

**Scoping the landscape  
of pharmacology**  
Careers, experiences and  
meetings worldwide

# Editorial

Margaret Cunningham  
Editor-in-Chief, *Pharmacology Matters*



In our winter issue of *Pharmacology Matters* we hear from members from across the world who share their diverse experiences of being part of a global community of pharmacologists.

Following on from Jono's update on the changes within the Society, Ross King sheds light on the value of work experience gained through laboratory internships. With the newly formed Advisory Groups set up by the Society, we get the chance to catch up with Patrick Sexton and Felicity Gavins, as they take the time to share their vision for the International Advisory Group (IAG), outlining its priorities and objectives for the year ahead. With the deadline for abstract submission for the 18th World Congress of Basic and Clinical Pharmacology approaching, Hitoshi Hashimoto invites you to attend the meeting in Kyoto and provides important information and key dates for those interested in venturing to Japan in July 2018. Adam Pawson and Steve Alexander promote the 2017/18 edition of the Concise Guide to PHARMACOLOGY. The scale of the effort involved in bringing this free online database to the scientific community is inspiring, with contributions from an international consortium of over 150 collaborators from 22 countries, across industry and academia.

After being awarded a BPS travel bursary, Gillian Durham shares her experience of attending her first international conference, the XXXVII Congreso Sociedad Española de Farmacología (SEF) meeting in Barcelona. We then turn the spotlight further afield to hear from Kim Outhoff and Vanessa Steenkamp at the University of Pretoria who describe the careers options open to pharmacology graduates in South Africa. Simon Maxwell shares his insight into the differences in the UK and international prescribing assessments and areas of variability in structure and delivery across different institutions. We then round up this issue of *Pharmacology Matters* with an update on the Society's meetings for the year ahead, and news from our Affinity Groups.

As 2017 draws to a close, it only leaves me to thank the editorial team of *Pharmacology Matters*, the team at the Schild, and all of the authors who have contributed over the year to make the magazine the success it is today.

Best wishes for the new year ahead,  
Margaret

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# Your BPS



**Jono Brūin**  
Chief Executive

**In September, we published a report from PricewaterhouseCoopers (PwC)<sup>1</sup> as part of our ongoing Focus on Pharmacology project. The report was commissioned with the intention that it would provide a valuable insight into the educational and career landscape for UK pharmacologists.**

The main findings are encouraging and show that as an academic subject, pharmacology is growing: degrees are in high demand, and pharmacology graduates are experiencing positive employment outcomes. However, the report has also highlighted the need for further information and guidance for young people when considering university options and seeking work experience.

Findings from this report will inform how the Society acts to minimise obstacles to career progression and bridge gaps in provision of information and support for a diverse and ever-widening community of pharmacologists. One way of achieving this will be to explore opportunities for working with our partners in industry.

For a concise and informative summary of the PwC report, I would recommend reading our blog<sup>2</sup> written by our education and policy leadership.

October saw the launch of our inaugural Clinical Pharmacology Month. You may recall a report commissioned by the Society in 2016 which highlighted that each £1 spent hiring additional clinical pharmacologists has the potential to reduce NHS costs by £5.<sup>3</sup> Since that time our Clinical Committee and the Specialty Registrars Advisory Group have been working hard to ensure that message gets attention, and Clinical Pharmacology Month is a natural extension of these efforts.

A series of Grand Rounds, lectures and other educative and engagement activities took place throughout the month, printed materials that detail training and careers pathways were made available to medical students

and foundation doctors, an online careers hub was developed and case studies were collated to illustrate the variety and vibrancy of the discipline and encourage interest in CPT specialty training.

Over the course of 2017, we have been pleased to welcome many new staff to the BPS team and since I last wrote to you in July, we have successfully reorganised into 4 business units: finance, operations and membership; education, engagement & policy; business development, and; research dissemination.

The reorganisation of the team at the Schild included a transformation of our education, training & policy team to support and expand our reach and impact in these critical areas. I would firstly like to congratulate Anna Zecharia on her recent promotion to director of policy & public affairs, where she will drive the Society's strategies for education, engagement and policy work. Anna's previous role as head of education and engagement will be filled by the BPS's very own Lee Page. The domino effect continues as Lee's previous role as clinical education, training & policy manager will be taken up on an initial interim basis by Lisa Hevey, and our summer intern Alison Bate will be staying with the Society for several additional months in Lisa's former role as education, training and policy officer. I would like to extend my congratulations to the whole team and I look forward to working with you all in these roles.

Further people news, Yasmin Clark has joined us as a digital content editor, working on a contract basis with Dave Adams, acting senior manager, marketing and communications, to support and enhance our website and other digital media.

After more than 11 years with the BPS, our IT manager Carolina Medal made the decision to take a position that is closer to home, allowing her to spend more time with her daughter, Marnie. Carolina has been a huge part of the Society,

revolutionising our IT, commissioning and overseeing the new member database, and supporting the needs of our members and our growing team of staff at the BPS office. She has gone above and beyond the call of duty in her contributions over the years and we all wish her the very best in her new role.

As we approach the end of 2017, I'm acutely aware that we will also be reaching the last few months of Professor David Webb's presidency. I have enormously enjoyed the opportunity to work with David over the past 4 years (including his 2 years as President-Elect) and have benefitted hugely from his supportive, challenging and encouraging approach. David's commitment to the BPS, to pharmacology and clinical pharmacology, is genuinely inspiring and his capacity to drive excellence in all that we do has been consistent from day one. I wish David all the very best for the future, and look forward to the opportunity to work with Professor Steve Hill as BPS President from January 2018.

## References

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# Young Pharmacologists update



Ross King, William Harvey Research Institute

## Through the eyes of a young pharmacologist: The value of internships and work experience

The Society's published report from PwC shows that pharmacology is alive and well in UK higher education, and that graduates go on to a wide range of successful careers.<sup>1</sup> The PwC report also points to the value of internships and work experience<sup>2</sup> and our young pharmacologists agree.

For many aspiring young scientists, getting a foot in the door of a productive laboratory is often the first step on the long road to research independence. Undertaking internships at home, abroad or in industry demonstrates commitment and drive, whilst also equipping students with essential practical skills and the mental attributes needed to make the most of a challenging (but rewarding) career at the bench and beyond. In this article, the Young Pharmacologists Advisory Group (YPAG) explores some of the options available to student members and reflects on the experiences of those who have benefited from a diverse range of internship positions.

Whilst many bioscience courses offered by universities rightly include a focus on practical learning, typically offering 3-9 hours of laboratory time each week, this prescribed programme of teaching is often far removed from the true nature of the scientific method. Science at its heart is an expression of curiosity and creativity; undertaking a laboratory internship allows students to exercise these assets by using their

previous learning to solve common lab problems, outside of the confines of practical demonstrations.

Ross King, a member of YPAG and a post-doctoral researcher at the William Harvey Institute recalls his first taste of real research through his undergraduate summer studentship at the University of Glasgow:

*"I remember being terrified of approaching 'real scientists' for a placement, thinking they would never be interested in hand-holding a complete novice for an entire eight weeks. In reality, I received one polite 'no thanks' before another academic suggested we wrote an application for support from The Nuffield Foundation, which was accepted. It was initially a daunting experience, but I quickly gained confidence in my own practical and analytical abilities. Looking back, this experience, coupled with that of my undergraduate dissertation, definitely gave me the edge over my peers when applying for PhD studentships."*

The best advice for students looking for internships at this stage of their career is to be bold – the worst that can happen is someone saying 'no'. Most academics will be impressed, and possibly even a little flattered, that you've taken an interest in their work. When it comes to working in a lab, nobody is expecting perfection – there is only the expectation that you commit fully to your work.

Undergraduate students can be an invaluable resource to laboratories over the quieter summer months to keep essential projects ticking over. A good place to start to investigate funding options for short research projects is the Royal Society of Biology website. However, paid schemes are usually limited and young researchers may have to work for shorter, unpaid periods in order to gain that highly sought-after experience.

Some students may set their sights further afield. Laura Humphrys, one of the newest YPAG members, is a current recipient of the AJ Clark Studentship<sup>3</sup> from the British Pharmacological Society. Laura thinks that her willingness to step outside of her comfort zone and take part in the Universitas 21 exchange scheme as part of her integrated masters course is what helped her to strengthen her case as a PhD candidate. Most universities offer international exchange programmes and students looking to develop their research skills, whilst also seeking to expand their cultural horizons, should investigate which options are available to them.

Of course, aside from internship positions within academia, a wealth of distinct experiences can be gained from training in industry. Sam Groom is one of the British Pharmacological Society's newest AJ Clark students and spent his placement at Heptares Therapeutics. Sam told us that being

part of an industrial rather than an academic grouping gave him a distinct perspective on research at such a formative stage of his career:

*“My attitudes towards scientific research were changed through my placement, with industry’s principles of rigour, cooperation and professionalism integrating with my own ethos. Another benefit was receiving a salary for my work, giving me a taste of what a professional career in science might be like.”*

Sam’s hard work, growing confidence and improved scientific communication skills from working within an industrial environment led him to present some of his work at *Pharmacology 2016*, an experience that he highly recommends to other placement students. Both experiences bolstered his application for his current studentship.

In addition to these programmes geared at earlier-career researchers, the British Pharmacological Society provides financial support through the Schachter Award<sup>4</sup> for postgraduate members to visit another laboratory to learn a new technique that cannot be conducted at their home institute and to further develop their mental and emotional skillsets. Joanna Clarke, a PhD student at the University of Liverpool and recent recipient of The Schachter Award, deftly used her funding to further her investigations in both the industrial and academic sectors. Here’s what Joanna had to say about her experience:

*“The Schachter Award has not only improved my experimental knowledge and enabled me to attain valuable and novel data, but additionally these placements have given me a very useful insight into alternative research settings. At Novartis I was able to gain insight into the pharmaceutical industry, and my time at the University of Zurich gave me a flavour of how things are done in another academic department and indeed another country. Both experiences gave me the opportunity to develop new professional connections, and the chance to work independently and abroad has definitely boosted my self-confidence.”*

### Top Tips

- Be bold and don’t be afraid to ask!
- Commit fully to your work
- Talk about money – can you arrange payment or funding?
- Step outside of your comfort zone
- Use networks through the Society
- Have a growth mindset – you’re there to learn & develop
- Keep in touch afterwards
- Use it to find out if you’d enjoy a career at the bench

If you would like to read more about Joanna’s experience, see page 11 of the July issue of *Pharmacology Matters*.<sup>5</sup>

Resources are available to help young scientists gain coveted internships across academia and industry. Students need to be proactive in sourcing funding and securing placements as the experience gained can enrich and enhance careers. Grabbing the proverbial research bull by the horns for the first time can be an intimidating experience, but one that may develop vital practical skills and ease the opening of exciting doors to your future career.

