful kidney transplantation in autumn 2016.

Seventy days post-operatively, he was readmitted with acute graft dysfunction, fevers, rigors and neutropenia. Ultrasound showed reduced renal perfusion, and a CT scan demonstrated a probable arterial pseudoaneurym.

He was taken back to theatre. Intra-operative findings included a completely thrombosed renal vein and iliac artery pseudoaneurysm.

The decision was made to perform graft nephrectomy and use a saphenous vein graft to mend the iliac artery.

In terms of relevant laboratory results, transport perfusion fluid (TPF) collected at the time of transplant (Day 0) led to isolation of *Candida albicans* (susceptible in vitro to fluconazole). Tissue from the iliac artery pseudoaneurysm (Day +70) also led to isolation of *C. albicans* (susceptible to fluconazole).

Fungal typing performed in Aberdeen demonstrated an identical multi-locus sequence typing (MLST) pattern for both isolates. Specimens sent to the histopathology laboratory demonstrated an abscess within the kidney (PAS stain, fig 1), as well as fungal spores and hyphae within the iliac artery (Grocott stain, fig 2).

Background

Infectious complications are among the major causes of morbidity and mortality in patients undergoing solid organ transplantation. However, the original source of such infections is often unknown. Proven donor-derived transmission of infection is an infrequent event.

What is transport perfusion fluid?

TPF mimics, in a simple fashion, the intracellular electrolyte balance of mammalian cells. A number of cell impermeant agents in the TPF prevent the cells from swelling during cold ischemic storage.

Different types of TPF are available for purchase from multiple manufacturers. For example, Soltran® is used for kidney transplants, and has a advertised (unopened) shelf-life of 15 months.

TPF is used in the process of transporting harvested abdominal organs from the donor hospital to the recipient hospital, where the transplant will take place.

The liver, pancreas, and kidney can be successfully preserved, by flushing the organs with TPF and storing them at hypothermia, to allow tissue matching and sharing of organs between transplant centres.

In line with European practice, all organs should be stored in three bags. In the inner-most bag, the individual organ is submerged in sufficient cold preservation solution. The bagged organ is then placed in a special transport box and covered with melting ice.

Specimen processing

Historically, clinical staff at most transplant centres, including The Newcastle upon Tyne Hospitals NHS

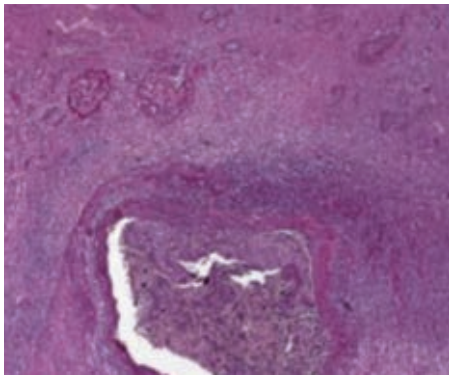


Fig 1. Abscess within the kidney (PAS stain)

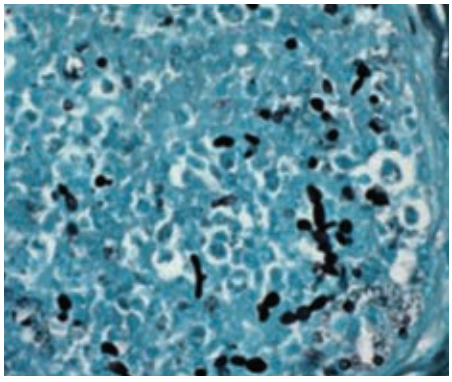


Fig 2. Fungal spores and hyphae within the iliac artery (Grocott stain)

Foundation Trust, have not sent TPF for culture from abdominal organs.

In August 2016, NHS Blood and Transplant (NHSBT) requested that a specimen of TPF be collected for culture from every transplanted abdominal organ (i.e. liver, kidney and pancreas transplants).

In practice, organs arrive triple-bagged, and the outer-most bag is opened by a non-sterile assistant. The inner two bags plus organ are removed to the sterile perfusion tray. TPF is then sampled from the inner-most bag, and sent for culture.

There remains little guidance on how best to process TPF samples, nor how to manage positive cultures. In January 2018, NHSBT issued a statement acknowledging that "the process for reporting and receiving reports of transport fluid results has led to significant workload and confusion within centres".

"Almost a quarter of laboratories recommended against routinely culturing TPF because of concerns relating to the low positive predictive value of results"

User surveys

In 2017, NHSBT conducted a survey of 25 microbiology laboratories servicing abdominal organ transplant programs. Responses were received from 14 out of 25 (56%) microbiology laboratories.

Almost a quarter of laboratories recommended against routinely culturing TPF because of concerns relating to the low positive predictive value of results. There was general consensus that a list of reportable organisms should be agreed, with most laboratories expressing an interest in isolation of yeasts from TPF.

In 2018, nephrology colleagues at the Newcastle upon Tyne Hospitals NHS Foundation Trust contacted all UK renal transplant units, focussing on "*Candida* positive-TPF" (CP-TPF).

Responses were received from six transplant units. Rates of isolation of *Candida* spp. from TPF varied from 2-10%, and treatment of organ recipients differed substantially. Some units were not routinely treating *Candida* spp. isolated from TPF, whilst others reported a "case-by-case" decision-making process, and one centre recommended 6 weeks' antifungal therapy for all cases of CP-TPF.

Local practice

At Newcastle upon Tyne Hospitals NHS Foundation Trust, between September 2016 and December 2017, 129 deceased donor kidney transplants were performed. An organism was isolated in 38 out of 129 (29%) cases, and *Candida* spp. were isolated from 14 out of 129 (11 %) cases.

All *Candida* spp. were reported as fluconazole-susceptible. Twelve out of 14 patients were treated with four weeks' oral fluconazole. Only one of the recipients with bacteria (rather than fungi) isolated from TPF was initiated on antibiotic therapy (Linezolid targeting MRSA isolated from TPF).

