Immunology News

June 2020 | ISSN 1356-5559

Connect on Coronavirus:

responding to the pandemic as a united community

Engaging online:
#CelebrateVaccines

Interactive app:
gene activity across multiple diseases

Vaccine research:
expert report

British Society for immunology
www.immunology.org

Welcome to the summer issue of *Immunology News*. To say a lot has changed since the last issue feels like an understatement. Over the past few months we've had to face immense challenges due to the Coronavirus pandemic, which has turned our world upside down. However, our mission to support our members and raise the voice of the immunology community remains, and it's now more important than ever.

In this issue, we summarise the numerous actions the BSI has taken to represent and help our members during this unprecedented time, including our online information hub, our joint report with The Academy of Medical Sciences on the COVID-19 immunology research priorities and our webinar series so you can stay up to date with the world of immunology.

We proudly present the new BSI committee members and highlight recent achievements of the BSI Forum. BSI members from the O'Garra lab share their open access web app of gene activity across multiple diseases, and we highlight examples of online engagement by our Regional & Affinity Groups.

We also take some time to celebrate vaccines and the success of our initiative, showcasing our virtual public engagement day on 26 March and featuring our vaccine research report 'Protecting the world: celebrating 200 years of UK vaccine research'.

We hope you're all well and staying positive during this difficult time.

Teresa Prados
t.prados@immunology.org

The Team

British Society for Immunology
34 Red Lion Square
London
WC1R 4SG
Tel: +44(0)203 019 5901
Email: bsi@immunology.org
www.immunology.org

Enquiries and correspondence:
Teresa Prados
t.prados@immunology.org

Advertising queries:
Sarah Green:
s.green@immunology.org

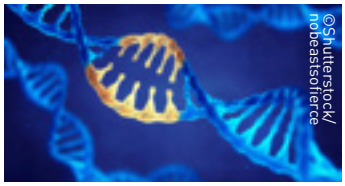
Registered charity 1043255 in England and Wales/SCD047367 in Scotland. Registered in England and Wales as company 3009533.

Contents

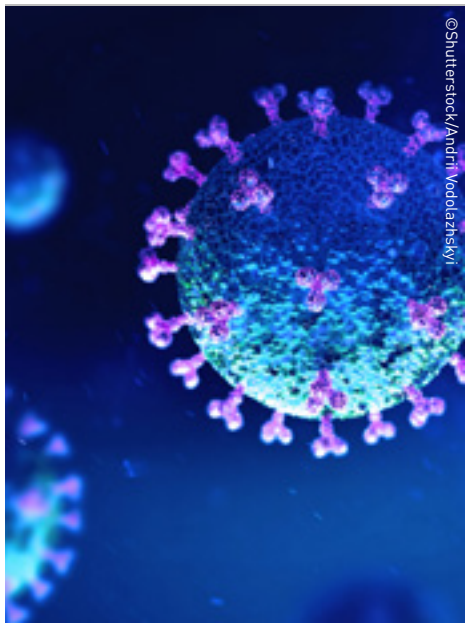
12 FEATURES:
Connect on Coronavirus

14 **BSI celebrates vaccine research**

18 **Web app of gene activity across multiple diseases**



21 **Vaccine research report**



4 Society news
26 BSI Regional & Affinity Groups
27 Congratulations
34 Journal news

Follow us:

britsocimm
britsocimm
britsocimm
britsocimm
britishsocietyforimm
british-society-for-immunology

VIEW FROM …

THE BSI PRESIDENT

When we looked forward to the new decade at the BSI Congress in December, I don't think any of us foresaw the situation we find ourselves in now. COVID-19 is a global crisis but one in which immunologists have a key role to play, through research, patient care and public information. The past few months have made me extremely proud of our immunology community and, on behalf of the Society, I would like to express our deepest thanks to those who are contributing to the COVID-19 effort. The way our community has come together to drive the global research efforts forward is unprecedented and we are starting to see the outputs of this through the increase in the number of publications on the understanding of the immunology of this pandemic. Although there is still a long way to go, BSI members across the board are playing a critical role in both the national and international response to this disease.

An expert taskforce on COVID-19

As President of the BSI, my priority over the last few months has been to ensure that our Society stands shoulder to shoulder with our members and to work on your behalf to support you and to ensure that immunology is well represented in policy circles and public debate. You can find a full summary of our many activities on pages 12-13, but one initiative I would like to highlight is our thought-leadership work with the Academy of Medical Sciences.

Over the past two months, I have chaired a joint expert taskforce on immunology and COVID-19, consisting of 15 leading immunologists, who were brought together to review the current knowledge on the immunology of COVID-19, and to identify immunology research priorities in response to the pandemic (see page 13). This group has already made a significant impact and we are engaging at the highest levels of Government to ensure that immunology expertise is brought to the fore in scientific discussions.

We also published our recent report on COVID-19 and immunology research, identifying both research priorities in this area and gaps in our understanding of the immunology associated with this disease at this point in time. We hope this will be a useful guide to our scientific community and to those looking to understand more about why immunology is so central to COVID-19 research efforts.

Coordinating this type of taskforce is a new area of work for the BSI, but one that I feel is critical at this time. We're aware that the science is developing quickly and our taskforce is now turning their sights to future activities to ensure that we continue to act quickly and decisively to raise the voice of immunology in public and policy arenas. Watch this space for more details soon.

How can we help?

I am also well aware that this is a difficult time for many of our members, facing uncertainty about funding, future job prospects and juggling home and work responsibilities. We're under no illusion that the coming months will present many challenges for all of us. However, the BSI is determined to be there for our immunology community and to support you every step of the way. Although we've already launched lots of new initiatives, we're keen to hear your ideas on what additional actions we can take. Please email me at president@immunology.org with your thoughts.

Record committee nominations

In some other news, the BSI recently held our committee elections and we were overwhelmed by the number of people who put themselves forward for these posts. Our committees are the lifeblood of the organisation and it is extremely heartening to see so many of you engaging positively with us. Thank you to all the candidates who stood for election and congratulations to the successful individuals. My thanks also go to all retiring committee members who have contributed so much to the BSI through their roles.

Thank you!

Finally, thank you again to everyone who has supported the BSI recently. It is an honour to be President of the Society at this time and to work with you all as members of the BSI. It is only through all of you that we can have this level of influence and stand up for the immunology community. I hope you all stay healthy and keep up the good work in these difficult times.

I would like to extend a special thank you to Doug Brown our CEO, Jennie Evans, our Head of External Affairs and the whole staff team. None of the work described above could have been done without their dedicated and enthusiastic efforts. We are extremely lucky to have them by our side as we move forward into the future with immunology in the UK. Please do drop them a note via Twitter or other media to show that we appreciate them.

Warm regards until we can meet face to face again, hopefully before too long.

Arne Akbar
BSI President,
British Society for Immunology
Email: president@immunology.org

'Although there is still a long way to go, BSI members across the board are playing a critical role in both the national and international response to this disease.'

VIEW FROM …

THE CHIEF EXECUTIVE

First and foremost, on behalf of all of us at the BSI I hope that you, your family and your friends are all keeping safe and well during these difficult times. It is without doubt that this is the greatest global challenge that we have seen in our lifetimes and, as we all know, immunology has such a crucial role to play in overcoming it. It has been so inspirational seeing how the immunology community, our BSI family, has stepped up in response to the pandemic with many of you involved in numerous ways – from increasing your NHS work, repurposing your research programmes and being involved in new research projects – to assisting the testing efforts, and helping steer public and political opinion! The list is endless and I, and the BSI team, am incredibly proud of all of you who have, are and will continue to increase our understanding of the immune system for the benefit of public health. Thank you.

As always, the BSI is here to support you as much as possible and, in response to the new challenges and ways of working, we have increased and adjusted the support we provide to you all. We have created a dedicated portal on our website (**www.immunology.org/coronavirus**) with access to lots of resources that you will hopefully find useful. This includes research funding information, updates on COVID-19 research, resources to assist with engaging with the public on Coronavirus, wellbeing support and much more – please do visit the portal as we update content and resources regularly. You can also find out more on page 16.

In addition to our online content we have also well and truly entered the webinar space! We started with our hugely successful 'Connect on Coronavirus' webinars where invited speakers present on emerging research and/or their own studies into COVID-19. We've had over 1,000 people view each webinar live with thousands more watching the recording online, which is incredible. This series continues with some very exciting speakers in the pipeline so do keep an eye open for announcements. In addition, we recently launched our 'Career Development' webinar series which, again, is getting a huge amount of engagement with the aim of providing our early and mid-career members with the support you have asked us for in a time where we cannot provide it face to face – again please do visit our portal to find out more details and spread the word! We are working on many more areas too, including the extensive policy work we are leading, but we want to continue to hear from you about how your BSI can support you best during these times – please do get in touch with your ideas.

Aside from COVID-19, but not a million miles away, we have continued our work to highlight the value and necessity of childhood vaccines though our Celebrate Vaccines campaign (see pages 14–15). Launching the initiative with your support on 26 March was a significant milestone for the BSI – never before have we embarked on a campaign this size! We then launched our major vaccines report (see page 21) which, among other insights, revealed that the UK has the greatest impact from immunology research out of all the G7 nations! It is wonderful to see how our members are engaging far and wide and how that engagement is leading to huge reach into the public and political arenas to ensure childhood vaccines get the attention they deserve. And, of course, the hunt and (hopefully) eventual delivery of a COVID-19 vaccine will need widespread public support to ensure adequate uptake – something this campaign is also aimed at helping achieve.

And finally, I just wanted to echo Arne's thanks for all of our new committee members who have joined the BSI in the last round of elections. It was another record-breaking election with our highest ever number of nominees and of votes, and I look forward to working with you all!

Please don't forget we would like to hear your ideas for future support! Thank you for all you do, and I wish you the very best as many of you begin to move back into the labs over the coming weeks and months.