### About the author

Dr. Ross King is a postdoctoral researcher in the Centre for Microvascular Research at the William Harvey Research Institute. His research focuses on the role of neutrophils in the development of vascular permeability following injury and understanding the importance of this process in pulmonary inflammation.

### References

1. British Pharmacological Society. Clinical Pharmacology Month Case Studies. 2017. Available online: [https://www.bps.ac.uk/about/our-campaigns/clinical-pharmacology-month-\(october\)/case-studies](https://www.bps.ac.uk/about/our-campaigns/clinical-pharmacology-month-(october)/case-studies). Last accessed: 13 November 2017.
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# Advisory Groups update: Uniting Pharmacologists Globally

Patrick Sexton and Felicity Gavins  
Chair and Deputy Chair, IAG



Four advisory groups have been set up by the British Pharmacological Society to provide members with specific channels through which their voices can be heard, further ensuring that members' needs are listened to and addressed.

The International Advisory Group (IAG) was established earlier this year with the aim of supporting and representing the interests and views of international members across all settings: academic, clinical and industrial. This core group facilitates and provides two-way communication between members and, the Council and Committees.

The impetus for establishing an IAG came from a 2016 Society survey of members which found that 89% of respondents (of the 52% of members that participated) said that such a group would be of value, and 74% expressed an interest in joining.

The Society is enriched by its 800+ international members and the creation of this new group provides an additional platform to promote and advance pharmacology worldwide.

As such, the IAG was born. The core group comprises fourteen members from 11 countries including the Chair, Professor Patrick Sexton, based in Australia, and Deputy Chair, Dr Felicity Gavins, based in the USA. The first meeting took place in March 2017 via video conference, and despite the challenge of multiple time-zones and various technical glitches, terms of reference were agreed and a healthy debate ensued on how best to align the IAG with the Society's strategic priorities.

Since this initial meeting, the IAG have met again and the international member respondent results from the 2016 member survey are being carefully evaluated to better understand needs and priorities of the Society's international members. The IAG are keen to capitalise on opportunities for raising awareness of the Society and promoting its many offerings at up-coming scientific meetings, including:

- APSA-ASCEPT, Brisbane, 5-8 December 2017
- *Pharmacology 2017*, London 11-13 December 2017
- ASPET, San Diego, 21-25 April 2018
- World Congress of Pharmacology, Kyoto, 1-6 July 2018
- ASCEPT, Adelaide, 27-30 November 2018

The IAG is still in its infancy, however areas of great interest are:

- How to best represent the IAG's members and their needs
- How to engage with non-members and recruit them to become members of the Society
- Promoting pharmacology and what the Society has to offer, including raising awareness of the Society's policies around supporting less economically developed countries. These policies include discounted or free rates for Society membership and publication in the Society's journals

- Exploring ways to make it easier for members to connect with each other
- Enabling international members to share educational reviews, presentations, points of interest and meeting information.

The BPS is committed to addressing the needs of all of its members, regardless of geography, and behind the scenes the IAG are working hard to find ways to best represent the views and interests of members from across the globe. The IAG aims to maximise international engagement and actively encourage BPS members to join the group.



The Advisory Groups are a great way to get involved with the Society. To find out more, members can go to the BPS website: [www.bps.ac.uk](http://www.bps.ac.uk) or use the contact details below:

### The Advisory Groups:

Women in Pharmacology  
Advisory Group: [wip@bps.ac.uk](mailto:wip@bps.ac.uk)

Specialty Training Registrars  
Advisory Group:  
[lisa.hevey@bps.ac.uk](mailto:lisa.hevey@bps.ac.uk)

Young Pharmacologists  
Advisory Group:  
[teesha.bhuruth@bps.ac.uk](mailto:teesha.bhuruth@bps.ac.uk)

International Advisory Group:  
[teesha.bhuruth@bps.ac.uk](mailto:teesha.bhuruth@bps.ac.uk)

### About the authors

Patrick is Head of the Drug Discovery Biology Theme, a NHMRC Principal Research Fellow, and Professor of Pharmacology at the Monash Institute of Pharmaceutical Sciences within Monash University. His research is primarily directed to understanding G protein-coupled receptors (GPCRs), the molecular basis for biased agonism, on allosteric interactions between GPCRs and other proteins, and on GPCR modulation by small molecule ligands. He has particular expertise in the study of GPCR structure-function, biased agonism and the structure-function of Class B GPCRs. Patrick is also an adjunct Professor in the Faculty of Pharmacy of Fudan University in Shanghai, a member of the Scientific Advisory Board for the Chinese National Centre for Drug Screening, and a Fellow of the British Pharmacological Society. He is a corresponding member of the International Union of Basic and Clinical Pharmacology Committee on Receptor Nomenclature and Drug Classification, a

member of the Faculty of 1000 (Molecular Pharmacology division), and Associate Editor for Pharmacological Reviews.

Felicity is Assistant Professor in the Department of Physiology and Director of the Small Animal Imaging Facility. Her research focuses on developing anti-inflammatory strategies that promote resolution of inflammation following ischaemia reperfusion injuries. She is particularly interested in events that occur at the microcirculatory level while studying platelet-leukocyte trafficking and endothelial dysfunction using a variety of imaging techniques including: spinning disc confocal intravital microscopy, magnetic resonance imaging, positron emission tomography, single photon emission tomography and *in vivo* imaging systems. Felicity has been a member of the British Pharmacological Society since 2000 and has served on a number of committees.

**BAP**  
British Association for  
Psychopharmacology

## Certificate in Non-Clinical Psychopharmacology

4th – 8th March 2018

The Royal Cambridge Hotel, CB2 1PY

This residential programme provides attendees with a unique opportunity to receive training in key aspects of experimental psychopharmacology from leading researchers in the field. The course will cover the following areas, using a combination of plenary lectures, taught and practical sections, round-table debate and a team project.

- Clinical Neuroscience
- Pharmacokinetics in Psychiatry
- The Molecular Biology of the Mind
- Statistics and Experimental Design
- Pre-clinical Behavioural Psychopharmacology
- Combining Neurobiology and Behaviour
- In vivo-Neuroimaging and electrophysiology in Psychopharmacology

It will benefit novice and experienced psychopharmacologists, and those working in related fields, by encouraging appraisal and refinement of experimental design and training in essential skills.

Presentation dinner at Queens' College on Wednesday 7th March

Professor  
Marcus  
Munafa  
confirmed as  
guest lecturer

£570

(excluding  
accommodation)

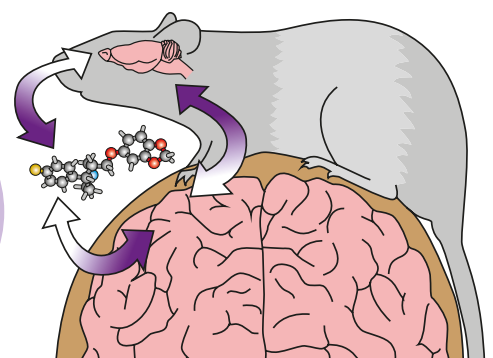
£870  
inclusive

Limited  
places  
available

Approved by the Royal Society of Biology for purposes of CPD, this event may be counted as **108 CPD credits**.

For more information and to book go to:

[www.bap.org.uk/nonclinical](http://www.bap.org.uk/nonclinical)



# WCP2018 Kyoto

## 18th World Congress of Basic and Clinical Pharmacology



Sunday 1 July to Friday 6 July, 2018  
Kyoto International Conference Centre, Kyoto, Japan  
Pharmacology for the Future - Science, Drug  
Development and Therapeutics

Hitoshi Hashimoto  
Vice-chairman of Public Relations  
Committee, WCP2018

WCP2018 in Kyoto is fast approaching. The Organizing Committee is pleased to share the latest information on the Congress with members of the British Pharmacological Society.

### Call for Abstracts

Abstract submission is now available at  
[www.wcp2018.org](http://www.wcp2018.org)

**Submission Deadline: December 14, 2017**

In principle, accepted abstracts shall be presented as posters, and only a limited number of requests for oral presentation will be granted. Please note that your preferred presentation format may not necessarily be granted, and the final judgement rests with the Scientific Programme Committee.

### General Guidelines:

- The body of abstracts should contain a maximum of 350 words and must be in English
- The abstract should be constructed with clear paragraphs for background, methods, results and conclusion(s)
- One image (figure, table, chart or illustration) can be attached to the abstract
- Acceptable data formats: JPG, GIF, PNG. Maximum file size: 5MB, 600(w) x 800(h) pixels
- 2-3 keywords should also be provided that best describe the abstract's content
- The first author must present his/her presentation
- The first author must complete pre-registration when submitting an abstract
- Abstracts must be submitted via the congress website
- Notification of abstract acceptance will be sent to the first author no later than March 30, 2018
- The Scientific Program Committee reserves the right to reject any abstract that it considers not to be appropriate in relation to the congress criteria

### Congress Bursaries & IUPHAR Young Investigator Awards

When you submit your abstract, please indicate if you would like to apply for the Congress Bursaries and/or IUPHAR Young Investigator Awards. There will be a question in the online form asking if you would like to apply for the grants or not. It is possible to apply for both Congress Bursaries and the IUPHAR Young Investigator Awards. For more information, please visit the WCP2018 website at [www.wcp2018.org](http://www.wcp2018.org).

### Registration

Registration is now available at [www.wcp2018.org](http://www.wcp2018.org)

Early Bird Registration Deadline: **March 30, 2018**

Regular Registration Deadline: **May 31, 2018**

### Registration Fees

	Early Bird Registration	Regular Registration	On-site Registration
Regular	JPY 40,000	JPY 45,000	JPY 50,000
Student	JPY 10,000	JPY 10,000	JPY 10,000
Accompanying Person	JPY 15,000	JPY 15,000	JPY 15,000

Accommodation booking is also available through the WCP2018 website. WCP 2018 offers preferential rates to the delegates for the duration of the congress.







## About the Author

Hitoshi is Professor of Laboratory of Molecular Neuropharmacology, Graduate School of Pharmaceutical Sciences, Osaka University, Japan. He is also Adjunctive Professor at United Graduate School of Child Development and Group Leader of iPS Cell-based Research Project on Brain Neuropharmacology and Toxicology. He graduated from the Faculty of Pharmaceutical Sciences, Kyoto University and received a PhD.