The road ahead

Candida spp. are isolated from TPF more commonly than thought, and are often pathogenic. The range and severity of complications in the recipients remains varied, suggesting recipient factors are most important.

Our unit now prescribes four weeks' appropriate antifungal therapy when *Candida* spp. are isolated from TPF. Defending our previous policy of no treatment is difficult because of the risk of serious infectious complications. However, the clinical significance of non-fungal isolates from TPF remains debatable.

A UK Standards of Microbiology Investigations (SMI) is needed to standardise and unify our TPF-related clinical and laboratory practice. Wide variation exists with regards to the pre-analytical, analytical, and post-analytical phases of specimen processing and reporting. A consultation process completed over the summer for a UK SMI for Abdominal Organ Transport Fluid testing. BMS

Daniel Weiand is Consultant Microbiologist and Educational Lead at the Freeman Hospital in Newcastle

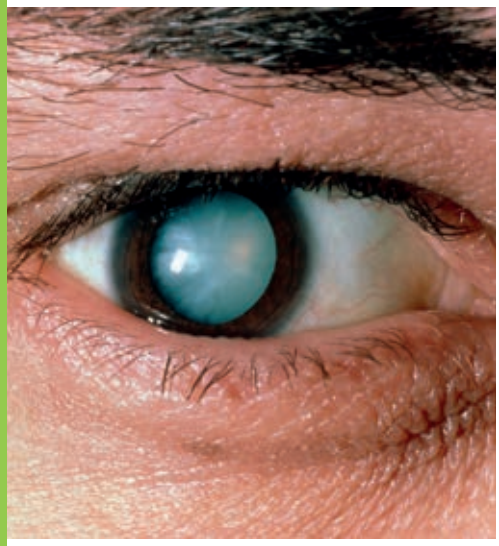
BRITISH JOURNAL OF BIOMEDICAL SCIENCE

ISSUE 3 2019 – A SYNOPSIS

Editor **Andrew Blann** outlines the content of the autumn issue of the journal.

The autumn issue of our journal is complete, with hard copies falling on doormats/desks in November. But, as usual, all the papers have been on the website for several weeks, if not months.

Of the 10 articles, eight refer to molecular genetics. One, that of Abdullah *et al* (pp184-189) focuses on miR-15a as a biomarker of age-related cataracts. Those unfamilar with miRNAs, and the other major group of non-coding RNAs, the lncRNAs, will find the review by Waller and Blann (pp157-165) on these molecules informative.