Doug Brown
Chief Executive,
British Society for Immunology
Email: d.brown@immunology.org

Celebrate Vaccines

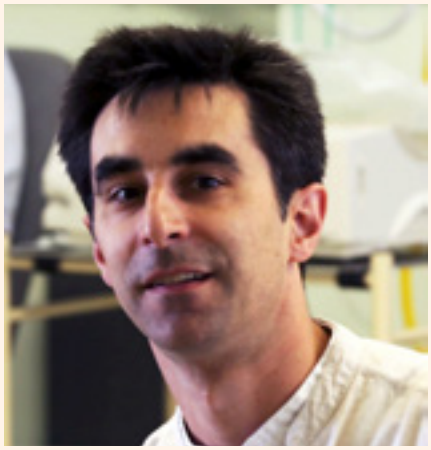
with the British Society for Immunology

SOCIETY NEWS

New BSI committee members

We are pleased to announce the following appointments on the BSI Board of Trustees, Secretaries and Forum. The turnout for these elections was over 21% of the BSI membership, with most posts contested by more than one candidate. We would also like to announce new Congress Committee members appointed by Congress Secretary Professor Gary Entrican and our CEO Dr Doug Brown. Our thanks to all other BSI members who stood for election.

Board of Trustees



MATTHIAS EBERL
BSI General Trustee

Professor of Translational Immunology, Cardiff University

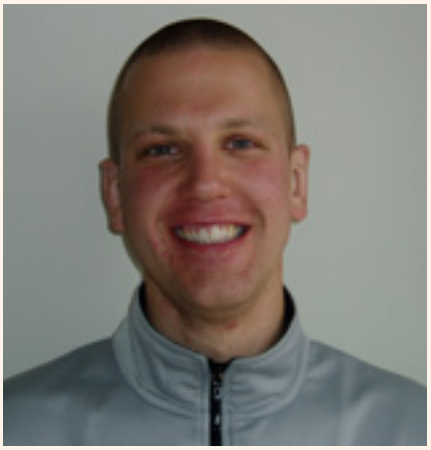
Matthias will continue as BSI General Trustee, commencing a new term in January 2021.

Secretaries

DONALD PALMER
BSI Education & Careers Secretary

Associate Professor of Immunology, University of London

Donald will take over as BSI Education & Careers Secretary from Helen Collins in Summer 2020.



MARK TRAVIS
BSI Groups Secretary

Professor of Immunology, University of Manchester

Mark will take over as BSI Groups Secretary from John Curnow in January 2021.

Forum

LAUREN CAMPBELL
BSI Forum PhD Representative

Oxford University Hospitals NHS Foundation Trust

Lauren will join our Forum from Summer 2020.

KARIM DIB
BSI Forum Northern Ireland Representative

Senior Lecturer in Molecular Immunology, Queen's University Belfast

Karim will join our Forum from Summer 2020.

TOMAZ GARCEZ
BSI Forum Clinical Representative

Consultant Immunologist, Manchester University NHS Foundation Trust

Tomaz will join our Forum from Summer 2020.

SOCIETY NEWS

Forum (cont.)

NIAMH RICHMOND
BSI Forum PhD Representative

University of Oxford

Niamh will join our Forum from Summer 2020.

LOUISE TOPPING
BSI Forum Early Careers Representative

Post-Doctoral Research Assistant, University of Oxford

Louise will join our Forum from Summer 2020.

Commitee Members

GRAHAM COOK
BSI Congress Committee member

Professor of Molecular and Cellular Immunology, University of Leeds School of Medicine

Graham will join our Congress Committee from January 2021.

MARGARITA DOMINGUEZ-VILLAR
BSI Congress Committee member

Senior Lecturer in Immunology, Imperial College London

Margarita will join our Congress Committee from January 2021.

JAMES HARKER
BSI Congress Committee member

Senior Lecturer, Imperial College London

James will join our Congress Committee from January 2021.

SANDRA SACRE
BSI Congress Committee member

Senior Lecturer in Molecular Cell Biology, University of Sussex

Sandra will join our Congress Committee from January 2021.

You can read the full candidate statement from each person in the members' section of our website at **www.immunology.org/new-bsi-committee-members-2020**. We welcome them all to the BSI and look forward to working with them to provide a strong voice for immunology..

New BSI Board Member

Our Board of Trustees is crucial to our work as they are responsible for overseeing our business activities and ensuring the Society is well-run, financially sound and that it meets its charitable aims and objectives. We're pleased to welcome Professor Colin Dayan to our Board.

PROFESSOR COLIN DAYAN
BSI Clinical Secretary and Trustee
Professor of Clinical Diabetes & Metabolism, Cardiff University

"I am co-lead of the Diabetes/ Autoimmunity group in the Division of Infection and Immunity at Cardiff University Medical School and Wellcome Inspire Lead for encouraging medical students to engage in research at Cardiff University. I am also Secretary of the Association of Physicians of Great Britain and Ireland and Chair of Diabetes UK Type 1 Diabetes Prevention and Therapies Clinical Studies Group.

I have a long-established interest in translational research in the immunopathology of type 1 diabetes and thyroid autoimmunity. I currently lead the UK Type 1 Diabetes Immunotherapy consortium, which coordinates 23 sites across the UK to recruit children and adults into immunotherapy trials. I am Chief Investigator in the USTEKID trial of anti-IL-12/IL-23 in new onset type 1 diabetes as well as early phase clinical trials in the development of antigen-specific immunotherapy. In thyroid autoimmunity I have a particular interest in thyroid eye disease (an autoimmune complication of Graves' disease) and I am Chair of the UK Thyroid Eye Disease Amsterdam Implementation Group to improve treatment of this condition.

I have been a BSI member for 30 years. I believe that we are now in a new era of targeted immunotherapy impacting on almost all clinical specialties and across many conditions. I will therefore play my part as Clinical Secretary and Trustee in helping the BSI lead on linking autoimmunity research across the specialties and training the next generation of clinicians in the safe use of targeted immunotherapy."

Virtual issue: Autoimmunity and Autoinflammation

In celebration of the International Day of Immunology, we compiled a selection of some of our favourite articles from the British Society for Immunology's two official journals, *Clinical & Experimental Immunology* and *Immunology*, focusing on this year's theme: Autoimmunity and Autoinflammation. In this collection we aim to highlight some of our recent reviews and original research papers on the mechanisms underlying autoinflammation and autoimmunity, and how these processes can contribute to a wide range of diseases, from arthritis to neurodegenerative diseases. Free access here: **https://bit.ly/2zs4rzr.**

Celebrate Vaccines virtual issue

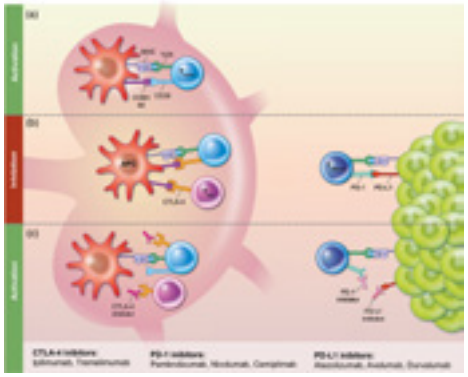
In this virtual issue of the British Society for Immunology's two official journals, *Immunology* and *Clinical & Experimental Immunology*, we provide access to some recently published reviews and original papers highlighting some of the best vaccine research. These articles cover a wide range of important topics, from a review of strategies for vaccine interventions against emerging viruses, to discussions of the roles of B cells and T cells in maintaining protective immunity. We aim to provide a resource highlighting high-quality work in this critically important field and to celebrate the contributions that vaccines have made to our lives. Free access here: **https://bit.ly/2Xs0zq7**.

Checkpoint inhibition review series

Our official journal ***Clinical & Experimental Immunology*** launched a new review series 'Immune Checkpoint Inhibition: from molecules to clinical application', edited by Leonie S Taams & Tanja D de Gruijl. This series was developed in conjunction with the Federation of Clinical Immunology Societies (FOCIS), guided by the scientific programmes of their recent annual meeting.

The identification of molecules that function to keep the immune system 'in check' has revolutionised immunotherapy. Following on from the initial discovery of CTLA-4 and PD-1 immune checkpoints in the 80s and 90s, it wasn't until later their involvement in anticancer immunity was realised. This revolutionary discovery led to James P Allison and Tasuku Honjo being awarded the Nobel Prize in Physiology or Medicine in 2018 and the identification of new targets and therapies has exploded ever since.

This review series focuses on immune checkpoint inhibition and its beneficial role in not only cancer immunotherapy, but also the potential to utilise the agonistic properties of immune checkpoint targeting



molecules in treatment of autoimmune diseases like diabetes mellitus. We invite you to read the freely accessible series papers here: **https://bit.ly/3d3PTob**.

SOCIETY NEWS

BSI Forum: there to represent you

The BSI Forum is the place where the voice of our membership is fed into our activities. Chaired by Ann Ager, the 18 elected members come from all sections of our membership. Their role is to act as our 'think tank' on issues relating to education and careers, public engagement, policy and public affairs, as well as communications.

The most recent meeting in April was focused entirely on the Coronavirus pandemic. We split our discussions into two sections: first, how the BSI could assist immunologists in contributing to efforts to counter the pandemic, be that through research, working in testing labs, on the clinical frontline, or raising knowledge about immunology in public, media and policy circles. The second discussion area was how this crisis is affecting the working lives of all immunologists and what the BSI can do to support this. Forum discussed this at length and in particular, the impact on early career researchers who will have had their studies interrupted.

In response to these discussions, the BSI has taken a number of actions. We have launched our 'Connect on Coronavirus' website hub – **www.immunology.org/coronavirus** – which contains lots of useful information for our members. For example, there you can find both information related to the current situation such as funding opportunities, research resources and public engagement resources around Coronavirus, and also some resources to help with wellbeing at this difficult time. Forum also commented on how useful webinars are for the community as a way to keep updated and informed, as well as providing training opportunities in their own right. Off the back of this, as well as our very well-received Coronavirus webinars, we also launched a series of career development webinars, specifically aimed at our early career members to help them build their skillsets.

In our outreach work, we are in the end stages of developing public information resources on testing to help explain what different types of tests for COVID-19 can and can't tell us. The BSI has continued to prioritise our policy and media work on COVID-19 as requested by Forum (see page 12 for more information). We are also looking at how we highlight what an important contribution immunologist have made to the pandemic response to the wider world.

The BSI Forum and its members are here to represent you. If you would like to raise any issues for Forum to discuss at an upcoming meeting, please do contact your relevant Forum member – you can find a list of your representatives on our website at **www.immunology.org/forum**. Alternatively, you can email our Head of External Affairs, Jennie Evans, at **j.evans@immunology.org** who can pass on the message.