He is currently investigating neurological mechanisms underpinning psychiatric disorders by using patient-specific iPS cells and whole-brain imaging system with a high definition, which he recently established. He serves as Director and Councilor of several academic societies. He is in charge of public relations of WCP2018.

## Scientific Program

THEME: Pharmacology for the Future – Science, Drug Development and Therapeutics

### Opening Lecture

Cancer Immunotherapy (tentative)  
Sunday, July 1, 2018 16:00-17:00  
*Tasuku Honjo, MD, PhD, Kyoto University, Japan*

### Opening Symposium

Pharmacology, Translational Medicine and Drug Discovery  
Sunday, July 1, 2018 17:00-18:40  
*Makoto Suematsu, MD, PhD, Japan Agency for Medical Research and Development, Japan*  
*Garret A. Fitzgerald, MD, FRS, University of Pennsylvania, USA*  
*Pierre Meulien, PhD, Innovative Medicines Initiative, Belgium*  
*Isao Teshirogi, PhD, Japan Pharmaceutical Manufacturers Association, Japan*

### Plenary Lecture

- Recent Progress in iPS Cell Research and Application  
Monday, July 2, 2018 11:15-12:15  
*Shinya Yamanaka, MD, PhD, Kyoto University, Japan*
- Optogenetics (tentative)  
Tuesday, July 3, 2018 11:15-12:15  
*Karl Deisseroth, MD, PhD, Stanford University, USA*
- The Cardiovascular Effects of Peptidase Inhibition  
Wednesday, July 4, 2018 11:15-12:15  
*Nancy J. Brown, MD, Vanderbilt University Medical Center, USA*
- Drug Development as an Outcome of Integration of Basic and Clinical Pharmacology  
Thursday, July 5, 2018 11:15-12:15  
*Adam Cohen, MD, PhD, Center for Human Drug Research, The Netherlands*

### Tang Prize Lecture

Genome Engineering: Technologies and Applications  
Tuesday, July 3, 2018 17:00-18:00  
*Feng Zhang, PhD, McGovern Institute for Brain Research, USA*

### Analytical Pharmacology Lecture

Towards a Molecular Understanding of Drug Action at GPCRs  
Wednesday, July 4, 2018 17:00-18:00  
*Bryan L. Roth MD, PhD, University of North Carolina at Chapel Hill, USA*

Plus, 33 cutting-edge lectures, 85 symposia, oral sessions, poster sessions and luncheon seminars where you can learn about the cutting edge research taking place in 26 specialty domains. For more information, please visit the WCP2018 website at [www.wcp2018.org](http://www.wcp2018.org).

In addition to the scientific program, the Organizing Committee offers a variety of opportunities for you to experience Japanese culture through social events and tours/excursions. Kyoto was the capital of Japan for over 1,000 years and still remains the heart of culture in Japan. Visit one of the many shrines, temples and historical sites in Kyoto, and there, you will feel the breath of many hundred of years of culture. We are looking forward to seeing you in Kyoto.

# The IUPHAR/BPS Guide to PHARMACOLOGY and the Concise Guide to PHARMACOLOGY 2017/18:

A collaboration between the British Pharmacological Society (BPS) and the Nomenclature Committee of the International Union of Basic and Clinical Pharmacology (NC-IUPHAR).



Stephen P.H. Alexander



Adam J. Pawson

There are many ways in which the British Pharmacological Society promotes pharmacology. Some of the more visible routes include the organisation of scientific meetings, as well as education and policy work. Alongside the publication of its three peer-reviewed journals, the BPS also supports the IUPHAR/BPS Guide to PHARMACOLOGY database (GtoPdb),<sup>1</sup> a free online resource for pharmacologists and scientists in related disciplines. Here, Steve Alexander and Adam Pawson reflect on the Concise Guide to PHARMACOLOGY (CGtP) 2017/18 and the database that underpins it.

## The IUPHAR/BPS Guide to PHARMACOLOGY database

The IUPHAR/BPS GtoPdb ([www.guidetopharmacology.org](http://www.guidetopharmacology.org)) is an open access, expert-curated, online database of drug targets and their ligands. It provides focused overviews and detailed introductions, key references and pharmacological characterisation of >2,800 (mostly

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**The Concise Guide to  
PHARMACOLOGY 2017/18**

SPH Alexander, E Kelly, NV Marrion, JA Peters, E Faccenda, SD Harding, AJ Pawson, JL Sharman, C Southan, OP Buneman, JA Cidlowski, A Christopoulos, AP Davenport, D Fabbro, M Spedding, J Striessnig, JA Davies and CGTP Collaborators

[www.bjpharmacol.org](http://www.bjpharmacol.org)  
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BRITISH PHARMACOLOGICAL SOCIETY

IUPHAR  
International Union of Basic and Clinical Pharmacology

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WILEY Blackwell

human) targets, along with quantitative pharmacological, chemical, genetic, functional and pathophysiological data on all the known biological targets of approved and experimental drugs. The database also has >9,000 distinct ligand molecules, including approved drugs, investigational small molecules, and

endogenous and synthetic peptides, and antibodies.

The content and data in the GtoPdb are largely derived from (and linked to) primary literature, utilising an international network of 500+ researchers arranged into more than 90 subcommittees of the

Nomenclature Committee of IUPHAR. Frequent interactions between these subcommittees and the team of expert curators and developers, based at the University of Edinburgh (led by Professor Jamie A. Davies), ensures that the information presented is up to date. All of the data presented in the GtoPdb is also available for download or in machine readable format to allow consumers working with other databases or resources ready access to the content.

Funding from the BPS and the Wellcome Trust allows free availability of this resource. The Wellcome Trust have also funded a recent expansion of the GtoPdb into the arena of immunopharmacology.<sup>2</sup> Not only have subcommittees been assembled to provide data on the targets and ligands of immunopharmacological relevance, but the scope of the online database has also been widened to include immunological cell types, processes and diseases. The GtoPdb also provides an integrated educational resource that includes access to high quality training in the principles of basic and clinical pharmacology and techniques ([www.pharmacologyeducation.org](http://www.pharmacologyeducation.org)).<sup>3</sup>

## The Concise Guide to PHARMACOLOGY 2017/18

The BPS's flagship CGtP publication (formally GRAC) is produced as a collaboration between the *British Journal of Pharmacology* and NC-IUPHAR. The GtoPdb provides an expanded substrate for the Concise Guide, which is a permanent, citable archive of the online version of the GtoPdb target summary pages. Updated and published every two years, the latest edition of the CGtP<sup>4</sup> was published as an Open Access resource on 21 October 2017. These publications present tabular extracts from the online GtoPdb, allowing for ready comparison of selective pharmacological tools (agonists, antagonists, modulators, channel blockers, substrates, inhibitors and labelled ligands), together with brief

overviews and suggestions for further reading.

The CGtP 2017/18 is not actually that concise; it is made up of over 440 pages and describes 1,700 human drug targets. More than 3,500 ligands are identified, including over 2,400 synthetic organic molecules and over 50 antibodies. Over 4,000 interactions between ligands and targets are described quantitatively, allowing assessment of the potency or affinity of these interactions.

The 2017/18 edition of the Concise Guide was a truly international endeavour, put together with help from over 150 collaborators, representing industry and academia from 22 countries across four continents.

The Concise Guide provides an evidence base for the data presented, with over 4,650 references cited and listed. These are linked to PubMed or Patents (where appropriate) in order that the reader can obtain further information from the source with a single click. It indicates, where available, selective pharmacological tools to enable researchers to identify a particular target in experimental investigations. The emphasis is not only on selectivity, but also on availability (either commercially or by donation) to ensure researchers have access to these tools. The impact of the Concise Guide is evidenced by its high citation rate – the nine publications from the 2015/16 edition have accrued over 1,200 citations since its publication in December 2015.

The broad coverage of the Concise Guide means its relevance also extends to scientists who would not normally think of themselves as pharmacologists; including physiologists, biochemists and cell biologists. For example, the Concise Guide has three sections on ion channels, which will be of interest to physiologists since, in many cases, molecular data are correlated with ion conductance at the cellular and channel level. Additionally, the

large section on enzymes, with a major focus on kinases, peptidase and proteinases will be relevant for biochemists and cell biologists wishing to identify whether selective tools for their enzyme of interest are available.

For those who teach pharmacology, the Concise Guide provides a handy starting point for researching specific pharmacological targets (receptors, ion channels, transporters, enzymes and other targets) which may be identified in lectures and practical classes. The further reading highlighted for these targets will also allow greater depth of insight from authoritative sources.

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### How to make the most of the Concise Guide to PHARMACOLOGY 2017/2018

For those new to a research topic, the Concise Guide allows a ready comparison of individual pharmacological targets within a family. Each family is introduced with an overview, which includes the nomenclature status of the family and general data, for example on



The CGtP is available as a Limited Edition hard copy, as well as in PDF format on a stylish, yet functional USB slap wristband, and for free download at [www.guidetopharmacology.org/concise](http://www.guidetopharmacology.org/concise). If you are interested in discovering more about the CGtP, come along to the Wiley stand (No. 21) at *Pharmacology 2017*.

the endogenous ligands for the particular receptor family. Each table of targets has an organisation which is standardised for each class of target (G protein-coupled receptors, enzymes, transporters, etc.). Each table includes clickable links to HUGO Gene Nomenclature Committee (HGNC) and UniProt - free online databases of gene and protein information.

Please email all enquiries to [enquiries@guidetopharmacology.org](mailto:enquiries@guidetopharmacology.org).



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Adam Pawson is Senior Database Curator for the IUPHAR/BPS GtoPdb at the University of Edinburgh. After receiving his PhD in Chemical Pathology at the University of Cape Town, he spent twelve years as a Post-Doctoral Fellow and Senior Investigator Scientist at the MRC Human Reproductive Sciences Unit in Edinburgh, focussing his research on GPCR structure/function, signal transduction and intracellular trafficking. Adam now oversees the curation and annotation of data for the GtoPdb.

Steve Alexander works on cannabis-related agents (and other stuff) in the School of Life Sciences at the University of Nottingham. He has worked on nomenclature guides for twenty years and been an Editor and Senior Editor of the *British Journal of Pharmacology* since 2004. Steve is the current chair of the International Union of Basic and Clinical Pharmacology Committee on Receptor Nomenclature and Drug Classification (NC-IUPHAR) and Senior Editor for the Concise Guide to PHARMACOLOGY.