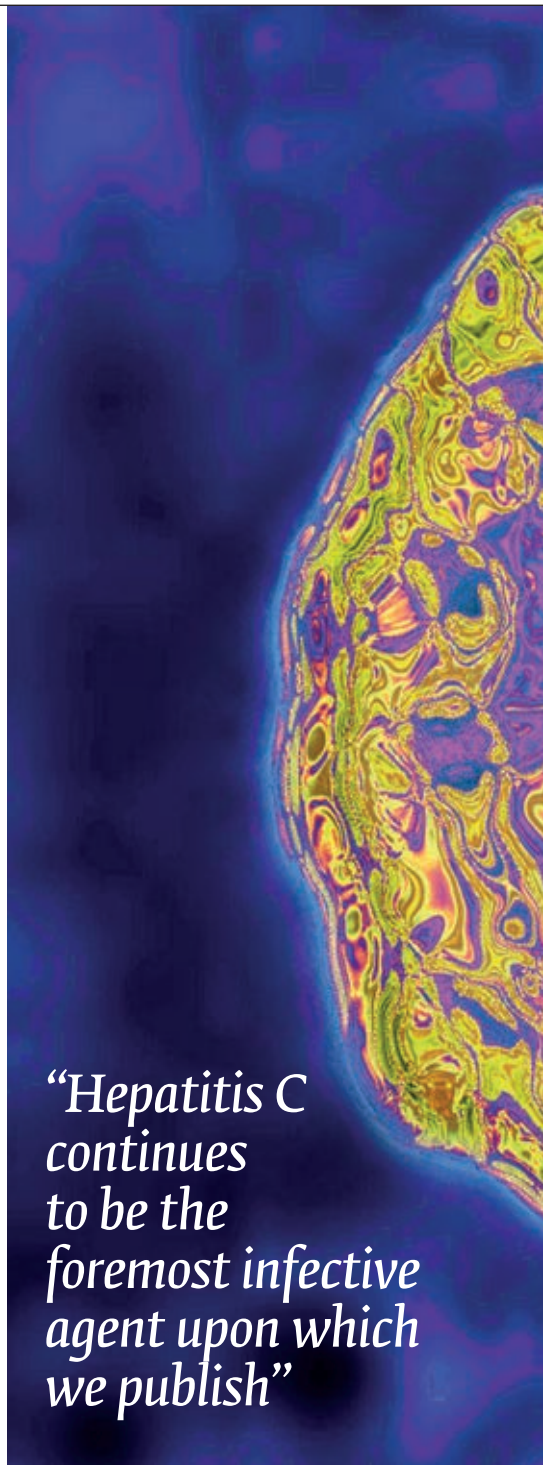


Hepatitis C

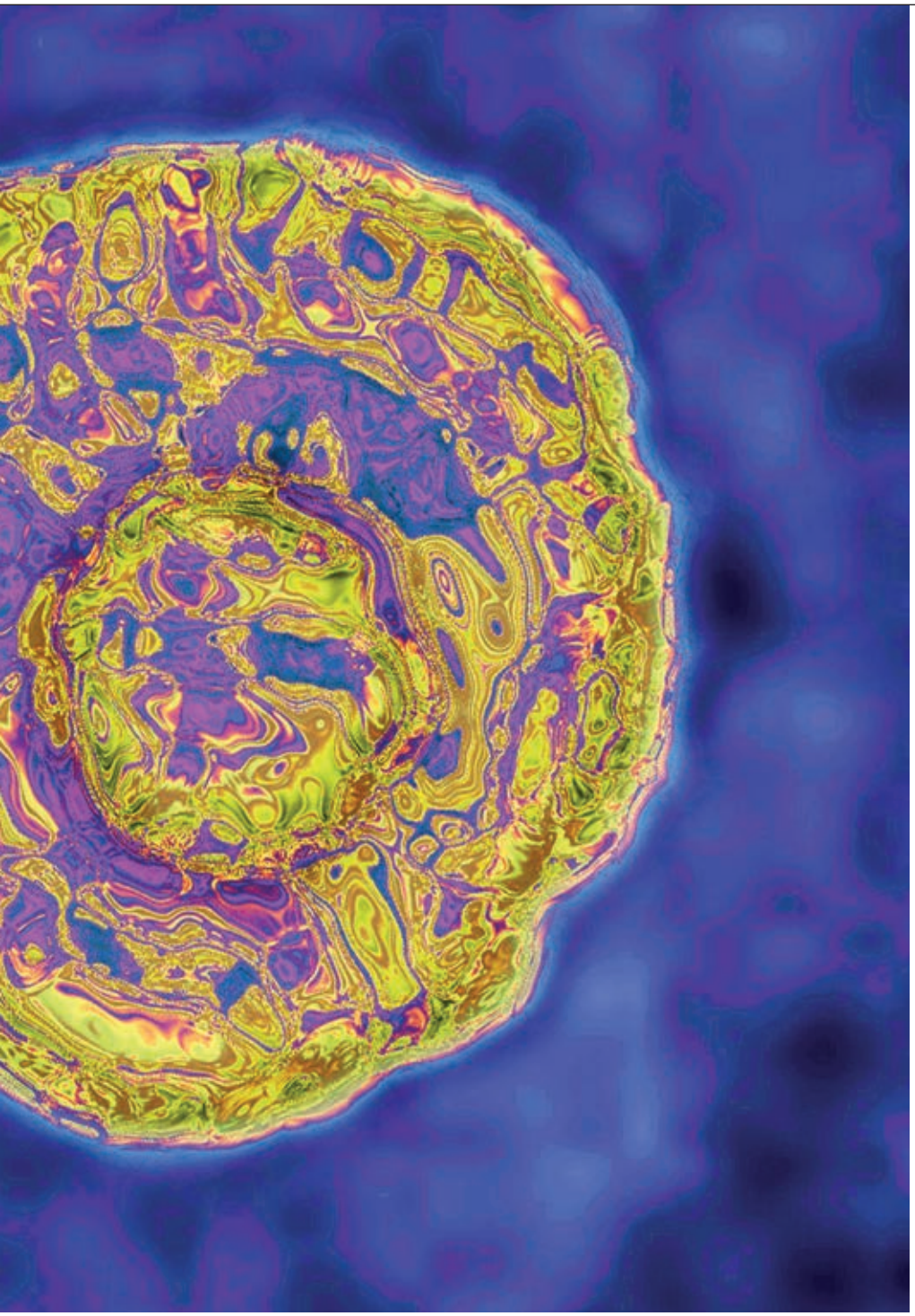
Hepatitis C continues to be the foremost infective agent upon which we publish. Lucejko and colleagues share data on suggesting that HCVag measurement could be an alternative for determining HCV treatment efficacy and chemotherapy, and that it could be an option in the diagnosis of a hepatitis C virus infection. Badawy and colleagues published two *In Briefs*. The first (pp195-197) linked a deletion tumour suppressor *PTEN* with hepatocellular carcinoma, although this was unrealted to levels of serum AFP. The second (pp201-204) showed that single-nucleotide polymorphisms (SNPs_ in the promotor region of the gene coding for interleuin-6 are also linked to the liver cancer. The question is, therefore, which of *PTEN* or *IL6* (or both) should be studied?

Single-nucleotide polymorphism

The anti-oxidant/oxidant balance hypothesis have been around for decades. One of the major pathways is that of glutathione, whilst enzymes, such as superoxide dismutase and catalase, may also be important. Banerjee and colleagues (pp166-171) determined SNPs in six such genes in 558 diabetics and 410 controls, finding that a combination of certain of these SNPs to be present in 13 patients, but in none of the controls, bringing an astonishing odd's ratio [95% CI] of 5083.35 [303.22-85,250.92]. Their result was partially confirmed and extended by the work of Osman *et al* (pp205-208) who reported a link between a SNP in the gene coding for glutathione-S-transferase and diabetes. The same gene (*GSTT1*) and an isoform (*GSTM1*) was studied by Walia and colleagues (pp198-200), who reported a SNPs in the



"Hepatitis C continues to be the foremost infective agent upon which we publish"



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latter gene to be linked to complete or partial remission after chemotherapy in cervical cancer.

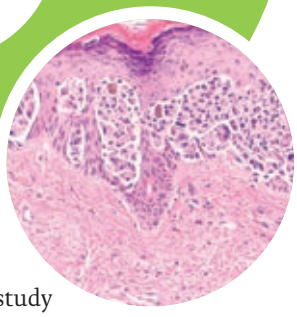
Melanoma

Malignant melanoma kills 1500-2000 people in the UK each year, with around 7,500-8,000 new cases reported.

A key feature in diagnosis is immunohistochemistry, but the frequent problem is that the final colour (such as dark brown) is masked by heavy pigmentation in the melanocytic lesion. Orchard and colleagues have addressed this issue with their report of a technique to bleach excess melanin with hydrogen peroxide, leaving tissues that retain their antigen reactivity to appropriate diagnostic antibodies.