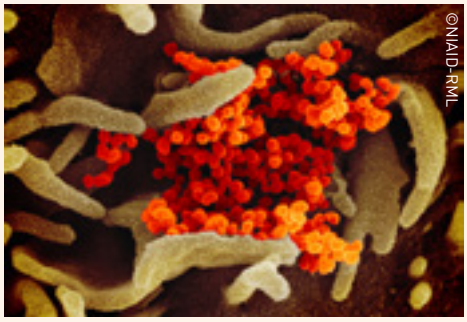
SOCIETY NEWS

BSI webinar series: connecting the immunology community

In March 2020, the British Society for Immunology took the decision to not hold any of our upcoming face-to-face events due to the situation with COVID-19. However, we remained committed to supporting our members and the immunology community during this critical time. To do so, in April we announced three webinar series: Connect on Coronavirus, BSI Career Development and BSI Regional & Affinity Group webinars. In this article, you will find information about our webinars and how you can stay connected and up to date with the world of immunology.

Connect on Coronavirus: the expert hub

The aim of this webinar series is to provide immunologists with a platform to keep informed with the latest developments on the Coronavirus outbreak by sharing relevant and timely information from expert sources. The sessions look into what we know so far about the science behind the Coronavirus and expert speakers discuss new and significant studies, emerging research questions and public health challenges. As a part of our commitment to the rapid dissemination of any information which may contribute to the understanding and treatment of COVID-19, these webinars are free to view with the recordings hosted on our website. Here are some of the webinars we've held so far, so you can catch up if you missed them, rewatch to learn more, or share them with your colleagues.



The impact of altered immunity during ageing on SARS-CoV-2 (COVID-19) infection
BSI President, Professor Arne Akbar,
University College London

Antibody testing, neutralising monoclonals and other immune therapeutics
Professor Danny Altmann,
Imperial College London

Emerging lessons about immunity to COVID-19: what does past experience with coronaviruses teach about protective herd immunity and vaccine approaches?
Professor Danny Altmann,
Imperial College London

Running the gauntlet in the development of a Coronavirus vaccine for global access
Professor Maria Elena Bottazzi,
Baylor College of Medicine and Texas Children's Hospital

Controversy in immunity to COVID-19: do we want an immune response or not?
Professor Peter Openshaw,
Imperial College London and
Dr Ryan Thwaites,
Imperial College London

BSI Career Development webinars

This series aims to support our members who are looking for information on how to deal optimally with the current situation and build their skills base. The webinars are aimed primarily at our early career members and will provide information, tips and discussion points on how to deal with our new working environments and take the next step on the careers ladder. We run one webinar every fortnight, all free for BSI members.

Preparing your paper for peer review: the life cycle of a manuscript
***Dr Laura Pallett**, University College London and **Professor Leonie Taams**, King's College London and Editor-in-Chief of the BSI's official journal* Clinical & Experimental Immunology

An introduction to public engagement in the time of COVID-19
***Dr Kat Arney**, First Create the Media*

Your wellbeing during the COVID-19 period
***Alexis Hutson**, Executive Coach*

BSI Regional & Affinity Group webinars

This series will be run by and for our Regional and Affinity Group members so that they can continue to come together and share some of the latest findings in their areas of interest. Webinars will be held every week and a different Group will host each week.

Our Regional & Affinity Groups are integral to the Society's activities and they provide the perfect way for you to get more involved and make the most out of your BSI membership. All BSI members are encouraged to join and become active in the work of our many Groups.

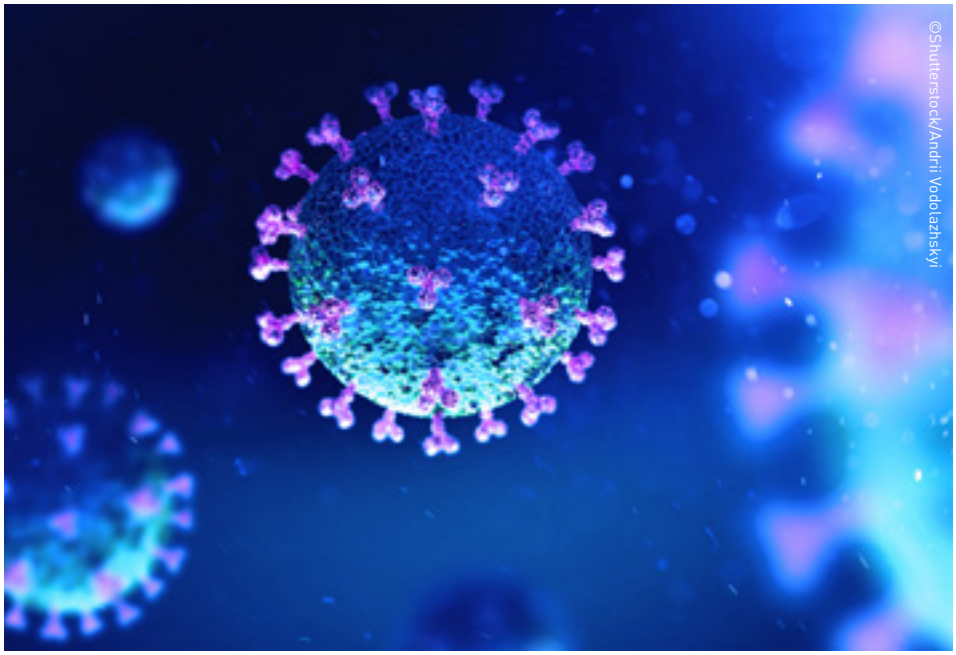
Find out more:

Keep an eye on the events section of our website for upcoming dates: **www.immunology.org/events**. Follow us **@britsocimm** and **@bsicongress** for regular updates and join the conversation with official webinar hashtags **#ConnectingOnCoronavirus** and **#BSICareerDevelopment**.

SOCIETY NEWS

Connect on Coronavirus

The Coronavirus outbreak has affected our lives in countless ways. From our jobs and research to our wellbeing and the way we connect to our peers, the immunology community has had to rapidly adapt to this new world. The British Society for Immunology's mission is to support our 4,200 members and advocate for immunology for the benefit of society. Here, we summarise the numerous actions we have taken to represent and help our members during this unprecedented time.



Policy focus

The BSI is working hard to ensure that the Government recognises that proper understanding of immunology is critical to the country's response. In addition to our work with the Academy of Medical Sciences (see opposite page), we've been active on many fronts in the policy sphere. In mid-March, we published an open letter to Government reflecting significant questions that the immunology community had over the strategy to tackle the SARS-CoV-2 outbreak at that time. This letter made an important contribution to Government policy and we know that it raised awareness of immunologists' concerns at the highest levels, with the Government subsequently putting much more emphasis on social distancing, particularly for at-risk groups.

We wrote to the Chief Medical Officers of all four UK nations to offer the services of the hundreds of BSI members who responded to our survey to volunteer their lab skills, resulting in a link up with the Lighthouse Labs. We also wrote to the Government Chief Scientific Advisor, Sir Patrick Vallance, to recommend our members' immunological expertise in the formation of the scientific advice that is offered to Ministers.

Separately, the BSI wrote to all 650 MPs, offering them a briefing from an immunologist so that they could be better informed and to aid them in their scrutiny of the Government. Several MPs took us up on this offer and our members have helped with everything from replying to technical aspects of constituents' correspondence to providing a briefing via teleconference to an opposition party's Commons and Lords health teams.

We've further engaged with Parliamentary Select Committees, which work to hold the Government accountable in certain policy areas. After correspondence with the House of Commons Select Committee on Science and Technology Chair, Rt Hon Greg Clark MP, Professor Danny Altmann gave oral evidence to the Committee on behalf of the BSI on the viability of easing lockdown measures, including immunity certificates and tracing applications, as part of their inquiry on UK science, research and technology capability and influence in global disease outbreaks. More recently, Professor Altmann has also given evidence on behalf of the BSI to the House of Lords Science & Technology Committee on what we know about SARS-CoV-2 and its transmission as part of their 'Science of COVID-19' inquiry. In the future we can look forward to an article on COVID-19 appearing in the Parliamentary and Scientific Committee's *Science in Parliament* magazine.

Media profile

Responding to journalists and making sure that the media and public are kept well informed is very important to us. BSI spokespeople have been active on many topics, regularly commenting on antibody tests, vaccine progress, effects of age on susceptibility to how to keep a healthy immune system to name just a few topics. We've targeted a diverse range of outlets including BBC Horizon, *Daily Mail, The Guardian, The Sun, Financial Times*, Channel 4 News and *New Scientist* to name just a few. This is an area of our work that we feel makes a real difference to public debate on COVID-19 and is one that we're certain to pursue in future.

Public engagement

Engaging directly with the public around the science of COVID-19 is another key area of focus for the BSI. We have curated a collection of public engagement resources on COVID-19 on our website, along with our own 'Colour in Coronavirus' to help inform kids and adults alike on how the virus interacts with our immune system.

The expert hub

We created an information hub (**www.immunology.org/coronavirus**) on our website to keep you up to date with developments during the Coronavirus outbreak, BSI activities as well as providing useful information and links to external resources (see page 16). This also houses our highly popular 'Connect on Coronavirus' webinar series – you can view all the recordings of past webinars on here (see page 10).

The BSI is working hard to represent and support the immunology community during this time. We hope that you've found our activities so far useful and we welcome feedback on our activities and any other areas you feel we should focus on.

Immunology focus: partnership with the Academy of Medical Sciences

Understanding the immunological elements of COVID-19 is a crucial piece in the jigsaw of managing our response to the disease. As immunologists all around the world have rushed to help research efforts, the British Society for Immunology wanted to make sure that we did our part to ensure that immunology is put firmly centre stage and appropriately recognised in policy discussions and public debates.

We were approached by Professor Sir Robert Lechler, one of our members and President of the Academy of Medical Sciences (AMS), to work with the AMS on a joint project to rapidly convene an expert group. The aims of this taskforce were to collate and review what is currently known about the immunology of COVID-19, and to identify immunology research priorities in response to the COVID-19 outbreak. This high-level co-ordination group is chaired by BSI President, Professor Arne Akbar, with an additional 14 members drawn from diverse areas of immunology. The group quickly set to work assessing the current evidence of what we do and don't know around immunology and COVID-19.

This type of initiative is a new step for the BSI but the group has already made a significant impact at a national level. In early May, they published an expert summary which rapidly reviewed current COVID-19 immunology research and identified urgent research priorities (see box). The paper examined what we know about COVID-19 from immunology research and highlighted knowledge gaps that could hamper efforts to get the pandemic under control. We hope that this document is helpful to the immunology community and will act as a guide to groups working in this area to focus their research efforts on the key unanswered questions that will make a meaningful difference to our ability to tackle this pandemic.