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# From Bradford to Barcelona: My First International Conference



Gillian Durham,  
PhD student, University of Bradford



Photo by Benjamin Voros on Unsplash

At the end of June 2017, I attended the XXXVII Congreso Sociedad Española de Farmacología (SEF) meeting in Barcelona as part of a group of four investigators from the School of Pharmacy and Medical Sciences at the University of Bradford.

Having only attended smaller local meetings, I was thrilled to be awarded a British Pharmacological Society travel bursary to attend and experience this major scientific meeting. The meeting had a jam-packed schedule with the morning plenary lecture beginning at 8.30am and the final plenary lecture finishing at 7pm. The time in between was filled with oral presentations, posters

and much appreciated coffee breaks. Social activities then began at 8pm.

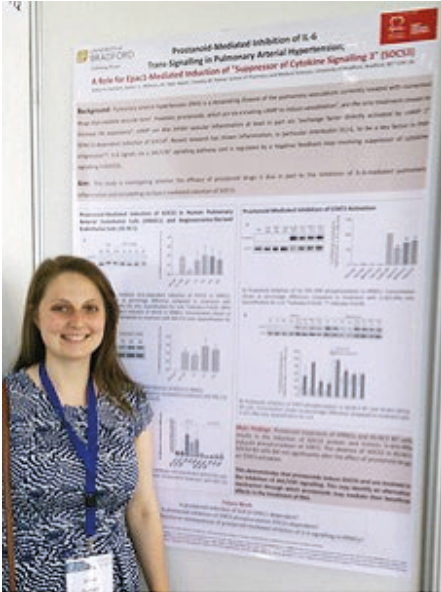
My main focus was the '*JAK-STAT signalling: new targets and therapeutics for multiple diseases*' symposia. In particular, the 'Inflammatory re-tuning of IL-6 mediated Jak-STAT signalling' talk delivered by Professor Simon Jones from the University of Cardiff, UK, was very interesting for me, and I was able to directly apply much of what I learnt. For instance, he discussed the use of tocilizumab, an interleukin-6-receptor inhibitor. As tocilizumab is commonly prescribed for rheumatoid arthritis, it would be worth examining whether there are any studies that have looked at the incidence of pulmonary arterial

hypertension (PAH) in rheumatoid arthritis patients compared to the general population.

I found attending symposia on such a wide-range of topics really useful for me to build up background knowledge on scientific and experimental approaches that are not directly related to my own PhD. In addition, talks given in other symposia were more relevant than I expected them to be. For instance, '*Novel mediators of inflammation in vascular damage in hypertension*' delivered by Dr Ana Briones from the University of Madrid, Spain, which was part of the cardiovascular and smooth muscle pharmacology symposia, was really



interesting and directly related to my own research interests. Her talk was on the use of prostanoid drugs and their interaction with reactive oxygen species with regards to endothelial dysfunction. I also study prostanoids but in relation to SOCS3 induction and limitation of IL-6 signalling in PAH. Endothelial dysfunction is a crucial part of PAH progression, therefore any prostanoid interactions that may affect endothelial dysfunction is relevant to my project.



Gillian presenting her poster at the XXXVII Congreso Sociedad Española de Farmacología (SEF) meeting in Barcelona

The same was true for the plenary lecture 'GPCR expression in health and disease identifies new therapeutic targets' delivered by Professor Paul Insel, who had travelled all the way from the University of California San Diego in the USA. Current treatment of PAH is limited with drugs aimed at relieving symptoms rather than limiting disease progression. One such drug class is prostanoids that target G protein-coupled receptors (GPCRs) to induce vasodilation increasing cyclic AMP levels and activating cyclic AMP-dependent protein kinase (PKA). Part of my PhD is to see if prostanoids act via other cyclic AMP signalling pathways to control induction of SOCS3, as this may also affect PAH pathology and could be exploited as a therapeutic target. His talk demonstrated that further understanding of GPCR function and regulation in diseased states such as

PAH may result in the identification of new targets for conditions where current therapeutic options are limited. Professor Paul Insel was inspirational in his delivery of the lecture and the energy and humour of his delivery was the perfect wake-up on a Monday morning.

Personally, something I found very useful was watching people present their work and learning from the way they addressed the audience or presented their data. Previously, I had only really experienced meetings where PhD students or early-career researchers had presented their work. Seeing how passionate and confident well-established scientists were when speaking about their topic really motivated me to improve my own presentation skills, and taught me some good presentation lessons.

As a second year student funded through a BHF Non-Clinical PhD studentship, this was a wonderful opportunity for me to present and discuss my research with scientists who are experts in similar fields to my own. Talking through my poster with established scientists from Europe and the USA was nerve-wracking, but they made me feel at ease and it was nice to speak to people who understood my PhD and were able to give me advice about how to further progress with it.

With regards to the social aspects of the meeting, there were several opportunities provided during the day to encourage us to network, as well as social events in the evenings. On the first day this was a live music reception which unfortunately I arrived too late for. I did attend the social event on the second day which involved a meal and drinks at the Norai Raval restaurant at the Maritime Museum of Barcelona. Due to the fantastic weather, we were able to enjoy our meal in a courtyard outside the museum which surrounded a lovely pond containing fish and turtles. The area was lit up with fairy lights as well which gave it a lovely, tranquil atmosphere.

The conference lived up to all of my expectations and more. From the freebies provided by the sponsors (including BPS Concise Guide USB

## About the Author

Gillian Durham is a BHF-funded 2nd Year PhD student within the Pharmacology and Experimental Therapeutics Research Group at the University of Bradford (UoB) under the supervision of Professor Tim Palmer and Dr Talat Nasim. Whilst her research sits within Pharmacology, she is a UoB Biomedical Science graduate. Her research interests include cytokines, in particular IL-6, JAK-STAT signalling, and cyclic AMP signalling, which forms the basis of her PhD. Gillian is also interested in skin science and molecular mechanisms of cancer.

Gillian is part of the School Athena Swan committee, as well as being the Pharmacy and Medical Sciences PGR student representative. When not busy in the lab, at a conference or in a committee meeting, you might find Gillian on the football pitch playing for UoB Women's Football Club.

wristbands!) and the unexpected delights served during lunch and coffee breaks, to knowing that I was learning about novel scientific breakthroughs from the people actually making those discoveries. I found the meeting to be a very enjoyable and, perhaps more importantly, a very thought provoking experience. All in all, an excellent way to spend the majority of the working week, even if I was a little bit disappointed that I only got to enjoy the lovely weather from inside a conference hall.



Photo by Tyler Hendy on Unsplash

# Spotlight on: Pharmacology Careers in South Africa



Dr Kim Outhoff (MBChB, FFPM, ACCP) and  
Professor Vanessa Steenkamp, Department of Pharmacology,  
University of Pretoria, South Africa

Current university applicants are at the interface of two generational cohorts: they are sufficiently old to relate to the values and entitled attitudes of generation Y millennials, but young enough to embrace the more socially conscious generation Z with their concerns for fairness, equity and justice.<sup>2,3</sup> These digital natives inhabit a hybrid space between generations that hold divergent views on technology and ethics.

They move effortlessly between inter-generational camps and guard against potential crises of identity by being pragmatic and fluid, and developing a sense of global citizenship. As trailblazers of the generation Z university cohort, they are set to become the intellectual elite, likely to become opinion leaders and trendsetters amongst their peers, and take an active role in inducing social change.<sup>5,6</sup>

Ironically, current tertiary-level students are not yet expected to take care of themselves. They are accustomed to being disempowered by nanny state interventions and unlimited parental involvement; it appears that generation X parents are still hovering to make decisions, seek opportunities and problem-solve for their adult children at university.<sup>6</sup> Student loyalties between the old ways and the new are being tested. In the simmering South African #FeesMustFall movement, student activists demand that past apartheid-based inequalities be addressed as promised in the National Plan for Higher Education (2001) and that 'free, quality, decolonised education' be accessible to all.<sup>7</sup> Interestingly, it is

quietly argued that it is not them, but rather their previously disadvantaged and financially-stretched parents, who are being discriminated against.<sup>8</sup> The rub is that many are desperate to provide a tertiary education for their children because it continues to represent upward social mobility and a higher earning potential. Graduate unemployment in South Africa is relatively low in relation to overall unemployment, which is officially estimated at 27.7%, with 32.2% of youth aged 15–24 years not in employment, education or training.<sup>9</sup> University graduates remain the group with the best labour market prospects relative to other education cohorts.<sup>10</sup> In South Africa, where approximately half the population of 56.5 million lives in poverty, and 13.8 million live in extreme poverty, tertiary education is seen as critical.<sup>9</sup>

Against this complex and challenging South African socio-economic backdrop, a degree in pharmacology promises a heady mix of intellectually stimulating and exciting job opportunities, prospective wealth, cutting edge innovation, global travel and potential philanthropy.<sup>11</sup> It is drug discovery in particular that tickles the altruistic. How many prospective pharmacology postgraduates can resist the lure of the Nobel Prize? It represents selflessness, social awareness, honour and prestige – all attributes that resonate with the Mandela-proud rainbow nation youth. It also comes with an 18 carat gold medal and a million US dollars.

Mindful of this vision, the Department of Pharmacology at the University of Pretoria offers a one year full-time

postgraduate pre-clinical (basic) pharmacology honours degree track that focuses on scientific methodologies and pharmacology with primary emphasis on drug research and pre-clinical development.<sup>12</sup> Practical sessions instruct students on the use of laboratory techniques and equipment as well as principles of science, as these form the basis of a research project; students write a research protocol, conduct the planned experiments, perform data analysis, interpret results, and compile a draft research article and presentation. Students gain experience in a wide range of modern experimental and analytical techniques while becoming increasingly aware that it is not all that easy to be Sir Alexander Fleming. Times have changed. Serendipity is rare. Money is tight. The fact that it was a joint effort (with Ernst Boris Chain and Howard Walter Florey) that led to the 1945 Nobel Prize-share in physiology or medicine may, however, rekindle the dream and help soothe the frustration of delayed gratification.<sup>13</sup>

Institutional, local, national and international collaborations and further postgraduate study to PhD level undoubtedly expedite a career in drug discovery. On average, the department supports 10 PhD, 20 MSc and 18 honours students at any given time. Being increasingly dependent on competitive external grants, the basic research thrust is towards underlying mechanistic components of several high-priority communicable and non-communicable disease areas in Africa, notably malaria, diabetes and cancer. Locally applicable and internationally relevant research is also conducted in Alzheimer's disease, wound healing

and inflammatory conditions, including infectious diseases and biofilms. Briefly, this encompasses methodological development, disease model optimisation, proteomic and bioinformatics-based intra and extracellular target identification and validation, *in-silico* and looking to nature (herbal remedies) 'hit' molecule identification, *in-vitro* and *in-vivo* screening and preclinical toxicology.