Trousseau was amongst the first to describe cancer as a pro-thrombotic state. Yin and Zhu (pp178-183) continue his legacy with a study of 740 patients with nasopharyngeal cancer and 238 controls. Unsurprisingly, the former were linked to increases in many coagulation and platelet indices, but with their outstanding statistical power they show that the combiation of prothrombin time, APTT and platelet diameter width was best at differentiating cases and controls with an AUC (95% CI) of 0.88 (086-0.91)(p<0.001). The combination of APTT, fribrinogen and FDPs brought an AUC of 0.84 (0.78-0.91)(p<0.001) for determining metastatic disease.

Trousseau was amongst the first to describe cancer as a pro-thrombotic state



CPD

In common with previous articles, any of the above may be the subject of Journal-based learning, and the review on non-coding RNAs certainly will be. BMS

Andrew Blann is the Editor of the *British Journal of Biomedical Science*.

HOW TO... REFLECT

Richard Lovie, a Senior Biomedical Scientist working in cytology at York Teaching Hospital NHS Foundation Trust, reflects on reflection.

Reflection has become a part of our working lives, whether we like it or not. I remember a number of years ago, when I was a fresh-faced, newly-qualified biomedical scientist, we had a talk by a nice gentleman who sang the merits of reflection and stated he sat quietly on a Sunday afternoon with a glass of wine and reflected about his past week. You may think this sounds like an excellent idea, or, if you are more like me, you are more likely to just drink your wine while trying to clear up your children's Lego. It wasn't until undertaking a management course, that I realised that reflection can actually be a really useful tool and help you formulate your thoughts.

Reflective thinking is a skill, apparently Albert Einstein thought up the theory of relativity while riding a bike, everyone knows the story of Sir Isaac Newton and the apple tree, and the lyrical masterpiece *Park Life* by Blur was written in Hyde Park. Obviously, working in busy labs as busy professionals we often need to make quick decisions, but I hope this brief article can highlight some methods to employ reflective thinking, in a way to benefit you and maybe give you some ideas to help with CPD.

Something I initially struggled with is that you can reflect upon anything, it doesn't have to be following a course or a presentation, maybe this sounds obvious but as long as you have learned something, or gained further insight into a situation, you can reflect upon it.

Reflection models

There are a number of different models and methods that can be employed when trying to reflect, these are some of my preferred methods and my opinions on how I have employed them for reflective exercises.

Lesson plan evaluation

This method for a lesson plan evaluation is written from the point of view of the person who gave the talk, it could obviously be modified and extra sections added, or used from the perspective of having attended a talk.

It is useful to get feedback on the group's experiences, they can provide surprising insight and this can be useful to reflect upon your own feelings and how the lesson went.

EVALUATION

Lesson Evaluation

- Was the lesson reasonable, how the student/s found the difficulty was it too advanced/easy?
- How could the lesson be modified?
- What could be improved to provide a greater understanding of the topic?

Student evaluation

- How did the student behave, were they enthusiastic/interested/bored?
- What feedback did they provide?
- Did they ask appropriate questions (this can help to show they have understood what you are discussing)?

Teacher evaluation

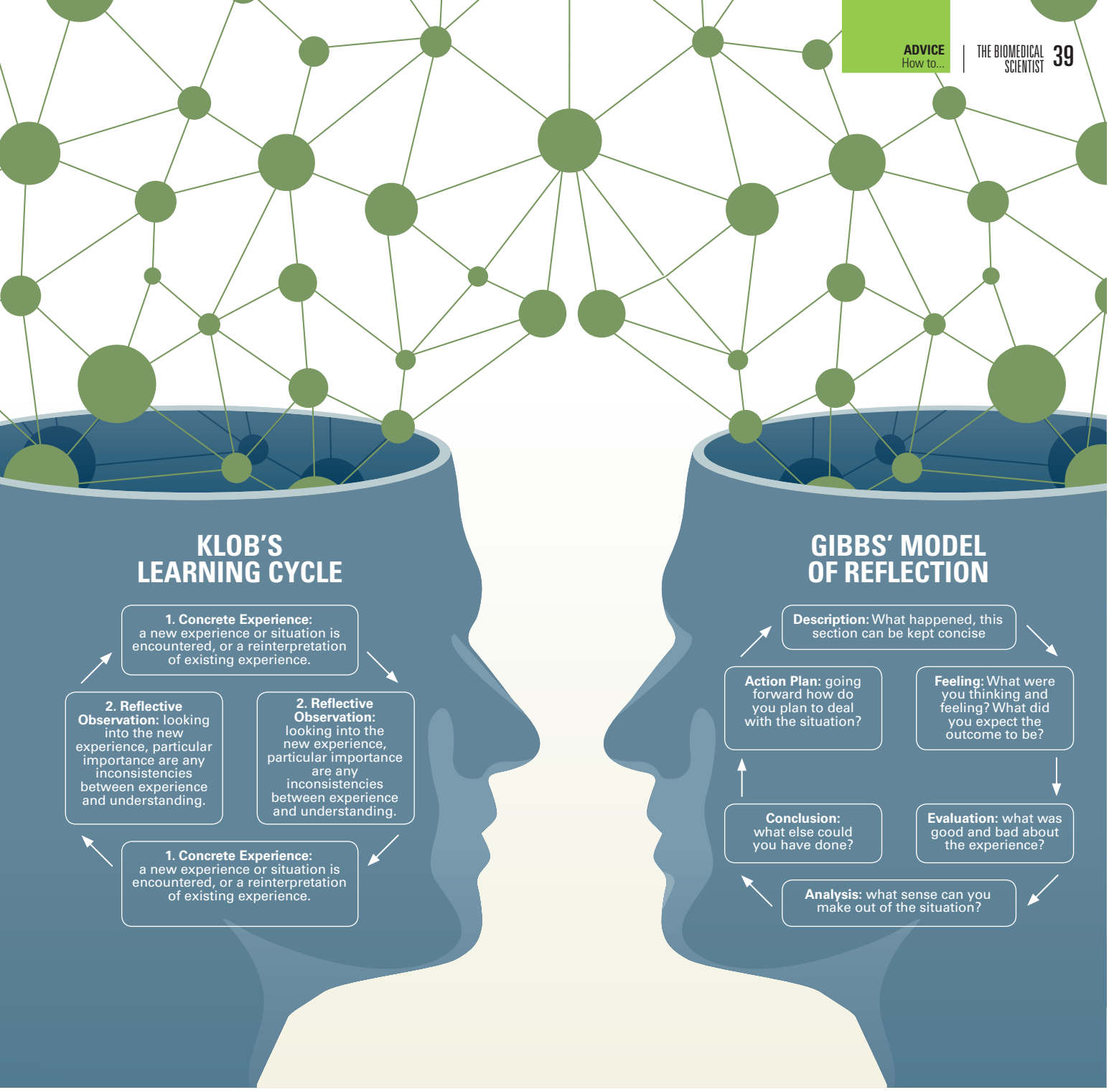
- How do you feel the lesson went?
- What do you intend to change to improve?