Additionally, the Group have been interacting with policymakers and Government at a high level to ensure that the voice of immunology is well-represented. We have been liaising with the Government Office for Science and Chief Scientific Officer, Sir Patrick Vallance, to provide immunology input to them as and when required. Indeed, an earlier version of the Group's report was sent to the Scientific Advisory Group for Emergencies (SAGE) to inform their discussions. We have also worked closely with Parliamentary Select Committees to input to their enquiries (see previous page).

Understanding the immunological response to the SARS-CoV-2 viral infection will help us to develop successful treatments and vaccines, identify vulnerable groups, and help inform public health measures to control the Coronavirus outbreak. Our expert group has already made a huge impact and we are grateful to all members for their contributions and to the AMS for their work on this. However, there is more we still want to achieve to ensure that immunology research into COVID-19 maintains a high profile in the coming months.

As the AMS steps back their involvement, the BSI will continue to run this group with a dynamic approach to ensure that we can respond quickly to issues as and when they arise. The UK leads the world for the quality of our immunology research and now is a crucial time for our community to ensure that our voices are heard and that we stand up and be counted.

Jennie Evans
Head of External Affairs, BSI
Email: j.evans@immunology.org

Find out more:

Read the full report: **www.immunology.org/coronavirus/immunology-and-covid-19**

Read our Q&A blog: **www.immunology.org/coronavirus-immunology-qa**

Immunology and COVID-19 research priorities

Rapid learning about immunity for public health impact

- What, if any, antibody properties confer protection against the virus, and what proportion of antibody responses are protective?
- What are the roles of immune cells from the adaptive (T-cells) and innate systems, such as natural killer cells and T-cells, in protective immunity?
- What is the sero-prevalence of SARS-Cov-2 antibodies? What proportion of individuals mount either an antibody, or a cellular response or both after infection?
- How can laboratory-based antibody tests be safely scaled to reliable commercial equivalents that are not confounded by cross-reactivity to other coronaviruses?

Rapid impacts for COVID-19 treatment

- What is the full immunopathology of COVID-19 in the lung and other organs?
- What are the biomarkers predictive of severe disease?
- What is the potential role for antiviral and immunomodulation therapies in COVID-19 treatment?
- How can we reliably test whether COVID-19 patients remain infectious?

Key long-term research investments

- What is the rate of asymptomatic spread, and how does that contribute to transmission?
- What proportion of individuals mount a protective immune response?
- How long is natural and vaccine immune protection likely to last?
- What immunological factors correlate with protection to SARS-CoV-2 by vaccines, and how effective are vaccines at protecting older people?
- What is the role of immunogenetics in SARS-CoV-2 infection, and what can this tell us about potential therapeutic targets?

BSI celebrates vaccine research

The BSI has recently focused our external affairs work on advocating the importance of vaccination and vaccine research. To celebrate the successes of vaccine research we held a virtual mass public engagement day on Thursday 26 March. Here, our Public Engagement Officer, Erika Aquino, tells us how it went.

Celebrate Vaccines is the BSI's campaign to champion the critical role of vaccination and vaccine research in saving lives and advancing global health. The aim of the initiative is to strengthen public understanding of the importance of vaccination and help everyone make informed decisions about vaccinations and their children's health.

Earlier this year, the BSI joined forces with several partners to carry out vaccine advocacy in the run-up to the next Gavi Replenishment Conference on 4 June, hosted by the UK Government. Gavi, the Vaccine Alliance, aims to help low-income countries protect children from preventable infectious diseases through supporting routine immunisation programmes. The Replenishment Conference gathers world leaders as they announce their country's contribution to Gavi's next strategic cycle, which aims to raise $7.4 billion to immunise 300 million children and save more than 7 million lives. The BSI represents the voice of researchers who work on vaccines in our policy, media and public engagement work and we are proud to join this collaboration. We aimed to showcase the benefits of vaccine research in advancing global public health as well as increasing overall uptake rates of childhood vaccinations in the UK.

Engaging the public

A large element of the Celebrate Vaccines campaign was a mass public engagement day on Thursday 26 March 2020. This was an opportunity for BSI members to inspire the public directly and share their passion for vaccine immunology research successes. We funded 18 public engagement events run by members across the country, from Edinburgh to Brighton, in settings including schools, hospitals and shopping centres. Unfortunately, due to the ongoing situation with COVID-19, we had to postpone the face-to-face events planned but will reschedule them for later in the year in accordance with official advice. We would like to sincerely thank all those members who volunteered to run events.

#CelebrateVaccines success

Not discouraged by the postponement of face-to-face events we turned to social media and focused our efforts on running a virtual public engagement campaign. We called on BSI members to join us in raising the expert voice of the immunology community loud and proud in support of vaccination, and we were not disappointed.

On Thursday 26 March 2020 we held a mass online public engagement day to spearhead the vaccination conversation across digital platforms. We took to social media for a day of vaccine advocacy, education and celebration. In the weeks before our celebrations, the crucial role that vaccines play in protecting our health and keeping our world safe came into sharp focus with emergence of a new Coronavirus. Through appreciating the power of vaccines in saving lives, our Celebrate Vaccines campaign engaged and informed the narrative about how vaccines work and why they are important for improving global public health.

As well as reaching out to BSI members and the wider immunology community, we asked organisations and individuals working in the sector to get involved on social media to like, share, post and tweet important vaccine messaging. We produced a social media toolkit with a range of different graphics and assets to facilitate engagement with the campaign. It can still be accessed at **https://bit.ly/2W7Ag99**.

This was the first time that the BSI has attempted a large-scale social media campaign and it was an enormous success. The Celebrate Vaccines campaign trended on Twitter with over 1,800 posts using #CelebrateVaccines and we saw a surge of followers. On LinkedIn, Facebook and Instagram we also received extremely positive engagement.

It wouldn't have been possible without our incredible members raising a collective voice and significantly amplifying the message about the importance of vaccines in saving lives. We're immensely grateful to all those who contributed – you were all fantastic! We hope you felt huge pride in our immunology community, as we certainly did.

If you missed the social media activity on the day, we've collected some highlights on the website (**https://bit.ly/35CZgIp**). Check out the informative articles, engaging infographics, educational animations and supportive posts.

Public engagement resources

For the Celebrate Vaccines launch, we created a brand new section on the BSI website to host the campaign and its resources. It can be found at **www.celebratevaccines.com** and has lots to explore and discover.

A range of digital educational and engaging resources can be found on the website for all to use and share. The resources aim to increase public knowledge about vaccines and enable researchers and doctors to speak up about the importance of vaccinations.

We developed three short animations covering different aspects of vaccinations – the global impact of vaccines, how vaccines work and how they are made. These are an easy-to-understand resource for sharing widely to support teaching and engagement in a fun and visual way. They can be found on the website and the BSI YouTube channel.

We updated our popular BSI 'A guide to childhood vaccinations' and uploaded it online so it's easier to access and navigate. The guide explains how vaccines work and how they effectively protect from diseases, and provides updated information on the current vaccination schedule for children in the UK. We designed new infographics based on information and graphics from the guide. Topics covered are 'How do vaccines work?', 'What is herd immunity?' and 'How effective is vaccination?'.

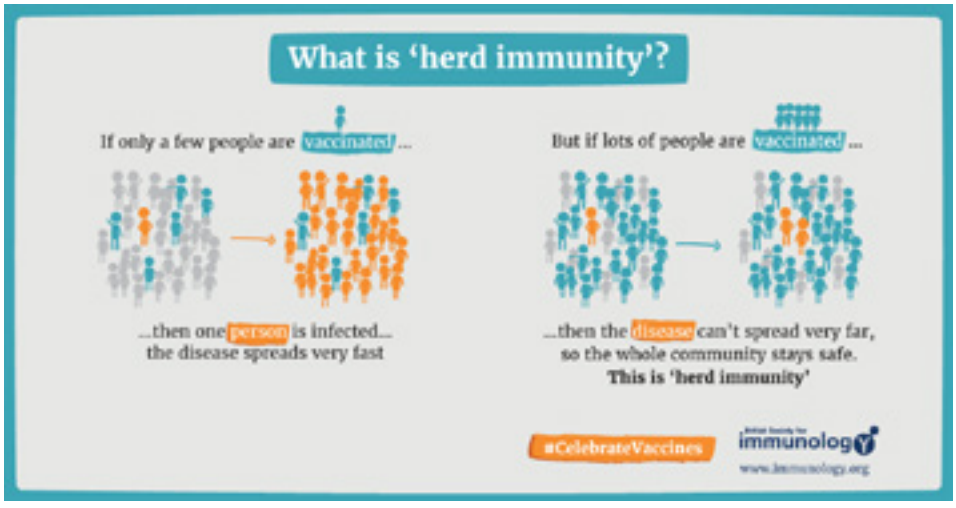
These can be downloaded from the website for free, for use online and in print to explain vaccine concepts and to enhance face-to-face public engagement events.

In addition, we created a 'vaccines public engagement kit' aimed at families and school-aged children. The kit has been developed to facilitate public engagement about vaccines and contains a range of materials and resources needed to deliver interactive, hands-on activities and classroom workshops. The kit contains fifteen new resources with facilitator how-to guides and instructions, including lists of materials needed, although most items people may already have at home. The activity packs are free for the public to access and try their hand at exploring how the immune system fights viruses and bacteria, how vaccines take advantage of those natural functions, the concept of immunological memory and the importance of herd immunity. You'll also see these activities in action at future Celebrate Vaccines events and you are welcome to use them at your own public engagement events.

We highly encourage members to explore the new website and resources and share their adventures with others and us on social media, remembering to tag @britsocimm, so we can see how you've been celebrating vaccines.

We will continue our Celebrate Vaccines campaign throughout the year during important touchpoints. For World Immunisation Week 2020 we championed the critical role of vaccination and vaccine research in advancing global health. We showcased our new Celebrate Vaccines activities and resources and continued posting on social media to promote the campaign, encouraging others to join our movement.

Erika Aquino
BSI Public Engagement Officer
Email: e.aquino@immunology.org



Find out more about #CelebrateVaccines

Visit our website:
www.celebratevaccines.com

Explore our social media toolkit:
trello.com/b/iCOrP8qe

Watch our animations on our YouTube channel:
www.youtube.com/britishsocietyforimm

Join the conversation online with
#CelebrateVaccines

SOCIETY NEWS

Coronavirus: the expert hub

We created an information hub to provide updates and resources for our members and the wider immunology community during the Coronavirus outbreak. All the information is easily accessible and free to view by visiting **www.immunology.org/coronavirus**. This section is regularly updated with new content so do get in touch regarding what information you would like to see here. Please email **j.evans@immunology.org** with any suggestions you have.