Although several South African universities are currently offering pharmacology lectureships with some non-clinical research opportunities, for all intents and purposes, the most direct route to the award ceremony in Stockholm is via North America or Europe, where numerous well-funded academic and research institutions are recruiting pharmacology post-docs for long-term positions in drug discovery.<sup>14</sup> In addition, a move from academia to full-time senior research positions in the pharmaceutical industry is relatively straightforward with a few years of post-doctoral experience, although it is noted that some companies are currently recruiting scientists with a relevant bachelor's degree. Thus, numerous realistic and sustainable career opportunities in drug research are available to South Africans with a pharmacology degree, although almost exclusively in the colder climes of the northern hemisphere.

In contrast, local career opportunities for pharmacology graduates not interested in conducting research are plentiful. A brief perusal of contemporary South African recruitment sites reveals that the pharmaceutical and biotechnology industries continuously seek pharmacology graduates for sales, medical marketing, medical scientific liaison, regulatory affairs and quality assurance positions. Pharmaceutical sales representatives (potentially leading to product and national key accounts management and other exciting marketing opportunities) and Clinical Research Associates (CRAs) are currently in high demand.<sup>15</sup> In order to fill the latter industry gap, our specialized clinical pharmacology honours track students are expected

## About the Authors

Kim is a Pharmaceutical Physician, Senior Lecturer and Clinical Pharmacologist. She studied Medicine at the University of Cape Town, attaining her MBChB degree in 1991. She worked as a House Officer, General Practitioner and Senior House Officer in Namibia, Canada and the UK, respectively. She joined Guy's Drug Research Unit, London, as a phase I and II Pharmaceutical Physician in 1997, and Organon Laboratories, Cambridge, as a Senior Medical Adviser in 1998 where she was part of the UK launch of the antidepressant, mirtazapine. During this time she attained her Dip.Pharm.Med (1999) from Cardiff University and became a Member (2002) and subsequently a Fellow (2012) of the Faculty of Pharmaceutical Medicine of the Royal College of Medicine (UK). She moved from the Pharmaceutical Industry to Academia as a Senior Lecturer in Pharmacology in 2007, and was registered as an Associate of the College of Clinical Pharmacologists of the Colleges of Medicine of South Africa in 2016. She teaches Pharmacotherapy to undergraduate and postgraduate Medical and Dentistry students, and coordinates the Master's MPharmMed degree programme where she also supervises both clinical and non-clinical research projects. Her *in-vitro* and *in-vivo* doctoral research is on Her-2 positive breast cancer. The views expressed in this article are her own, and do not necessarily reflect those of the Department, Faculty, University or Government.

Vanessa is currently Head of Department of Pharmacology, University of Pretoria. She did her undergraduate and postgraduate studies up to Master level at University of Pretoria. She obtained her PhD in Clinical Biochemistry at the University of the Witwatersrand. Her research interest focuses on traditional herbal remedies where she is involved in pre-clinical testing and development of new drugs, including toxicity testing. Vanessa is actively involved in postgraduate supervision. Amongst others, she is President of the South African Association of Basic and Clinical Pharmacology, Vice-President of the Toxicology Society of South Africa and serves as chair of the Clinical Toxicology Committee of the International Association of Therapeutic Drug Monitoring and Clinical Toxicology as well as member of the Executive Committee of the International Federation of Clinical Chemistry.





to have an in-depth knowledge of the theoretical component of the postgraduate pharmacology course, as well as to show practical proficiency in all aspects of clinical trials including designing and writing a protocol, applying for ethics and regulatory authority approval, and initiating and conducting a clinical trial according to good clinical practice (GCP).<sup>12</sup> Hands-on experience is gained at the Faculty of Health Sciences' FDA-accredited Clinical Research Unit where phase II-IV Industry-sponsored trials are conducted in a variety of therapeutic areas, notably in HIV, diabetes and rheumatoid arthritis. Not surprisingly, the local employment rate for these prospective CRAs by contract research organisations (a burgeoning industry in

South Africa) and other pharmaceutical companies approximates 100%.

Meanwhile, our third specialised honours track, Regulatory Pharmacology, equips postgraduate students with theoretical and practical knowledge in regulatory affairs in South Africa's modern day pharmaceutical environment, thus providing well-qualified candidates for this industry niche.<sup>12</sup> Relevant and current research experience is strengthened by industry as well as Medicines Control Council (MCC) mentorship, relationships that clearly foster future employment.

The three pharmacology honours (BSc. Hons Pharmacology) track graduates have an extensive knowledge

of pharmacology and research methodologies in common, with scope for further MSc or PhD studies in any of the specialised areas. This increases their initial earning potential exponentially. Their versatility enables them to meet diverse job requirements in both academic and industry sectors, nationally and globally. This is important because it is an increasing proportion of this particular generation's taxable income that will ultimately finance future South African university applicants. University fees are falling and the current generation Z cohort will almost certainly have to bridge the budgetary gap. The million-dollar prize money may well come in handy.

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# Prescribing Assessment: News from the UK and Internationally

Simon Maxwell,  
University of Edinburgh



ID : 1199 Prescribing Once Only Medicines 10 marks 🔍 📄 📅 ☰ ✓ Mark for review A A ➔

**Case presentation**  
A 62-year-old woman is admitted to hospital with a 3-day history of increasing breathlessness, wheeze and dry cough. **PMH.** COPD with several admissions for exacerbations. **DH.** Salbutamol inhaler 200 micrograms as required, tiotropium inhaler 18 micrograms daily, fluticasone propionate 250 micrograms with salmeterol 50 micrograms inhaler (Seretide 250 Accuhaler®) 12-hrly. Treatment with prednisolone 30 mg orally daily has already been started by her GP.

**On examination**  
She appears distressed, and is centrally cyanosed and coughing.  
Temperature 37.1°C, HR 112/min, BP 116/72 mmHg, RR 30/min, O<sub>2</sub> sat 90% (94–99) breathing air. PEFR 120 L/min. She is using her accessory muscles to breathe. Auscultation of the chest reveals widespread wheezes bilaterally.

**Investigations**  
Hb 146 g/L (115–165), WCC  $9.8 \times 10^9/L$  (4.0–11.0).  
Na<sup>+</sup> 140 mmol/L (137–144), K<sup>+</sup> 4.2 mmol/L (3.5–4.9), U 7.2 mmol/L (2.5–7.0), Cr 85 μmol/L (60–110). CXR shows hyperinflated lungs.

**Prescribing request**  
Please write a prescription for ONE drug that will provide rapid relief of her bronchospasm.  
*(use the hospital 'once-only medicines' prescription chart provided)*

**PRESCRIPTION FORM**

**Medicine**

**Dose**

**Route**

**Frequency**  
once only

**Duration**  
once only

**Prescriber**  **Date**  **Time**

An example prescribing question item from the BPS's online Prescribing Skills Assessment system.

## Concerns about prescribing

Prescribing is a core activity for all healthcare systems and most of the doctors who work in them. The average member of the public in the UK will be in receipt of around 20 prescriptions annually which are intended to treat current illnesses and symptoms or prevent future disease.<sup>1</sup> Recent studies have demonstrated significant numbers of prescribing errors and potentially avoidable adverse drug reactions both in hospital and general practice.<sup>2,3,4</sup> While the causes are multiple, one important response has been to focus on providing better training pathways, especially for medical students.<sup>5</sup> This has included the development of assessments that might serve as a predictive measurement of prescribing performance.

## Why assess prescribing?

There are two principal reasons to consider assessing prescribing. First, there are important patient safety and clinical governance concerns. It is important that all independent prescribers have reached a basic level of performance sufficient to be able to work effectively and safely in the healthcare environment. The required knowledge and skills will be determined by factors such as the likely case-mix, time pressures and the supervision that will be available. Second, there are important educational

reasons. For individuals, it is important that they have the opportunity to reflect on their performance in this vital aspect of their work. This can be aided by provision of feedback about specific areas of weakness. Assessments also make it possible for educational institutions (e.g. medical schools) to reflect on the success of their training programmes, which often vary considerably.<sup>6</sup>

## Variability in prescribing assessments

Prescribing assessments come in many forms and the following headings highlight some of the areas of variability:

- (i) *Coverage.* Prescribing has been well defined as 'A written order, which includes detailed instructions of what medicine should be given to whom, in what formulation and dose, by what route, when, how frequently, and for how long'.<sup>7</sup> While prescribing assessments might focus only on this complex action, many reflect the fact that prescribers spend at least as much time supervising and directing the use of medicines in other ways. Therefore, many assessments also extend into other skills such as reviewing prescriptions written by others, communicating about medicines, calculating drug dosage, monitoring the effects of medicines and interpreting data.

- (ii) *External validity.* Prescribing assessments are intended to serve as surrogate markers of likely performance in the real-world setting. Therefore, the extent to which candidates are faced with realistic challenges is an important factor that determines validity and interpretation. These may range from largely knowledge-based exercises undertaken as Multiple Choice Questions (MCQs) in an examination hall to much more contextualised exercises in either a high-fidelity simulation or even in a real clinical environment (Table 1).
- (iii) *Delivery.* The setting for the assessment may range from a remote location to a simulated or real clinical environment and it may be based on paper or an electronic system. The latter offers the opportunity for distributed delivery and automation of marking.
- (iv) *Purpose.* This may range from a summative high-stakes assessment that influences progression decisions to a formative exercise that serves to provide feedback, and encourage learning and reflection. For summative assessments there is a need to ensure that there is a suitable standard-setting process in place.
- (v) *Reliability.* An ideal assessment will be reliable, meaning that there can be confidence that a candidate who performs well on one occasion would do so again if re-tested. The factors determining reliability are the number of items in the assessment (i.e. its length), the discrimination of the items between strong and weak candidates and the number of different skills that the assessment tests.<sup>8</sup>
- (vi) *Marking.* This should ideally be objective and consistent. Whenever human marking is involved an element of subjectivity is introduced even if it is based on a well-developed rubric. Automated electronic marking provides objectivity and avoids the very resource-intensive exercise of human marking, but it can be extremely difficult to mark prescriptions that way.

Noting the considerable variability in structure and delivery, Table 1 offers a simple classification based primarily on the relationship of the assessment to the relevant workplace environment. A very simple analysis would suggest that higher validity (contextualisation) comes at the expense of a lower chance of psychometric reliability, more risk of confounding and a greater requirement for resource.