Klob's learning cycle

Using Klob's learning style as a method of reflection is a more cyclic process, it is typically represented by a four stage learning cycle process (see right).

The process stipulates that effective learning is seen, when a person progresses through a cycle of four stages, initially requiring you look at your experience, apply some direct reflection as to what you thought/felt/learnt, then delve a little deeper into the thought process theorising why you feel this way, before working out what you plan to do with this learning how you will apply this as part of the experimenting phase.

This method is useful for reflecting upon situations that have occurred outside of the classroom environment, the subheadings help rationalise thoughts, particularly following challenging experiences. For example you could use Klob's learning cycle following a UKAS inspection, the concrete learning would be the feedback from the inspector (good and bad), the reflective observation would allow you to think about how you felt the inspection went, could you have been more organised, was the inspector a bit militant etc, the conceptualisation would allow you to think about how you might change something what are you going to do about that CAPA etc, and the experimentation section would be when you formulated an appropriate action plan to put these procedures in place.



Gibbs' model of reflection

Gibbs' model of reflection is also cyclic (see above, right), it is concerned with "learning by doing". There are a number of separate stages, descriptions of these stages are a little clearer. As with Klob, effective learning is seen when a person progresses though all the stages – the cycle encourages people to think systematically about experiences they have during a specific situation, event or activity.

The Gibbs model has a number of strengths, firstly you don't really need to write too much, it works well with concise information, the model can be used to fit a lot of situations, from reflection on a DATIX and how you could improve, to reflection on a full MSc project.

You start with a description of what you are reflecting on – this needs to be clear. The next stage is to do with how you were feeling at the start of the process, what you were hoping to achieve and your evaluation of the situation, this can be as involved as required. Leading into your analysis of the situation – what sense can you make out of it? The conclusion requires you to think about what the evidence supports? The action plan is required to take the situation forward. As long as you have gained some form of learning you can utilise this model.

In conclusion

All methods have strengths and weakness, and some methods may be more situational than others, but I hope I have highlighted some new ways to employ reflective thinking, rather than just the same old "what I have done, what I have learnt, how will I use it in the future" method. BMS

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MY IBMS NEWS

SCIENCE COUNCIL

MEMBERS SCOOP AWARDS

IBMS members receive awards and commendations at this year's Science Council CPD Awards

The annual awards celebrate the continuing professional development (CPD) efforts and achievements of registrants from across the Science Council registers.

This includes Registered Scientist (RSci), Registered Science technician (RSciTech), Chartered Scientist (CSci) and Chartered Science teacher (CSciTeach).

Three IBMS members were recognised for their exceptional CPD: Katarzyna Sala, RSciTech (winner); Sheri Scott CSci (commendation); Joanne Watkins, CSci (commendation).

Awards and commendations are given for an individual's commitment to undertaking work-based and self-directed learning. The work has to meet high professional standards and demonstrate that it has benefited the quality of their practice, their service and their colleagues, patients and clients.

Katarzyna said: "I'm honoured to receive the award, it will motivate me even more."

Joanne said: "This is one of the fantastic things you are awarded as an individual, but because of the process of CPD, I believe my team and colleagues also benefit."

Sheri added: "I'm delighted to have this chance to promote CPD, as it's not just about developing yourself, but also your colleagues, your workplace, everyone benefits from the skills you've gained during your CPD."

The IBMS would like to congratulate the three members for their hard work.

PROFESSIONAL PROMOTION

National Pathology Week

The IBMS supported its members to promote their profession in National Pathology Week.

The week-long publicity drive took place at the start of November and was an excellent opportunity for IBMS members to showcase their roles and the specialities in the profession.

The IBMS sent out boxes of promotional items for labs across the UK who were holding events and activities.

The IBMS encouraged members to open the doors of their labs and invite fellow hospital staff to visit, publicised by posters available from the Institute.

It also provided members with resources and activity sheets to help them engage with the public and children.

→ **For more information on IBMS resources, which are available all year round, visit ibms.org/resources**

IBMS MEMBERSHIP

TIME TO RENEW FOR 2020

The IBMS is proud of all that it has achieved this year and would like to thanks members for their support. This year saw the most successful and inclusive Congress ever, with a record number of lectures and programme options – including a full three-day stream of free seminars.

To keep qualifications current and relevant for the profession, the IBMS has also developed a new distance learning Certificate of Expert Practice in Point of Care Testing, which it will be launching in January. To increase public awareness of the importance of biomedical scientists and laboratory staff, the IBMS produced three sample journey animations and *Superlab* – a comic book aimed at Key Stage 2 children.

It also built on the success of Biomedical Science Day, supporting and publicising events across the country, reaching millions of people, raising the profile of the profession and celebrating the vital role of our members #AtTheHeartOfHealthcare.

Members of the IBMS have helped to promote, develop and advance the profession and the IBMS hopes they will continue to do so for many years to come.