Webinars

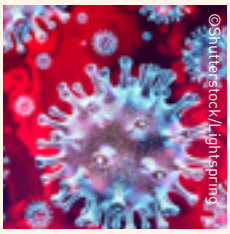
Our BSI 'Connect on Coronavirus' series provides immunologists with a platform to keep informed with the latest developments on the Coronavirus outbreak by sharing relevant and timely information from expert sources. Recordings of all previous webinars are online and free for all to view – they're a great way to keep up to date!

Resources for you

We have collected a range of useful resources for you including public engagement materials and activities for all ages and abilities, wellbeing support including coping strategies for lockdown, and research highlights on ongoing efforts to understand and manage the outbreak.

Research and funding

We have signposting pages for immunologists whose research has been interrupted by the outbreak, including information on funding calls relevant to COVID-19.



Supporters

Our thanks to the following organisations for supporting our BSI Coronavirus expert hub: The Lorna and Yuti Chernajovsky Biomedical Research Foundation and Gold Corporate Members: 10x Genomics, Fluidigm, NanoString and Miltenyi Biotec.

Whole tissue transcriptional RNA signatures can detect distinct immune responses across different diseases

Find your favourite gene in the O'Garra lab open access web app of gene activity across multiple diseases

Host immunity during infection and inflammation is complex, with a spectrum of responses having been reported across infections with parasites, viruses, bacteria, fungi or allergy.

These responses are often driven and dominated by specific groups of cytokines, with protective and/or damaging consequences for the host. In an attempt to understand host immune responses and identify genetic signatures associated with different diseases, transcriptomic approaches have been applied broadly to whole blood or peripheral blood mononuclear cells, which are readily obtained from patients. However, little is known about how immune responses in blood are reflected at disease sites, from where human specimens are harder to obtain. Transcriptional studies of the tissue have been performed from different experimental models of disease, but this has been reported to a lesser extent for the blood. Additionally, transcriptional studies on the global immune responses spanning different experimental models of diseases across distinct types of immune responses, are scarce.

Building a framework

The O'Garra laboratory has been using transcriptomic approaches for more than a decade to advance the knowledge of the immune response and diagnosis in tuberculosis. Taking advantage of this expertise and in a major effort to provide a framework for discovery of pathways of gene regulation in disease, we worked with numerous collaborators from the UK and abroad to measure gene activity from RNASeq data across different diseases in both the whole tissue and blood. The goal? To see how the immune response in the blood reflects the local response in the tissue, and vice versa.

The data obtained from 10 different experimental mouse models of infectious and inflammatory diseases was integrated in a comprehensive resource of modular transcriptional signatures in blood and whole tissue. The aim was to identify commonalities and differences in the immune response to specific infections or challenges to aid the discovery of pathways in disease. Importantly, the data being accessible to anyone through an open access web app – **ogarra.shinyapps.io/MouseModules**.

Using the new app, researchers anywhere in the world can look up gene activity in the lungs and blood of mice infected with a range of pathogens: the parasite *Toxoplasma gondii*, influenza A virus, respiratory syncytial virus (RSV), the bacterium *Burkholderia pseudomallei*, the fungus *Candida albicans*, or the allergen house dust mite (HDM). Blood transcriptional signatures from mice infected with *Listeria monocytogenes*, murine cytomegalovirus (MCMV), the malaria parasite *Plasmodium chabaudi chabaudi*, or a chronic infection with *B. pseudomallei* can also be interrogated through the app.

Developing the app

Using advanced and unbiased bioinformatics techniques, we clustered thousands of genes across the different disease models, based on their expression patterns and coregulation across all healthy and disease samples, into a biologically meaningful and visual form, which we refer to as modules. Thirty-eight lung and forty-one blood modules were derived as part of the study from samples from six mouse models of infection and inflammation, and annotated to determine their function and known physiological roles.

A broad range of immune responses was unveiled in the lung, where discrete modules were dominated by genes associated with type I or type II interferon (IFN), IL-17 or allergic responses (Figure1).

For example, of the 38 modules identified in the lung there is a discrete module associated with allergy containing over 100 genes that are overabundant only in the HDM allergic airway disease model. Indeed, each experimental model showed distinct immune responses. Type I and type II IFN-inducible genes were highly expressed in lungs of *T. gondii*, influenza A, and less so in RSV infected mice. Pathways driven by IL-17 were abundant only in the lungs of mice infected with *B. pseudomallei* and *C. albicans*, and a signature of Th2-type cytokines was abundant only in the lungs of mice challenged with HDM allergen. Additionally, using raw RNAseq data from purified cells, obtained from the ImmGen consortium, we identified cell types associated with these modules. For example, there was a strong enrichment of mast cells within the allergy module that was observed in the HDM allergy model. These findings show that a broad spectrum

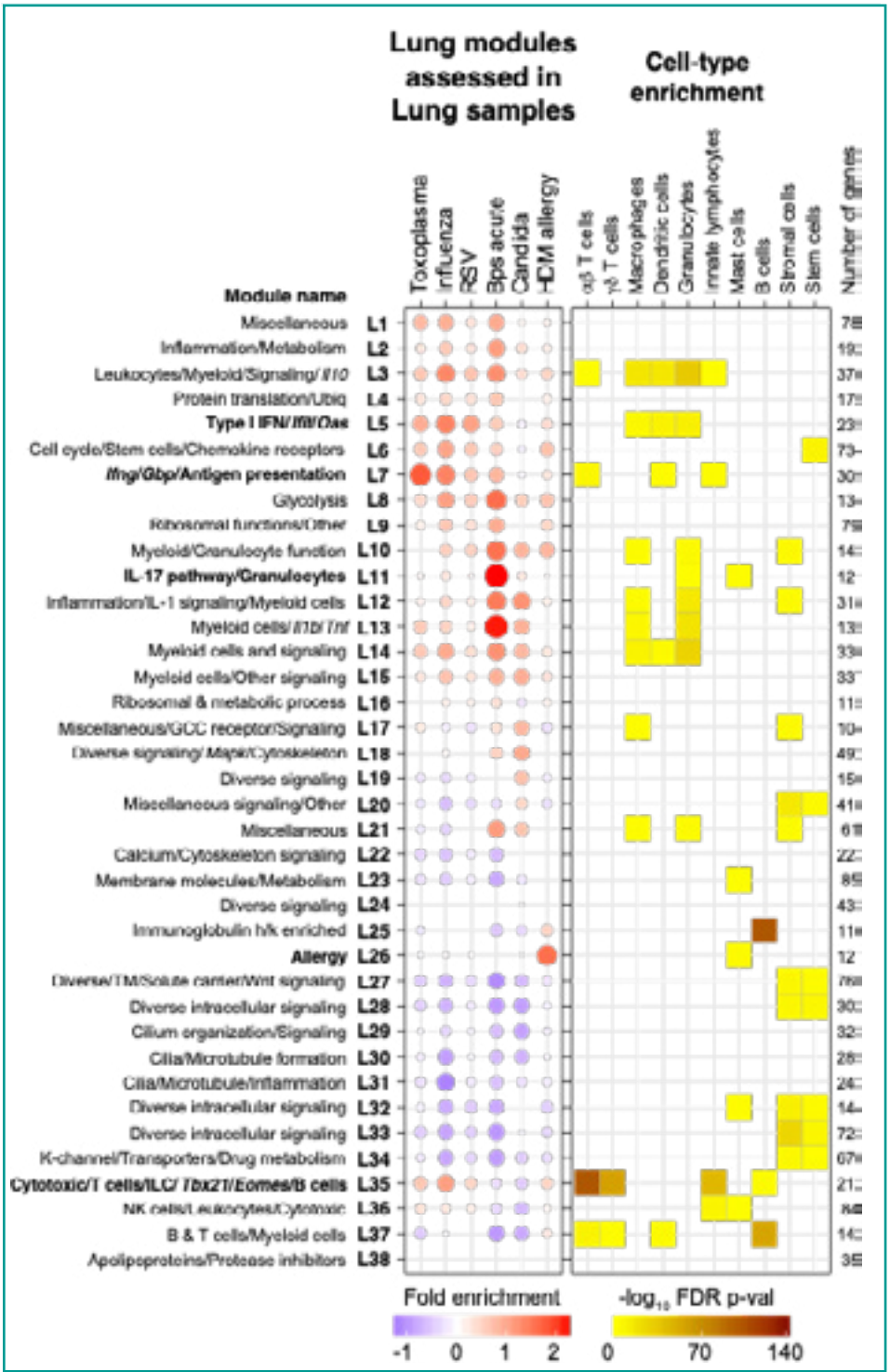


Figure 1. Modular transcriptional signatures define a spectrum of immune responses across diseases. a. Fold enrichment in disease compared to controls for modules of co-expressed genes derived using WGCNA in lung (L1 to L38) samples. Module name indicates biological processes associated with the genes within the module, and number of genes within each module are shown. Fold enrichment scores were derived using QuSAGE, with red and blue circles indicating the cumulative over or under-abundance of all genes within the module, for each disease compared to the respective controls. Colour intensity of the dots represents the degree of perturbation, indicated by the colour scale. Size of the dots represents the relative degree of perturbation, with the largest dot representing the highest degree of perturbation within the plot. Within each disease, only modules with FDR p-value < 0.05 were considered significant and depicted here. Cell types associated with genes within each module were identified using cell-type specific signatures obtained for 10 cell types from the ImmGen ULI RNA-seq dataset (Supplementary Figure 3). Cell-type enrichment was calculated using a hypergeometric test, with only FDR p-value < 0.05 considered significant and depicted here. Colour intensity represents significance of enrichment. GCC, glucocorticoid; K-channel, potassium channel; Ox phos, oxidative phosphorylation; TM, transmembrane; Ubiq, ubiquitination. Singhania et al. 2019 Nature Communications

'Anyone can search individual genes and examine detailed changes in the lung and blood of mouse models associated with various infections.'

of distinct immune response across different diseases can be demonstrated in whole tissue using bulk RNA-Sequencing approaches.