## UK prescribing assessments

Prescribing Safety Assessment (PSA). The PSA has been developed by the British Pharmacological Society (BPS) and Medical Schools Council Assessment (MSCA) as a national summative assessment of knowledge, judgement and skills related to prescribing and supervising medicines at a basic level in a modern healthcare system.<sup>9</sup> Its primary purpose is to enable final-year medical students to demonstrate that they have achieved the necessary competence to prescribe and supervise the use of medicines at the standard expected of a foundation doctor in an NHS hospital. The PSA is based on the competencies identified by the UK General Medical Council in outcomes for graduates (2015).<sup>10</sup> It is delivered to all UK final-year medical students as a 2-hour online assessment that is divided into 8 sections (Table 2). It is intended to assess, as far as possible within the confines of a virtual environment, complex skills including powers of deduction and problem solving that are relevant to the work of junior doctors in UK hospitals. The innovative delivery system enables around 60,000 prescriptions to be instantaneously assessed against a standardised marking scheme. In 2016, a total of 7,343 final-year students from 31 UK medical schools sat the PSA in 200 individual events held around the UK with an overall pass rate of 95%.<sup>11</sup> There was significant variation in the performance of individual medical school cohorts. The mean Cronbach's alpha across the four papers used was 0.75. While not quite achieving the nominal 0.8 considered as ideal reliability for high-stakes assessments, this compares favourably with expectations for

Table 1. Allocation of question items and marks to each section of the Prescribing Safety Assessment.

Section	Description	Marks	Question items
1	Prescribing (PWS)	80	8 items of 10 marks
2	Prescription Review (REV)	32	8 items of 4 marks each
3	Planning Management (MAN)	16	8 items of 2 marks each
4	Communicating Information (COM)	12	6 items of 2 marks each
5	Calculation Skills (CAL)	16	8 items of 2 marks each
6	Adverse Drug Reactions (ADR)	16	8 items of 2 marks each
7	Drug Monitoring (TDM)	16	8 items of 2 marks each
8	Data Interpretation (DAT)	12	6 items of 2 marks each
<b>TOTAL MARKS</b>		<b>200</b>	



Table 2. Categorisation of prescribing assessments.

Category	Example	Comment
Non-case-based	Multiple-choice questions that require a knowledge of modes of action, indications, contra-indications, adverse effects and interactions of drugs but do not set this in the context of cases encountered in clinical practice. Prescription writing completely absent although some of the answer 'options' may be prescriptions. No clinical judgement required.	External validity for the workplace largely absent. Content easy to develop. Easy to deliver. Amenable to automated marking. Psychometric reliability easy to achieve.
Low-fidelity simulation	Question items have some relation to clinical cases but may not be rich in content (e.g. clinical and medication history, examination findings). Prescription writing may be completely absent although some of the answer 'options' may be prescriptions. Little clinical judgement required.	Poor external validity for the workplace. Content relatively easy to develop. Easy to deliver. Amenable to automated marking. Psychometric reliability easy to achieve.
Medium-fidelity simulation	Question items are based on well-described case content (i.e. clinical history, examination findings and investigations). Clinical experience and judgement very important. Not delivered in a clinical environment.	Some external validity for the workplace. Question content challenging to develop because it requires authors with clinical experience who can develop more complex materials demanding judgements. Relatively easy to deliver. Automated marking of prescriptions difficult and often resource intensive. Psychometric reliability more difficult to achieve (because of the collection of skills being tested).
High-fidelity simulation	Delivery in a physical space that may contain simulated or real patients. Objective and structured in design. Assessment largely subjective based on individual candidate marking by examiners.	Relatively high validity. Resource intensive. Psychometric reliability more difficult to achieve (because of the collection of skills being tested). Automated marking not possible.
Real world practice	Observational. Based on performance in real world clinical practice. Delivery in a physical space that may contain simulated or real patients. Marking subjective based on assessment of work against pre-specified best-practice standards by individual raters.	High validity. Observational. Unstructured. Potential for confounding. Resource intensive. Very hard to test the other skills demanded of prescribers. Reliability poor.

a multi-domain assessment that is only 2 hours in duration. Prescribing rights have now been extended to other professional groups (e.g. nurse practitioners, pharmacists) and early pilot work has been started to explore the utility of the PSA in that setting.<sup>12</sup>

### Other UK prescribing assessments

There are numerous local assessments in operation, mostly focusing on screening competence amongst new doctors.<sup>13,14</sup> The largest has been developed by Kent, Surrey and Sussex local education and training board (LETB) which is based on the combination of a 'long answer scenario' and short answer MCQs.<sup>15</sup> Local assessments have the advantage that they are able to provide additional validity in terms of assessing against local protocols using local documentation and decision support. However, they suffer from the significant disadvantage of being expensive to support and maintain and difficult to make reliable. For these reasons, they might be ideally seen as a supplement to a national screening assessment.

### International prescribing assessments

There are no international reports of large scale prescribing assessments, like the PSA, that are being delivered widely on an annual basis across multiple institutions, although numerous smaller assessments have been described.<sup>16</sup> Two recent international initiatives are worthy of note. The European Association for Clinical Pharmacology and Therapeutics (EACPT) education working group organised a cross-sectional comparison of prescribing-related knowledge among 895 final-year medical students in 26 medical schools from 17 European countries.<sup>17</sup> Each was asked to complete a standardised online assessment (clinical scenarios and MCQs). The majority of prescriptions (55%) contained errors and there were differences between schools. A Dutch national prescribing assessment is currently being piloted,<sup>18</sup> although there is currently no English language description. The successful development and implementation of the PSA in the UK has led to several international collaborations with medical schools in Ireland, Malta, Australia, New Zealand, Canada and India.

## Future questions

Important issues for future research have arisen. The assessments above are intended to be surrogate markers of the likely performance of candidates in future clinical practice. The reliability of that prediction should be tested by research that links assessment performance to real world practice. However, addressing this question poses significant challenges. There are numerous other confounding

factors that might influence performance measures in the workplace (e.g. workload, supervision, case mix). Furthermore, following up and assessing clinical outcomes for large cohorts over a prolonged period of time will be resource intensive. There is also a need to seek explanations for the variability in performance between cohorts from different institutions. This might help to understand which training programmes are most successful in providing firm foundations for future prescribers.

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## About the author

Professor Simon Maxwell is Director of Clinical Pharmacology & Therapeutics (CPT) teaching at the University of Edinburgh, where he has been active in developing e-Learning strategies to support education in this area. He has led a number of national education initiatives on behalf of the British Pharmacological Society (BPS) including developing a core curriculum for CPT teaching in UK medical schools, the Prescribe e-Learning project undertaken with Healthcare Education England, and the Prescribing Safety Assessment, a joint initiative with the Medical Schools Council to produce a national assessment of prescribing for all UK medical students.

# Meetings update



**Niall Hyland**, Vice President – Meetings  
**Susanne Schweda**, Head of Meetings & Events

## Recent highlights



### 8th European Workshop on Cannabinoid Research

31 August – 2 September 2017 | London, UK

This three-day focused meeting concentrated on the latest developments in cannabinoid research and its 97 attendees saw a total of 53 oral communications and posters presented. Professor Javier Fernandez Ruiz, Universidad Complutense, Spain, presented the EPHAR lecture 'The current biomedical challenge of neurodegenerative disorders: an opportunity for cannabinoid-based therapies'. The best oral communication prize was awarded to Annelot Van Esbroeck of Leiden University in The Netherlands, for her talk 'Activity-based protein profiling reveals off-target proteins of the FAAH inhibitor BIA 10-2474' and the best poster prize was presented to Adrian Olmos-Alonso, Hospital Clinico San Carlos-IdISSC, Spain for his poster 'Cannabidiol prevents neonatal brain hypoxia-ischemia-induced increase of adult seizure threshold in rats'.

### About the authors

Niall is Lecturer in Pharmacology in the School of Medicine at University College Cork, Republic of Ireland. He also holds a Faculty position at the APC Microbiome Institute, a Science Foundation Ireland research centre where his research focuses on the microbiota-gut-brain axis. Niall has a PhD in Pharmacology from King's College London and trained in both the USA and Canada. He is co-chair of the Society's Systems and Integrative Pharmacology Affinity Group and on the Editorial Board of the *British Journal of Pharmacology*. He also contributes to the activities of the European Society of Neurogastroenterology and Motility and The American Gastroenterological Association Institute Council.

Susanne joined the British Pharmacological Society from the Royal Society of Medicine, where she had looked after a number of medical specialities and organised clinical and non-clinical meetings and events. Previous to that Susanne lived and worked in Bournemouth and Brussels where she organised educational and pharmaceutical conferences in Europe and North America. She is responsible for the logistical organisation and management of upcoming meetings and events.



## Update on upcoming meetings

### Pharmacology 2017

11–13 December 2017 | London, UK

If you have not yet registered, do so soon. Don't miss out on attending this year's annual meeting with our biggest programme to date: 15 symposia, seven workshops, six plenary lectures as well as oral communications and poster presentations. This year the welcome reception will take place at the QEII conference centre to make the social event more accessible to attendees and allow for even more extensive networking. The annual dinner and prize giving will take place at One Whitehall Place in Westminster, a short walk from the venue. Social tickets can be booked during the online registration process.



#### Deadlines to note:

Online registration deadline:  
Friday 1 December 2017  
(11:59pm GMT).

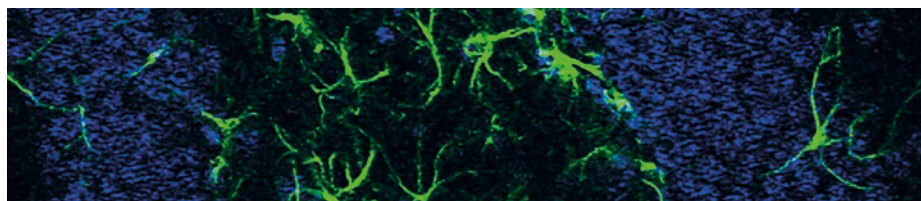
The Meetings Committee would like to encourage Society members to get involved with chairing sessions and judging posters at its annual meeting. If you are interested, please contact [meetings@bps.ac.uk](mailto:meetings@bps.ac.uk).

For further information please visit [www.bps.ac.uk/pharmacology2017](http://www.bps.ac.uk/pharmacology2017).

### 7th Focused Meeting on Cell Signalling

16 – 17 April 2018 | Nottingham, UK

This two-day focused meeting on Cell Signalling will give 200 participants the opportunity to hear leading experts in the field from across the world present their research. The focused meeting is the seventh in a highly successful series and for the first time, the meeting will include the JR Vane Medal plenary lecture. The meeting provides invaluable opportunities for participants to network with pharmacologists from the UK and overseas and present their work in the form of oral and poster presentations.