→ For more information, visit ibms.org/join/membership-fees. If you have any queries, contact subs@ibms.org

TRAINING FUNDING

Advanced roles in histopathology

Health Education England (HEE) has shared an important announcement about funding for training for extended and advanced roles in histopathology.

In response to the medical pathologist shortages in histopathology in England and the success of the introduction of the Institute's Advanced Specialist Diplomas in Histopathology dissection and reporting, HEE has announced that it will support the training costs for two individuals per NHSI-recognised network to undertake one of the histopathology training programmes offered by the IBMS/RCPath.

The IBMS said this is a very welcome recognition of the value of the Institute's qualifications as a means for developing the scientist workforce.

It is stressed that as HEE will only support two applications per network, trusts will need to agree which trusts/departments will bid for funding in advance of submitting applications.

DATE ANNOUNCED

BIOMEDICAL SCIENCE DAY 2020

The IBMS has announced that Biomedical Science Day 2020 will take place on Thursday 11 June.

By promoting biomedical science to the public, it will be once again asking members to take part by throwing open the doors to their laboratories to show they work #AtTheHeart OfHealthcare.

The Institute is looking for four hospitals to act as hubs, representing each of the four home nations.

With over 150 hospital and university laboratories in the UK taking part in Biomedical Science Day 2019, it hopes to encourage even more to take part in next year's event.

New resources, activities and event packs will be available for our members to order, while non-members can download versions from the Institute website.

Members can also apply for up to £500 towards their events through the IBMS activities bursary.

Information on themes and how to plan your event will be available in the new year.

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.

EVENTS AND TRAINING COURSES

DATE	TITLE	VENUE CONTACT
November		
4-8 Nov	**Advanced Practical HPLC Course**	Rochester I stuart@laserchrom.com
6 Nov	**UK NEQAS Clinical Chemistry Roadshow Belfast 2019**	Belfast I birminghamquality@uhb.nhs.uk
11-12 Nov	**UK NEQAS CPT Annual Participants Meeting**	Dublin I chantell.hodgson@nhs.net
11-14 Nov	**FIS 2019: Federation of Infection Societies Conference**	Edinburgh I k.mistry@microbiologysociety.com
12 Nov	**Fine Needle Aspiration Cytology for Technical Staff**	Bristol I SWRCTC@nbt.nhs.uk
13 Nov	**UK NEQAS Cellular Pathology Technique non-gynae cytology beginners/refresher workshop**	Gateshead I chantell.hodgson@nhs.net
13-14 Nov	**Advanced Immunohistochemistry**	Sheffield I l.baxter@sheffield.ac.uk
14 Nov	**IBMS Northern Ireland Branch Annual General Meeting**	Belfast I NI_IBMS@hotmail.com
14 Nov	**IBMS Scotland Branch Annual General Meeting**	Glasgow I scotland@ibms.org
14 Nov	**UK NEQAS Cellular Pathology Technique non-gynae cytology intermediate workshop**	Gateshead I chantell.hodgson@nhs.net
19 Nov	**Into Clinical Practice: Meeting the Challenges of Gram-negative Infection Management**	London I ecarruthers@bsac.org.uk
19 Nov	**Waters UK and Ireland Clinical User Meeting**	London I helen_macdougall@waters.com
26-28 Nov	**BMS/Cytoscreener Update Course in Gynaecological Cytology**	Harrow I LNWH-tr.lrctcbooking@nhs.net
27 Nov	**UK NEQAS Cellular Pathology Technique TEM workshop 2**	Leicester I chantell.hodgson@nhs.net
27 Nov	**Update in Cervical Cytology for pathologists, consultant BMS and holders of the Advanced Specialist Diploma in Cytology**	Bristol I SWRCTC@nbt.nhs.uk
28-29 Nov	**Antibiotic Resistance and Mechanisms Workshop for Researchers**	Birmingham I ecarruthers@bsac.org.uk
December		
2-3 Dec	**Agilent HPLC Equipment Servicing Course**	Rochester I stuart@laserchrom.com
2-5 Dec	**British Society for Immunology Congress**	Liverpool I j.sessenwein@immunology.org
3 Dec	**One-Day Update in Cervical Cytology – HPV cancer audit day**	Bristol I SWRCTC@nbt.nhs.uk
4 Dec	**Medical Laboratory Assistant – Introductory Course**	Harrow I LNWH-tr.lrctcbooking@nhs.net
5 Dec	**POCT: The Power to Disrupt**	London I info@thornhillhealthcareevents.co.uk

DATE	TITLE	VENUE CONTACT
11 Dec	**BSAC OPAT Conference 2019 – A Global overview of drug development and effective use through diagnostics, stewardship and shared learning**	London I ecarruthers@bsac.org.uk
16-17 Dec	**Advanced Agilent HPLC Servicing Course**	Rochester I stuart@laserchrom.com
17 Dec	**Haematology 2020: Updates, Controversies, Uncertainties**	London I kristen.pontello@rcpath.org
2020		
March		
2-3 Mar	**Introduction to Practical HPLC Course**	Rochester I stuart@laserchrom.com
4-5 Mar	**Intermediate Practical HPLC Course**	Rochester I stuart@laserchrom.com
9-11 Mar	**Practical HPLC Method Development Course**	Rochester I stuart@laserchrom.com
12-13 Mar	**Practical HPLC Troubleshooting Course**	Rochester I stuart@laserchrom.com
15-16 Mar	**Practical HPLC Troubleshooting Course**	Rochester I stuart@laserchrom.com
30 Mar-3 Apr	**Microbiology Society Annual Conference 2020**	Edinburgh I conferences@microbiologysociety.org
April		
24 Apr	**Association of Anatomical Pathology Technologists and Human Tissue Authority Consent Training Day 2020**	London I christianburt@ibms.org
September		
7-25 Sep	**HPLC Masterclass Course**	Rochester I stuart@laserchrom.com
17 Sep	**EntericBio Molecular GI Conference**	Limerick, Ireland I sflanagan@serosep.com
October		
5-6 Oct	**Introduction to Practical HPLC Course**	Rochester I stuart@laserchrom.com
7-8 Oct	**Agilent HPLC Equipment Servicing Course**	Rochester I stuart@laserchrom.com
7-8 Oct	**Intermediate Practical HPLC Course**	Rochester I stuart@laserchrom.com
12-14 Oct	**Practical HPLC Method Development Course**	Rochester I stuart@laserchrom.com
November		
1 Nov	**Scottish Pathology Network Annual Event**	Edinburgh I NSS.SPAN@nhs.net
9-13 Nov	**Advanced Practical HPLC Course**	Rochester I stuart@laserchrom.com
December		
14-15 Dec	**Advanced Agilent HPLC Equipment Servicing Course**	Rochester I stuart@laserchrom.com