Type I IFN are known to be released in response to viruses, while type II IFN (IFN-g) activates phagocytes to kill intracellular pathogens, and IL-17 attracts neutrophils causing early inflammatory immune responses. Interestingly, IFN gene signatures were present in blood modules similarly to the lung, but IL-17 and allergy responses were not. Immune response genes associated with type I IFN, which are induced during viral infections, were highly active in both the lungs and blood of mice infected with the *T. gondii* parasite and the *B. pseudomallei* bacterium; this confirms previous studies suggesting that the type I IFN response is not restricted to viral infections.

We found that mice without the receptor for type I and/or type II IFN, and therefore without IFN signalling pathways, were less able to fight off *T. gondii* infection. This was observed for both type I and type II IFN, which have a complex relationship with each other. Our unbiased transcriptomic analyses revealed that, although genes known to be inducible by type I IFN were decreased in the absence of type I IFN receptor signalling as expected, they were completely abrogated in the absence of IFN-g signalling, revealing an advanced layer of regulation in an environment dominated by type II IFN resulting from *T. gondii* infection.

Use the app to find your favourite gene!

We found that both type I and type II IFN play a key role in protection against the parasite in part by controlling granulocyte responses which, when uncontrolled, can cause damage to the host. The data, published in *Nature Communications* last year[1] and available through the online app (**https://ogarra.shinyapps.io/MouseModules**), show the activity of more than 45,000 genes. By using the new app anyone can search individual genes and examine detailed changes in the lung and blood of mouse models associated with various infections and HDM allergen exposure.

The app is subdivided into five distinct pages that can be accessed through the tabs displayed on the top of the page, with a customised sidebar for user input on each page, and is very easy to use. The user can input any gene of interest to visualise its expression across the different mouse models of infection and inflammation in the 'Gene expression' tab or to find out which lung and blood module it belongs to in the 'Gene lookup in modules' tab.

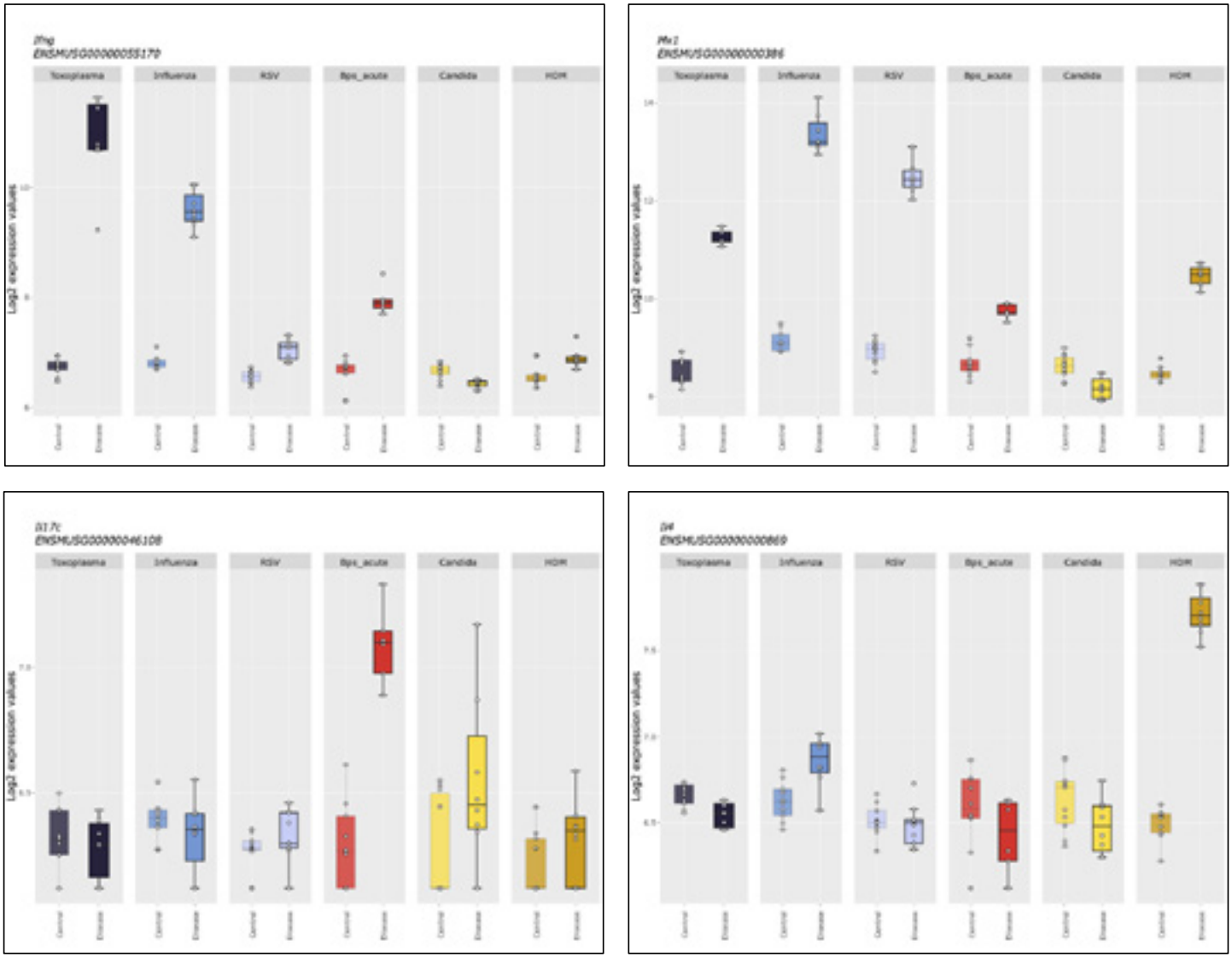


Figure 2. From online app **(a)** Plot of gene expression across six disease models, for two genes: *Ifng*, associated with type II interferon signalling and T helper 1 (Th1) cells and ILC1 and NK cells; and *Mx1*, associated with type I interferon signalling; **(b)** Plot of gene expression across six disease models, for two genes: *Il17c*, associated with Th17 cells and ILC3; and *Il4*, associated with Th2 cells and ILC2 and with allergy responses. Singhania et al. 2019 Nature Communications

> 'The app is very interactive and detailed information for each sample point can be visualised by hovering over the data points.'

As shown in the representative data from the app in Figure 2, *Ifng* (IFN-g) was most highly expressed in lungs of mice infected with *T. gondii*, as expected for this intracellular parasite; whereas the type I IFN signature gene *Mx1* was highest during respiratory viral infection, with more modest induction in some of the other disease models. Expression of the IL-17 family cytokine gene Il17c was highest in lungs during acute *B. pseudomallei* infection, which drives a highly neutrophilic immune response, and to a lesser extent during *C. albicans* infection; whereas expression of the Th2 cytokine gene *Il4* was restricted to the HDM allergic airway disease model.

User-friendly interface

In the 'Lung modules' and 'Blood modules' the user can visualise the expression of each lung or blood module across lung or blood samples (respectively) obtained from the different mouse models of infection and inflammation. The list of genes within each of the lung and blood modules, and the biological annotation of these modules, can be downloaded from the 'Download data' tab. The app is very interactive and detailed information for each sample point can be visualised by hovering over the data points. Additionally, all plots in the app can be adjusted by the user and downloaded as *png* files.

The app is already being used to guide ongoing research. Researchers in the lab of Professor Clare Lloyd at Imperial College London, who collaborated on the study, have used the app to check the expression of chemokine genes of interest identified in allergy in models of lung viral infection, generating ideas for future experiments in the Lloyd lab.

We hope that this tool will enable researchers everywhere to quickly test and generate hypotheses in this way, thus avoiding unnecessary additional mouse experiments.

Lucia Moreira-Teixeira, Akul Singhania, William Branchett and **Anne O'Garra**
Laboratory of Immunoregulation and Infection, The Francis Crick Institute, London

REFERENCES

1. Singhania *et al.* 2019 *Nature Communications* doi:10.1038/s41467-019-10601-6 **https://go.nature.com/2wrpPTT**

Vaccine research report

On International Day of Immunology, the British Society for Immunology published a new report, 'Protecting the world: Celebrating 200 years of UK vaccine research'. Through new analysis and expert interview, our report reviews the UK's outstanding contribution to vaccine research and how this has improved global health. It also looks at future challenges that must be overcome to speed up the vaccine development pipeline to bring new vaccines to tackle existing and emerging diseases.

Over the past couple of years, the cornerstone of the BSI's policy and public affairs programme has been our work to improve vaccination uptake and tackle the origins behind this trend. We were delighted, therefore, to be chosen as a partner organisation to support the replenishment of Gavi, the Vaccine Alliance, by utilising our status as a voice for research. The report lays out the rich tradition of vaccine research in the UK, from Edward Jenner's smallpox vaccine to 2020's endeavour to develop a vaccine against COVID-19, and explores the obstacles and challenges that face the sector at the moment, while championing the impact that vaccines themselves have both at home and abroad.

It became clearer during writing the report that there is mutualistic symbiosis between funding for the UK's international development efforts and for UK vaccine research and that by helping one, we help them both. The news that came two hours after the report was released, – that the Secretary of State of International Development announced that the UK will continue its funding of Gavi to the equivalent of £330 million every year for the next five years – is therefore a cause for celebration, not just for international public health but also for UK vaccine research.

In our report, we highlight the critical role that the immunology community plays in delivering these benefits and why long-term strategic funding of vaccine research is vital. The full report can be found at **www.celebratevaccines.com/policy**.

What did we find?

Today's vibrant UK bioscience ecosystem fosters effective collaboration between industrial, academic, charitable and government-funded research, leveraging global connections to bring novel vaccines to the places that need them most.

- **UK immunity research is world-leading**, topping the G7 for impact and influence, boasting a 68% increase in immunity publications between 2008 and 2017. Despite being home to just 9% of the G7 population, the UK produces 14% of its immunity research publications.
- **We need to continue our global record in vaccine research**, which remains highly valued internationally, being the second most cited country of the G7 by the WHO, as well as being the most often cited by the UK Government. It is crucial that we continue to provide the vaccine research sector the resources that they need to maintain their global leading status.
- **Living in a globalised world increases the threat of disease but bolsters our response**. The global COVID-19 pandemic clearly demonstrates that public health issues are global events. But, globalisation provides an excellent platform for international scientific collaboration to develop vaccines against diseases that threaten us all.