#### Deadlines to note:

Abstract submission deadline:  
Friday 2 February 2018  
(11:59pm GMT).

Bursary submission deadline:  
Friday 2 February 2018  
(11:59pm GMT).

Early-bird registration deadline:  
Monday 12 March 2018  
(11:59pm GMT).

For further information please visit [www.bps.ac.uk/cellsignalling2018](http://www.bps.ac.uk/cellsignalling2018).

### Pharmacology Futures 2018 – celebrating 250 years of pharmacology in Edinburgh

17 May 2018 | Edinburgh, UK



Pharmacology Futures 2018, a one-day focused meeting in Edinburgh, will explore the technologies and skills that will drive drug development over the next 10 to 15 years, with speakers sharing their visions of the future to celebrate 250 years of pharmacology. The University of Edinburgh's Cameron Prize for Therapeutics will be awarded during the meeting.

#### Deadlines to note:

Abstract submission deadline:  
Friday 2 March 2018  
(11:59pm GMT).

Bursary submission deadline:  
Friday 2 March 2018  
(11:59pm GMT).

Early-bird registration deadline:  
Monday 16 April 2018  
(11:59pm GMT).

For further information please visit [www.bps.ac.uk/pharmacologyfutures2018](http://www.bps.ac.uk/pharmacologyfutures2018).

# Affinity Groups update

Mike Seed and Andy Webb –  
The Education & Skills Affinity Group



The Education & Skills Affinity Group serves members with interests in all aspects of education related to pharmacology, toxicology, clinical pharmacology and therapeutics. This group brings together members engaged in, or who have an interest in, teaching undergraduate, postgraduate and professional learners, and enabling students to demonstrate competencies in relation to prescribing and the safe and effective use of medicines. Another activity performed by this group is communicating pharmacology in the public domain.

For a Society Affinity Group, the Education & Skills Affinity Group is unusual in that it aligns with a British Pharmacological Society (BPS) committee - the Education and Training Committee chaired by Dr Lisa Wallace and managed by Dr Anna Zecharia, Director of Policy & Public Affairs at the BPS. This gives group members important opportunities to inform the BPS of pharmacology educators' needs and concerns, and to advise of developments in innovative practice. It also allows Lisa and Anna direct access to members for 'on the ground expertise and opinion'.

Members of the group have both presented and reviewed the education contributions at *Pharmacology 2016*. See the previous issue of *Pharmacology Matters*<sup>1</sup> for a full report (page 26) on the highly successful education symposium and workshop. Members have also been very active in contributing to the development of the new pharmacology core curriculum<sup>2</sup> through the expert group run by Dr Lisa Wallace and Dr Anna Zecharia. Members are now involved in the *In vivo* Skills Expert Group<sup>3</sup>.

Following these successes, the Affinity Group is committed to ensuring that education is embedded at the Society's annual *Pharmacology* meetings. This year the Education Committee and Education & Skills Affinity Group are running a workshop 'Innovation

in pharmacology education' on Wednesday 13 December from 9.00 to 11.00. The session will start with updates on pharmacology education activities in 2017-2018, followed by the hugely popular interactive demonstration workshop. The day will include oral and poster presentations and there will be the opportunity to take part in small group discussions that will formulate the direction of the Society's next efforts in the education sector. *What can the Society do to support you? And, what can you do to support the Society?* Affinity Group members were recruited to review abstract submissions aligned with the Affinity Group for *Pharmacology 2017*.

The Affinity Group acts as a source of information and networking for pharmacology educators and has already been involved in discussions on the teaching of 'wet' and *in silico* organ bath practicals.

This year pharmacology education has experienced unprecedented pressures, from the impact of the Teaching Excellence Framework (TEF), to small degree programme sizes, graduate recruitment and graduate employability, and the maintenance of 'wet lab' practical work in pressured curricula. The Affinity Group wishes to address these issues through a series of symposia, local to university nodes of pharmacology education throughout the country. Proposals are sought for

pharmacology education activities, events, and relevant symposia from across the national education sector, and further afield. These symposia would bring together universities to discuss issues topical to pharmacology education. If you would like further information on the support available from the Education & Skills Affinity Group<sup>4</sup>, please do contact us on [affinitygroups@bps.ac.uk](mailto:affinitygroups@bps.ac.uk).

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Chris Garland and Jillian Baker –  
The Cardiovascular & Respiratory Pharmacology Affinity Group



The Cardiovascular & Respiratory Pharmacology Affinity Group serves members with interests in all areas relevant to the cardiovascular and respiratory systems in health and disease including both experimental and clinical aspects from the molecular level, through to cellular, systems and whole-body approaches.

The Cardiovascular & Respiratory Pharmacology Affinity Group aims to provide a supportive, inclusive forum for Society members with an interest in all aspects of cardiovascular and respiratory pharmacology.

This encompasses the whole spectrum of pharmacology, so will be of relevance to members interested in medicinal chemistry, cellular, tissue and whole organism responses, and those involved in human clinical studies. The aim is to provide an overarching forum for pharmacological aspects of normal physiological responses through to studies in different disease states, including the effect of existing drugs as well as novel interventions. Those who are already a member of other Society Affinity Groups, who may also have cardiovascular or respiratory interests, are also encouraged to join the Cardiovascular & Respiratory Pharmacology Affinity Group.

Cardiovascular and respiratory research has always been very strongly represented at British Pharmacology Society meetings, with many oral and poster communications and symposia. *Pharmacology 2017* will be no exception;

In partnership with the British Society for Cardiovascular Research, we are presenting a symposium: 'Cardiovascular pleiotropy, fact or fantasy?' where we will explore cardiovascular benefits of drugs used for diabetes as well as statins and anti-platelet targets

- We will also explore coagulation and thrombosis in disease states in the symposium: 'Clearing the blockage: bench to bedside approaches for clearing inflammation-induced thrombosis'
- A third symposium will concentrate on hypertension, with particular emphasis on the immune system: 'Immune targets in hypertension'

Inflammation and cytokine-based therapies are also explored in other symposia, aligned with the Integrated Systems Pharmacology Affinity Group, with specific emphasis on cardiovascular disease and acute and chronic lung inflammation ('Cytokine-based therapies in inflammatory diseases').

Over the past year, events organised by the Cardiovascular & Respiratory Pharmacology Affinity Group have included a BPS Focused Meeting at Magdalen College, University of Oxford last September on 'Pharmacological aspects of microvascular cell-cell

signalling and CVS disease', which attracted delegates and speakers from across Europe, and as far away as Australia and the USA.

Overall, we welcome you to the Cardiovascular & Respiratory Pharmacology Affinity Group,<sup>1</sup> and if you are not already a member, we encourage you to sign up on the BPS website. We look forward to welcoming you to *Pharmacology 2017* and seeing you in London. Finally, we are always keen to hear your thoughts and ideas about Focused Meetings or events you would like us to organise, and suggestions for symposia we should include in future BPS meetings.

This is your Affinity Group, join the conversation! Please contact [affinitygroups@bps.ac.uk](mailto:affinitygroups@bps.ac.uk) with any suggestions.

## Reference

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Magdalen College, University of Oxford – the location of the focused meeting on the pharmacological aspects of microvascular cell-cell signalling and CVS disease





Poster presentation and welcome reception at the pharmacological aspects of microvascular cell-cell signalling and CVS disease focused meeting, organised by the BPS's Cardiovascular & Respiratory Pharmacology Affinity Group

## About the authors

### The Education & Skills Affinity Group

Michael Seed (BSc and PhD Pharmacology, University of Bath) is Professor Emeritus of Pharmacology, University of East London. A past member of BPS Council, his interests include pharmacology teaching, *in vivo* arthritis/inflammation modelling, human and animal research ethics, anti-rheumatic sulphated carbohydrates, and Loin Pain Haematuria Syndrome. He has Pharma experience, and worked at the William Harvey Research Institute with Biotech, EU, and Wellcome SDDI initiatives. These encompassed immune modulators, kinases and dissociated steroids. Teaching includes Bath Pharmacy/Pharmacology, QMUL MBBS, and UEL Pharmacology/Medical Physiology/Pharmaceutical Science. Co-awarded the BPS Rang Prize 2014, he is Director of the UEL Clinical Research Group.

Andrew Webb qualified from Charing Cross & Westminster Medical School in 1994 and after General Professional Training in Brighton, he started his Specialist Registrar training (ABPI-scheme) in Clinical Pharmacology & General Medicine at Barts & The London in 1998. He moved to King's College London in 2010. Andy contributes to undergraduate teaching and assessment, particularly in pharmacology and prescribing. He is a Senior Editor for the *British Journal of Clinical Pharmacology* and he is a member of the Prescribing Skills Assessment Steering Group, established by the Medical Schools Council and the British Pharmacological Society, to develop a National Prescribing Assessment

### The Cardiovascular & Respiratory Pharmacology Affinity Group

Chris Garland leads the vascular pharmacology group in Oxford, with Professor Kim Dora. The group use advanced imaging and electrophysiological approaches with isolated arterioles, to study how signalling occurs between the cells in these minute vessels, to control blood flow through the microcirculation and impact on blood pressure. The focus of the group is to unravel how calcium activated potassium channels in endothelial cells are recruited to attenuate the smooth muscle contraction which reduces arteriolar diameter see, for example, *Sci. Signal.* 10, eaal3806 (2017). Their research includes the use of human coronary arterioles, to investigate the impact of vascular disease.

Jillian Baker is a practicing medic working in the area of adult respiratory and sleep medicine in Queen's Medical Centre, Nottingham and sees first-hand many of the short-comings of current drugs. Her research interests are therefore two-fold. Firstly, she is interested in the molecular pharmacology of GPCRs, including drug-receptor selectivity, and understanding how drugs interact with receptors to cause changes in the cell behaviour. Secondly, she combines her clinical and pharmacology knowledge to understand how clinical drugs act, why side effects occur, and to identify novel drugs for medical conditions with few treatment options. Her ultimate aim is to improve clinical drug treatments for patients.



BRITISH  
PHARMACOLOGICAL  
SOCIETY

# PHARMACOLOGY MATTERS IS RECRUITING!

**Pharmacology Matters** is the digital magazine of the British Pharmacological Society, with an online circulation of over 4,000 professionals and students working in academic, industrial, and clinical settings. The magazine is produced three times a year as a PDF publication and as a regular blog, and is often themed around topics of special interest selected by the Editorial Board.