IBMS RESOURCES

CONTINUING PROFESSIONAL DEVELOPMENT

My CPD

Members can enhance their professional practice and development with the IBMS CPD scheme. The scheme offers members a flexible system of recording CPD that is easy to use and meets the requirements for achieving and maintaining professional registration. The scheme is now electronic, so recording, amending and validating are all carried out online.

Journal-Based Learning (JBL)

IBMS JBL involves reading and answering questions based on articles in scientific journals. It is an excellent way to learn about scientific advances and techniques as part of CPD.

Reading resources

IBMS reading lists, textbooks and journals support learning and development.

HERE TO HELP

RESEARCH GRANT APPLICATIONS

Jocelyn Pryce, IBMS Deputy Head of Education, looks at the ways in which the Institute is supporting member research.

Did you know that the IBMS annually awards grants for those undertaking research that is considered original? This article aims to raise awareness of the ways that the IBMS supports advances in biomedical science by raising the profile of and facilitating research undertaken by our members.

Research is a vital aspect of the development of biomedical science and the IBMS plays an important role in contributing to that research with financial support and sharing the new knowledge by its dissemination in the sister publication of *The Biomedical Scientist*, the *British Journal of Biomedical Science* (*BJBS*). Members are able to access the *BJBS* either online or in hard copy and so keep up to date with the latest advances in the various biomedical science disciplines. In 2019, the *BJBS* published 22 original articles, 17 reports and a review across a range of disciplines, including cellular pathology, clinical chemistry, haematology, bacteriology and virology. In addition to research carried out in the "mainstream" disciplines, 2019 also saw papers in andrology and those which cross discipline boundaries, with techniques in molecular genetics featuring highly across all papers.

Those of you who take the time to read and digest the articles published in the *BJBS* (an excellent source of CPD!) will recognise that the gulf that once existed between some researchers and registered biomedical scientists is closing and more projects are being undertaken by practicing biomedical scientists, often as part of a higher qualification. The IBMS is working hard to support this development and, on an annual basis, the IBMS invites applications (deadline 31 March) from members for grant awards up to £5000 for UK members and £3000 for international members, to facilitate a practical project which will result in a new body of knowledge.

The grants are awarded to assist members who are undertaking a research project, which could be linked to a course of study leading to a post-graduate higher education award (see page 28-32 for information on the most recent grants awarded). The expectation would be that publications arising directly from this grant-funded work would be considered for inclusion in the *BJBS* in the first instance, thereby offering the recipient a supported route into research publication. The IBMS follows each grant awarded through the lifetime of the project, receiving reports on progress and a short report or case study could be presented in *The Biomedical Scientist*. Additionally, manuscripts resulting from research grant funded work can be entered for relevant prizes awarded by the IBMS.

As you can see, there are many benefits of grant awards, including developing individual researchers and also in developing and disseminating knowledge across the biomedical science disciplines, raising the profile of both. So, why not consider investigating your eligibility for one of these grant applications?

For more information on IBMS grants and awards and how to apply, visit ibms.org/grants-prizes-and-awards

Senior Specialist Biomedical Scientist

The Isle of Man Government is seeking a Senior Specialist Biomedical Scientist to join our small, friendly, forward thinking and dedicated team in the Chemical Pathology department at Noble's Hospital on the Isle of Man.

The island provides an excellent environment in which to live and work, with low pollution and low crime rates. The Isle of Man boasts amazing scenery and some of the most diverse wildlife in the UK. Outdoor pursuits are easily accessed, with hiking, surfing and cycling being popular pastimes.

This is an interesting and varied post based in a district general hospital laboratory setting however we also perform a range of specialist investigations due to our Island location. The post offers a rewarding, unique and diverse working environment that comes with an Island setting.

For more information about the post please contact Charlie Houston, Chief Biomedical Scientist Biochemistry on 01624 650661.

To apply for this opportunity, please go to www.gov.im/jobs and search for DOH&-009895.

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To discuss recruitment advertising in ***The Biomedical Scientist***, please contact the sales team on **+44 (0)20 7880 7665** or email **biomedicaljobs@redactive.co.uk**

YOUR NEXT CAREER STEP IS WITH THE DOCTORS LABORATORY

Opportunities have arisen at the largest independent clinical pathology service organisation in the UK.

The Doctors Laboratory provides an extensive range of testing services to the NHS and the private sector across 37 laboratory sites across the UK. We have a number of roles to suit your qualification and circumstances including night-shift work and senior post opportunities.

We are rightly proud of the excellent working environment that has been created at all of our laboratory sites. As well as a competitive, NHS reflected salary package and other benefits, staff can expect a varied CPD programme led by our Education and Training Faculty, equipping them for a rewarding and accomplished career.