UK **1st** in immunity research impact & influence among the G7

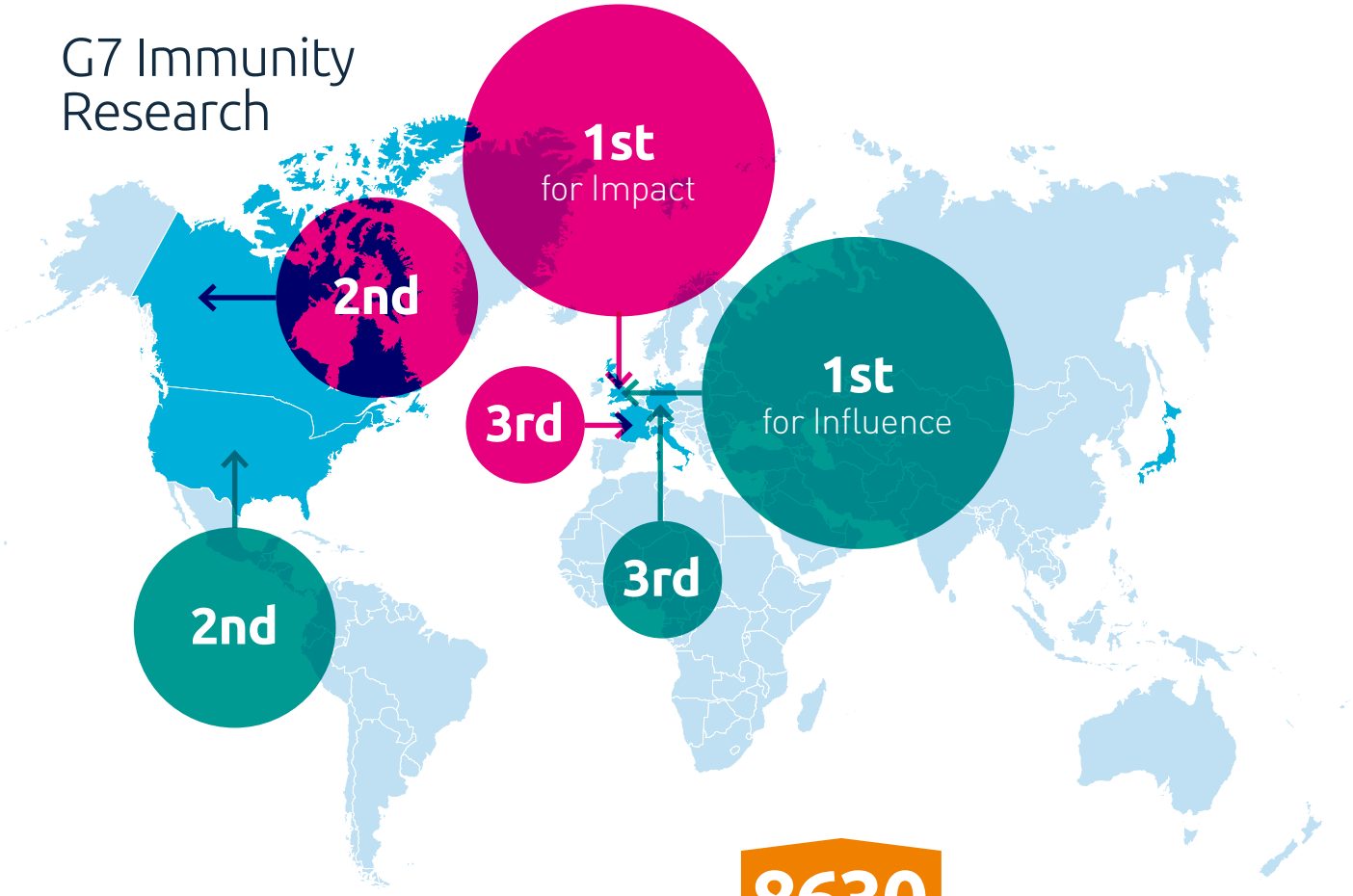
2nd UK research as source for WHO

Each UK publication on immunity is cited on average **29.3x** in other research papers

68% increase in UK immunity publications

14% of G7's immunity publications

> 'We highlight the critical role that the immunology community plays and why longterm strategic funding of vaccine research is vital.'



UK research is leading the world

The UK has been at the cutting edge of science for centuries, and research into immunity and vaccination is no exception. From understanding the immune system to tracking infections, developing new vaccines to life-saving clinical trials, our researchers are making a major contribution to global progress in public health.

Despite its relatively small size, the UK punches well above its weight when it comes to producing world-leading research, particularly around the science underpinning immunity. When comparing UK immunity research performance with other G7 countries, the UK consistently outperforms its peers in terms of the volume and influence of research outputs relevant to vaccines.

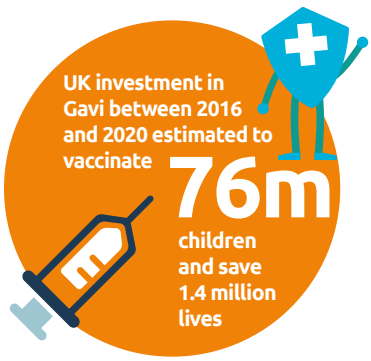
The UK contains around 9% of the G7 population, and yet produces 14% of the G7's scientific publications in immunity. The UK also leads the G7 in terms of the impact of these publications, indicated by the number of times the results are cited in other research papers. UK publications on immunity are cited on average 29.3 times. The UK's Fields Citation Ratio, a measure of the scientific influence of those publications, is also the highest of all G7 countries.

In 2017 the UK published 8,630 scientific papers in immunity, an increase of almost 68% from the 5,141 published in 2008, making the UK the fastest growing country of the G7 in this area. However, research specifically focusing on vaccines is lagging behind immunity research in the UK in terms of performance and influence. At a time when the world is acutely aware of the threats posed by emerging diseases, it is concerning to see that the number of grants awarded for vaccine research and development in the UK appears to have taken a downturn over recent years. When vaccine research is more important than ever before, we must ensure that efforts are being undertaken to bring vaccine research to parity with the rest of the immunity sector. The effect of the recent downturn in grants being made to vaccine research is yet to become clear.

5141
2008 UK immunity publications

8630
2017 UK immunity publications

A report by the All Party Parliamentary Group on Global Health, published in February 2020, also highlighted the quality and impact of UK research, placing the UK at the top of the G7 across multiple health research disciplines, including immunology. Immunology research was shown to outperform other health research disciplines in the UK, with a higher citation score than the UK's public health and healthcare sciences sectors. UK immunology also ranked higher among the G7 compared with our research and experimental medicine sector. The same report estimated that the UK's investment in Gavi, the Vaccine Alliance, between 2016 and 2020 enabled 76 million children to be vaccinated and saved 1.4 million lives. According to the WHO, Gavi has averted medical costs of $350 billion and brought $820 billion in economic and social benefits since 2000 across the 73 countries it has operated in. The importance of vaccine research to patient benefit, not just in the UK, but across the whole world is clear. It is evident that maintaining the UK's status as the engine room of immunity research and levelling up its vaccine research sector is key to increasing the number of diseases which we can protect ourselves against using vaccines.



Working together for global health

Throughout the 20th century, UK researchers have built a strong network of international collaborators and partnerships, although it has tended to be focused on a relatively small number of countries. As our world becomes increasingly connected, bringing new opportunities for international scientific exchanges and training, it's easier than ever before to forge partnerships and collaborations wherever they are needed.

In the past, many vaccine research projects in lower-income countries – where many of the studied diseases are endemic, were carried out by visiting teams of European or American scientists. Today, most of the pioneering research projects and papers published on vaccine research have a long list of scientists and institutional partners drawn from many countries, including across Africa and Asia. Working together with scientific organisations in these regions enables UK researchers to share expertise and resources, and creates new opportunities to empower and upskill local scientists.

UK research brings vaccines where they're needed

New vaccines are often developed in higher-income countries like the UK and do eventually reach low- and middle-income countries (LMICs), but logistical and financial challenges mean that this process can take a long time. For example, the first conjugate pneumococcal vaccines were licensed in Europe 20 years ago, but they still are not available everywhere.

UK research and funding are vital for speeding up the availability of vaccines in LMICs. International organisations like Gavi, the Vaccine Alliance, have been instrumental in making vaccines commonplace in these countries, with strategic funding from the Wellcome Trust and MRC also working together for global health playing a significant role. These efforts have increased vaccine coverage globally, with 86% of infants worldwide now receiving the diphtheria-tetanus-pertussis vaccine.

Harnessing the 'network effect'

Current vaccine development pathways are expensive, complicated and convoluted, with each new product often taking 10–15 years to come to fruition. Delays and challenges during the development process can stop life-saving vaccines from ever making it to market. Networks that bring together international experts from industry, academia, philanthropy and government can help overcome these roadblocks and deliver crucial vaccines where they are needed most.

Despite the challenges associated with coordinating such large international networks, they have been very successful and sprouted collaborations that have impacted research around the globe. Besides bringing together experts to share ideas and resources, the networks also provide small research grants for overcoming research hurdles or generating pilot data. They also play a vital role in building research capacity in LMICs by providing post-doctoral fellowships, collaboration opportunities and training for early-career researchers.

From Nepal to the world

Professor Andrew Pollard from the University of Oxford has been tracking infectious diseases in Nepal for 15 years. After identifying typhoid as one of the commonest killers of under-fives in the country, he and his collaborators developed a new conjugate typhoid vaccine that was first tested in the UK and manufactured by the Indian company Bharat Biotech International.

The vaccine underwent large-scale trials in Nepal and elsewhere in Asia and Africa, with interim results showing that it reduced typhoid infections by an impressive 82%. In 2019, the vaccine was employed by the Pakistani health authorities to tackle an outbreak of antibiotic-resistant typhoid. Following its success, the vaccine is now being rolled out to many more countries including Zimbabwe and Liberia, supported by Gavi, the Vaccine Alliance.

> 'We have been amazed by the sheer enthusiasm for the Network among our international colleagues. It has grown extraordinarily rapidly, and we now have members in around 50 countries all over the world.'
>
> **Dr Beth Holder,** IMPRINT Network

Case Study

An army of African scientists

Professor Faith Osier is a group leader at the KEMRI-Wellcome Trust Research Programme in Kilifi, Kenya, where she's working on promising malaria vaccine candidates. She established the SMART consortium, bringing together scientists from seven African countries to share resources, training and data to support malaria vaccine research.