The Society are looking to expand the Editorial Board of *Pharmacology Matters*. This is an exciting opportunity for enthusiastic members to help with the Society's mission to promote and advance pharmacology in all of its forms, and help to communicate the varied activities of the Society and its members.

## What do our editors do?

- Keep an eye out for, and highlight to the Editorial Board, any interesting topics or activities for articles for each issue of *Pharmacology Matters*
- Commission and work with authors to develop articles for *Pharmacology Matters*, ensuring that they are provided within the deadlines and to the required specifications
- Make all efforts to attend the Editorial Board meetings/teleconferences (at least two per year)
- Where applicable, author at least one article per year
- Make recommendations to the Editorial Board for developing *Pharmacology Matters*

## Term of office

Successful applicants will need to be able to begin their 2-year term from 1 February 2018.

## Applicants should:

- Be members of the BPS
- Have strong critical analysis and appraisal skills
- Be enthusiastic!

## How to apply

- If you are interested in joining the Board, please send no more than 250 words on how you believe you are suited to the role to Emma Needham, Managing Editor of *Pharmacology Matters* ([emma.needham@bps.ac.uk](mailto:emma.needham@bps.ac.uk)) **by 8 January 2017.**
- If you would like to discuss the role in more detail before applying, please contact our Editor-in-Chief Margaret Cunningham ([margaret.cunningham@strath.ac.uk](mailto:margaret.cunningham@strath.ac.uk)).

**We look forward to  
hearing from you!**





Submit your abstract and register now:

# 7<sup>TH</sup> FOCUSED MEETING ON CELL SIGNALLING

16 – 17 April 2018, East Midlands Conference Centre, The University of Nottingham, Nottingham, UK

This two-day scientific meeting is the 7th in a highly successful series and will give delegates the opportunity to hear leading experts in cell signalling from across the world present their research. For the first time, the meeting will include the JR Vane Medal plenary lecture. The meeting also provides invaluable opportunities for participants to network with pharmacologists from the UK and overseas.

## Aim:

To provide a forum, led by internationally-leading researchers, to discuss the latest findings and ideas in cell signalling research with an emphasis on G protein-coupled receptor (GPCR) pharmacology and therapeutics.

## Objectives:

- To discuss the latest advances in our structural understanding of GPCRs, including quaternary interactions
- To link structure to function with respect to key GPCR features (e.g. orthosteric and allosteric ligand-receptor interactions, structural basis of GPCR coupling to G proteins, GRKs, arrestins)
- To highlight progress in our understanding of receptor-arrestin interactions
- To review and contrast recent advances in our understanding of structure-function relationships in families A, B and C GPCRs
- To explore the therapeutic potential of ligand 'bias' in drug discovery
- To appreciate the latest findings linking pharmacological manipulation of specific GPCR subtypes as novel therapeutic approaches to disease



For more information about attending or presenting please contact [meetings@bps.ac.uk](mailto:meetings@bps.ac.uk) or visit [www.bps.ac.uk/CellSignalling2018](http://www.bps.ac.uk/CellSignalling2018)

## Speakers:

**Professor Patrick Sexton**,  
Monash University, Melbourne, Australia

**Dr Madan Babu**,  
MRC Laboratory of Molecular Biology,  
Cambridge, UK

**Professor Laura Bohn**,  
Scripps Research Institute, Florida, USA

**Dr Sophie Bradley**,  
Institute of Molecular Cell and Systems  
Biology, Glasgow University, UK

**Professor Davide Calebiro**,  
Institute of Metabolism and Systems  
Research, University of Birmingham, UK

**Dr Anthony Davenport**,  
Experimental Medicine and  
Immunotherapeutics, University of  
Cambridge, UK

**Dr Karen Gregory**,  
Monash Institute of Pharmaceutical  
Sciences, Monash University, Melbourne,  
Australia

**Dr Lora Heisler**,  
Rowett Institute of Nutrition and Health,  
University of Aberdeen, UK

**Professor Graeme Henderson**,  
Department of Physiology and  
Pharmacology, University of Bristol, UK

**Dr Graham Ladds**,  
Department of Pharmacology, University of  
Cambridge, UK

**Professor Rob Leurs**,  
Institute for Molecules, Medicines and  
Systems, Vrije Universiteit, Amsterdam,  
The Netherlands

**Dr Marthe Sommer**,  
Institute of Medical Physics and Biophysics,  
Charité – Universitätsmedizin, Berlin,  
Germany

## Meeting organisers:

**Professor John Challiss**,  
Department of Molecular and Cell  
Biology, University of Leicester, UK

**Professor Andrew Tobin**,  
Institute of Molecular Cell and  
Systems Biology, University of  
Glasgow, UK

**Dr Gary Willars**,  
Department of Molecular and Cell  
Biology, University of Leicester, UK

## Registration details:

Member registration*	£200
Student registration*	£100
Non-member registration*	£220
Non-member student registration*	£110
Student accommodation	£45
Standard accommodation	£80

**Abstract submission deadline:** 02 February 2018  
**Member bursary deadline:** 02 February 2018  
**Early bird registration deadline:** 12 March 2018  
**Registration deadline:** 9 April 2018





Submit your abstract and register now:

# PHARMACOLOGY FUTURES 2018

Celebrating 250 years of pharmacology in Edinburgh

17 May 2018, National Museum of Scotland, Edinburgh, UK

**Pharmacology Futures 2018 will explore the technologies and skills that will drive drug development over the next 10 to 15 years, with speakers sharing their visions of the future to celebrate 250 years of pharmacology in Edinburgh.**

The University of Edinburgh's Cameron Prize for Therapeutics will be awarded during the meeting.

PhD students and early career researchers\* are invited to submit a scientific abstract showing how their work contributes to the 'Future of Pharmacology'. The best three from each category will be invited to give an oral presentation. Two winners will be selected, one from each category (PhD students and early careers researchers) to receive certificates and prizes of £250. The authors of all other accepted abstracts will be invited to present a poster.



For more information about attending or presenting please contact [meetings@bps.ac.uk](mailto:meetings@bps.ac.uk) or visit [www.bps.ac.uk/pharmacologyfutures2018](http://www.bps.ac.uk/pharmacologyfutures2018)

## Speakers

**How do we make the UK a world leader in drug discovery?**

Professor Chas Bountra, University of Oxford, UK

**Human pluripotent stem cell models for future drug discovery and disease modelling**

Professor Christine Mummery, Leiden University Medical Centre, The Netherlands

**Minding the gap: Linking preclinical studies to the development of novel therapeutics at the National Institutes of Health**

Professor Susan Amara, National Institute of Mental Health, USA

**Drugging transcription: Progress and potential for treating human diseases**

Dr Rab Prinjha, GlaxoSmithKline, UK

**The pharmacology of turning thoughts into local blood flow in the brain**

Professor Mark Nelson, University of Vermont, USA

**The role of biomarkers in translational pharmacology**

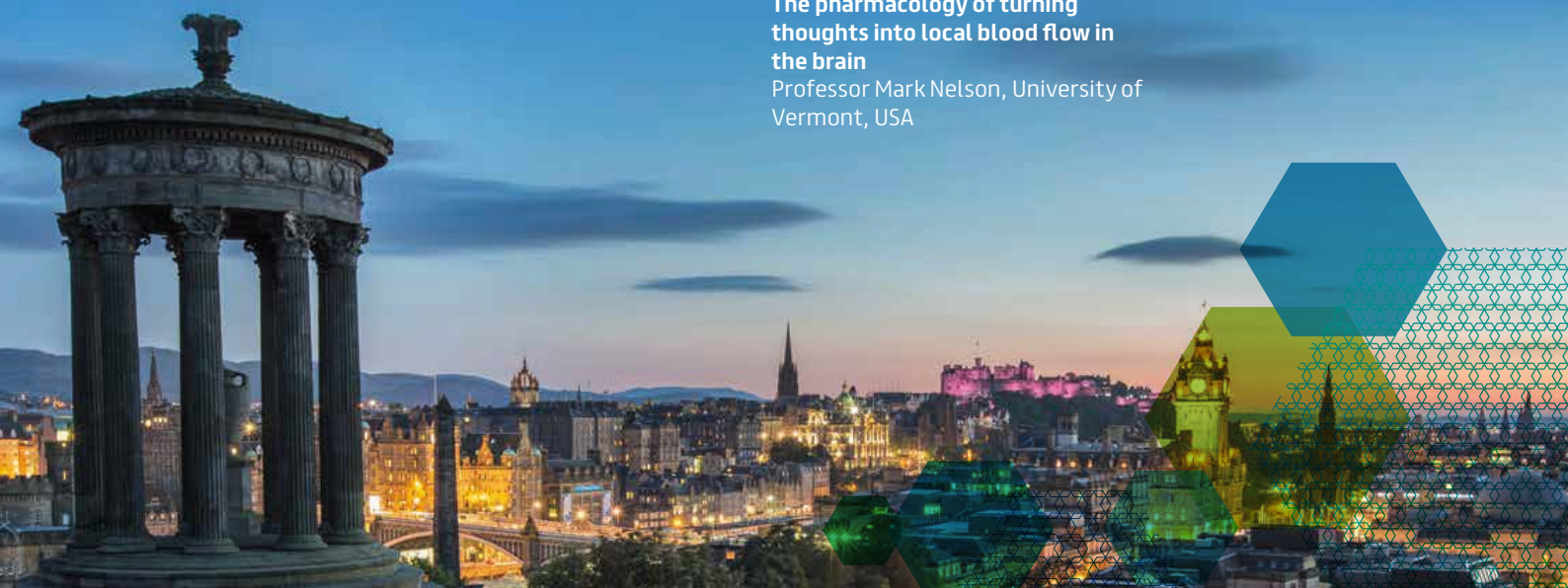
Dr James Dear, University of Edinburgh, UK

**GPCR allosteric: From theory to medicine**

Professor Arthur Christopoulos, Monash University, Australia

**2017 Cameron Prize for Therapeutics lecture: Building and maintaining a global response to antimicrobial resistance (AMR)**

Professor Dame Sally Davies, Department of Health, UK



Early bird registration rate expires: 16 April 2018 Registration deadline: 10 May 2018  
Abstract submission deadline: 02 March 2018 Member bursary deadline: 02 March 2018

Early bird registration fees from £50.

Please visit [www.bps.ac.uk/pharmacologyfutures2018](http://www.bps.ac.uk/pharmacologyfutures2018) to book your place.

\*Early careers researchers: oral communications – for those with up to 7 years' full-time equivalent post-doctoral experience as of May 2018