For further details, or to apply for any of the roles listed below, email: **jobs@tdlpathology.com**

Senior BMS (Biochemistry) - Northwick Park, London *(ref: NWPBIO3806)*
Senior BMS (Haematology) - Northwick Park, London *(ref: NWPHM3807)*
Night-Shift BMS - Hosp. of St John & St Elizabeth, London *(ref: HJEBMS3791)*
BMS (Multi-Discipline) - The Albyn Hospital, Aberdeen *(ref: ALB3214)*

For a full jobs list, visit: **www.tdlpathology.com**

Closing Date: **15th December 2019**

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.

NHS Shetland

Senior Biomedical Scientist

Transfusion/Haematology (Ref: 6050)

required for the Shetland Islands to provide services to the mainland population and the outlying islands - are you interested in practising in an area of outstanding natural beauty?

Full Time, 37.5 hours per week
Band 7 - Salary in range £37,570- £44,688 per annum
plus Distant Island Allowance of £1,841 per annum
Excellent relocation package of up to £8,000

NHS Shetland has an opening for a Head of Transfusion with experience in, or an interest in, Haematology. The position is in the Gilbert Bain Hospital, Lerwick. Serving a population of circa 24k and processing circa 100k samples per annum. The laboratory has a close working relationship with Grampian University Healthcare Trust in Aberdeen and NHS Orkney.

Working as part of a multi-disciplinary clinical diagnostic team offering a service to our small, remote and rural 51 bedded hospital and 10 health centres, you effectively run the day to day operations of the Transfusion section, ensure compliance with MHRA and supervise the Haematology area. As a rural remote lab there is a limited but essential transfusion service but plenty of opportunities to learn multi-discipline pathology alongside the "island medics".

Registered as a Biomedical Scientist with the HCPC, you will have an appropriate degree or equivalent experience suitable for MHRA compliance and a Band 7 role. Band appointment will be based on previous experience. After training, you will be required to participate in the multi-disciplinary out of hours roster, and lone working on rostered weekend days.

Shetland is a wonderful place to live and work. Shetland offers low pollution, low crime, excellent schools, great leisure facilities, unique wildlife and amazing scenery, whilst still only a short flight away from the UK mainland and Norway. To find out more about living and working in Shetland go to **www.shetland.org**

For further information on the post, please contact Sam Willis on 01595 743041.

Closing date: **12th January 2020**
Interview date: **w/c 27th January 2020**

For more information and to apply:

Internal Applicants: if you are currently working for NHS Shetland (including Bank Members) you must apply via the Jobtrain website link: **https://apply.jobs.scot.nhs.uk/internal/vacancies.aspx?chkDivision=173**

External Applicants: i.e. if you are NOT currently an NHS Shetland employee or registered on our Bank, you must apply via the following Jobtrain website link: **https://apply.jobs.scot.nhs.uk/vacancies.aspx?chkDivision=173**

If you require assistance or encounter any technical issues with your application, please e-mail support at **nss.eess@nhs.net** including the vacancy reference number and "NHS Shetland" in the subject line.

In promoting equal opportunities, we welcome applications from all sections of the community.

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MY LAB

MOLECULAR PARASITOLOGY RESEARCH

Adewale Oke, a doctoral student in medical microbiology, gives a guided tour of his lab at the Nigerian Institute of Medical Research in Lagos, Nigeria.

The molecular parasitology research laboratory (MPRL) is a well-equipped laboratory located within the Department of Public Health and Epidemiology at the Nigerian Institute of Medical Research (NIMR) in Yaba. Lagos. The laboratory, and the department as a whole, is headed by a reputable scholar and research fellow, Professor Olaoluwa Pheabian Akinwale, supported by competent research and technical staff.

Until recently, absence of in-country molecular confirmation of Buruli ulcer (BU) infection was a major challenge to the National Control Program in Nigeria.

The challenge was overcome through a WHO/TDR grant award and two other grants awarded to Prof Akinwale, thereby strengthening the national control program and preventing patients' treatment delay, in addition to making NIMR the only centre (National BU Reference Laboratory) for in-country molecular confirmation of BU infection in Nigeria. Most of the cases reported in the country before then had limitations, which included the use of purely descriptive approach, with most diagnoses being retrospective or prospective, based only on clinical presentations.

This led to the speculation that BU may be under-diagnosed, hence under-reported in the country, when compared with its two endemic neighbours on the east and west (Cameroon and Benin republic, respectively).

The laboratory is sustained through NIMR intramural research grant and support from DAHW German Leprosy and Tuberculosis Relief Association (GLRA) while samples are screened at no cost to the patients.

To date, a total of 2,921 samples have been screened, out of which 1,118 turned out to be positive. Samples received were collected from Abia, Akwa Ibom, Anambra, Bayelsa, Cross Rivers, Delta, Ebonyi, Ekiti, Enugu, Imo, Lagos, Ogun, Ondo, Osun, Rivers and the Federal Capital Territory Abuja.

The southern region has similar climatic conditions with other BU endemic areas of sub-Saharan Africa, which is a tropical rainforest type. The structure in charge of sample collection and transportation to the laboratory is done by GLRA.

The laboratory also plans to conduct genetic epidemiological studies of BU in Nigeria, including determination of prevalence of drug-resistance mutations among the strains using culture-free direct DNA sequencing of PCR products. Other research in the laboratory includes epidemiology of schistosomiasis, soil-transmitted helminthiasis and toxocariasis.

The laboratory also collaborates with institutions within and outside Nigeria. These include Department of Molecular Parasitology and Tropical Diseases, College of Medicine, Taipei Medical University, Taipei, Taiwan; Molecular Immunology Department, Swiss Tropical and Public Health Institute, Basel, Switzerland; Centre for Discovery and Innovation in Parasitic Diseases, Skaggs School of Pharmacy and Pharmaceutical Sciences, University of California, San Diego, USA; Department of Zoology, Faculty of Science, Obafemi Awolowo University, Ile-Ife, Nigeria and Lead City University, Ibadan, Nigeria. BMS

Adewale Oke was an IBMS Congress poster competition winner (category: Genomics and Molecular Pathology).

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