> 'My heart beats for the science in Africa.'
>
> **Professor Faith Osier,**
> Group Leader, KEMRI-Wellcome Trust Research Programme

Osier also works closely with UK institutions, including the Wellcome Sanger Institute, the University of Cambridge, the University of Oxford and the London School of Hygiene and Tropical Medicine. "Our collaborators in the UK provide access to high-end technology that we do not have or that we cannot get working quickly here, including technologies like sequencing, proteomics and structural biology," she says. "They also support the training of African scientists, allowing students to visit and work in their laboratories and learn new technical skills."

"My heart beats for science in Africa," Osier admits. "We need African scientists to work to eradicate diseases in Africa. I have a vision that African researchers can be involved in vaccine development from the beginning of discovery, to upscaling, conducting trials, regulation, and right through to the end of the process. To do that, we rely on our well-resourced colleagues to support their education and training."

> ‘We were able to go from having the virus’ genetic code to building a prototype vaccine and our first animal experiments within three weeks. In animals, the vaccine induced very potent neutralising antibodies with a single immunisation.’
>
> **Professor Robin Shattock,** Imperial College London

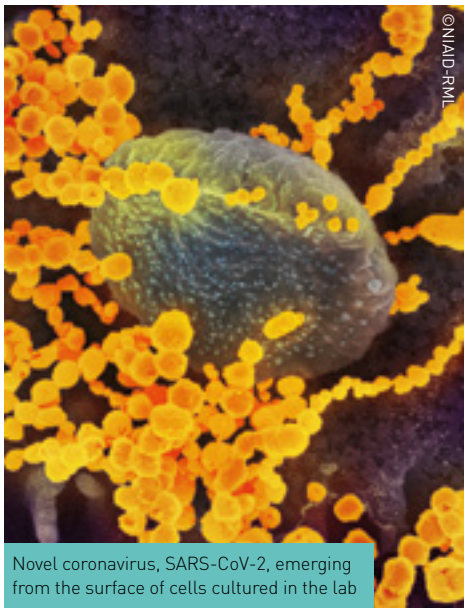
The hunt for a COVID-19 vaccine

On 31 December 2019, health authorities in Wuhan, China, reported a cluster of patients with cases of pneumonia with an unknown cause to the WHO. The disease was eventually named COVID-19 and a novel coronavirus, SARS-CoV-2, identified as the virus behind it. The virus rapidly spread, infecting millions worldwide in a matter of months. Many countries have introduced restrictive measures such as social distancing or lockdowns to contain or slow the spread, protect vulnerable populations and avoid overburdening healthcare services.

Despite these efforts, protecting the population through widespread vaccination will be the only way to beat the disease in the long term. By the end of March 2020 there were already more than 40 vaccine candidates in development from academic groups, established pharmaceutical companies and start-ups in many countries. This number had grown to at least 70 by the middle of April as more organisations joined the international research effort. Some are created from genetic material (RNA or DNA) derived from SARS-CoV-2, while others are based on fragments of its proteins.

UK vaccines in development

The UK is at the forefront of vaccine research efforts with two groups in particular advanced in their efforts.



Novel coronavirus, SARS-CoV-2, emerging from the surface of cells cultured in the lab

Scientists at the University of Oxford, led by Professor Sarah Gilbert, are developing a vaccine that uses a harmless weakened virus from chimpanzees to deliver Coronavirus RNA into cells in the body. Once the cells receive the RNA they produce viral proteins, which stimulate the immune system to generate protective antibodies against future Coronavirus infection. Similar experimental vaccines have already been tested in early stage clinical trials against MERS (Middle East Respiratory Syndrome), proving that this technique is safe for use in humans. Clinical trials of the virus-based SARS-CoV-2 vaccine are starting in April 2020.

At Imperial College London, Professor Robin Shattock and his team are working on a more experimental ‘plug and play’ approach, creating a vaccine made from self-amplifying RNA encapsulated in tiny droplets. This vaccine contains genetic instructions encoding both the virus spike protein (the part most likely to induce an immune response) and RNA copying machinery, enabling the vaccine to self-replicate inside cells and generate a greater protective immune response. The Imperial team expects to start clinical trials in June 2020.

Next steps for Coronavirus vaccine research

All of the vaccines in development must first prove they are safe and effective in small-scale clinical trials, which could take many months. Next come the challenges of scaling-up manufacturing and larger clinical trials involving hundreds or thousands of people before widespread rollout. This will be no small feat: vaccines are commercially risky investments for pharmaceutical companies and production facilities are generally designed to produce one specific vaccine. The scaling-up of infrastructure to manufacture any new vaccine will be a very serious challenge. There are still many questions about COVID-19 that need to be answered as we progress towards effective vaccine implementation: How long does immunity last and how many doses will be needed? Does protection vary between people according to genetic background, age or sex? And who should get priority access to vaccination in order to most effectively protect vulnerable populations?

Conclusion

The underlying aim of our report was to champion the UK vaccine research sector to policymakers, while making the case for the UK to make another substantial multiyear investment in Gavi, the Vaccine Alliance, ahead of their next replenishment conference in June, to be hosted virtually by the UK. A few hours after the report was launched, the Secretary of State for International Development announced in Parliament that the UK Government has decided to fund Gavi to the equivalent of £330 million per annum for the next five years. Meanwhile, our report had been sent to all MPs, all peers, a number of civil servants in Whitehall and officials in Parliament, as well as our partner scientific and civil society organisations.

We have had a number of leads from this work which are being followed up, not least the opportunity for working with Lord Patel, Chair of the House of Lords Science and Technology Committee on their next parliamentary inquiry on SARS-CoV-2. This is a piece of work which will have longevity; many of the statistics produced for it will continue to inform our conversations with policymakers for months and years to come, and we will keep you updated on all our progress.

Matthew Gibbard
BSI Policy & Public Affairs Manager
Email: m.gibbard@immunology.org

Find out more

Download the full report from our website: **www.immunology.org/celebrate-vaccines/policy**.

Explore our social media toolkit including a range of resources you can use to show your support for the report: **trello.com/b/0LbVMjf8**.

Follow **@britsocimm** and join the conversation with the official hashtags **#ProtectingTheWorld** and **#CelebrateVaccines**.

Engaging with your online network:

BSI London Immunology Group's photo competition

The British Society for Immunology's London Immunology Group organised the first UK B cell meeting for July 2020. To coincide with this first meeting, they ran a competition for the best B cell-inspired image, from confocal imaging to abstract art. Even though the ongoing situation with COVID-19 means this meeting is now postponed, a winner was chosen and proudly announced on Twitter. In this article, we feature the winning image showcasing an example of online engagement by one of our Regional & Affinity Groups. Now, more than ever, we need to stay connected with our networks and the wider immunology community.

Uniting immunologists

The B cell meeting was organised by the BSI London Immunology Group (LIG) with the aim of bringing together the UK's diverse group of B cell researchers and clinicians and fostering collaboration in a friendly and fun environment. The BSI's LIG network unites the immunology community based in London, as our other Regional Groups connect BSI members around other locations in the UK. They set up different types of events, such as seminars and symposiums, on all areas of immunology, from macrophages to microbiota. Conversely, our Affinity Groups are arranged around specific themes in immunology.
All of our Regional & Affinity Groups have committees made up of members from different backgrounds and career grades. The BSI's LIG committee is made up of members from each of the main London universities and they actively encourage PhD students and early career researchers to get involved.

The source of antibodies

Planned for Wednesday 1 July 2020, the meeting offered many different opportunities to present B cell research, including short elevator-style pitches, posters and 10 min talks. The importance of B cells to human health and scientific discovery is difficult to overstate. B cells are central to immunity and memory of infection, yet B cell deficiencies have devastating impacts and dysregulation underlines many autoimmune and allergic diseases. Their unique ability to produce antibodies underpins many cutting-edge treatments, forming the basis of the majority of vaccines and checkpoint blockade therapies.

Over 50 years on from the discovery of their role as the source of antibodies, B cells remain one of the most diversely studied and utilised cells of the immune system. Thanks to recent progress in experimental approaches, we now have a greater appreciation of the complex nature of B cell development and their role in immune regulation and homeostasis. Despite this wealth of knowledge, there remains still great activity and interest in the field, with numerous challenges remaining.

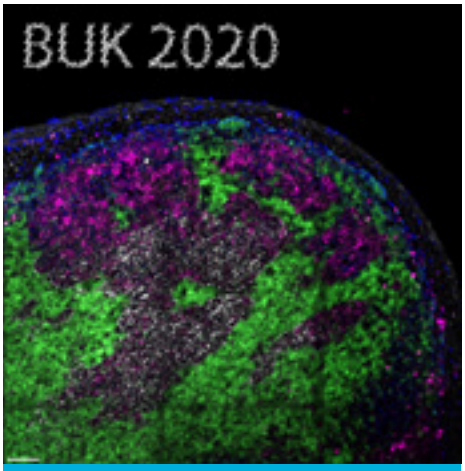


Image by Adi Biram, Weizmann Institute of Science. . Naïve B cells (shown in green) reside in the B cell follicle and surround the GC B cells (shown in purple). Upon antigen encounter by naïve cells, the antigen-specific B cells enter the GC reaction. During the GC response, B cells bearing high-affinity antibody variants undergo iterative cycles of migration between two areas: the dark zone (DZ), where they proliferate and mutate their antibody-encoding genes; and the light zone (LZ) (shown in white, marked by follicular dendritic cell staining), where they are selected by T follicular helper (Tfh) cells for expansion and differentiation into plasma cells. Markers used for staining: IgD (naïve B cells), GL-7 (GC cells), CD35 (FDC), Hoechst (Nuclear staining). Scale bar 50 µm.

Winning image

The winning submission came from Adi Biram from The Weizmann Institute of Science, who prepared the sample and captured an image of a germinal centre formed within the gut-associated lymphoid organs in response to microbiota-derived antigens.

Active on Twitter

Many of our Regional & Affinity Groups have Twitter and other social media accounts to connect and engage with their networks online. One recent example of online engagement by our Groups is the BSI Tumour Immunology Group. It was relaunched last year and their inaugural meeting planned for March 2020 was sadly postponed due to COVID-19. However, they continue to interact online and share anything useful, interesting or fun relevant to tumour immunology. In particular, they supported our official journal *Clinical & Experimental Immunology* in the launch of their new review series 'Immune checkpoint inhibition: from molecules to clinical application' (see page 8 for more details).

Teresa Prados
BSI Marketing & Communications Manager
Email: t.prados@immunology.org

Find out more

Follow the BSI Regional & Affinity Groups on Twitter! Here's a list of their accounts, including **@London_immuno** and **@BSI_TumourImm: twitter.com/i/lists/170444251.**

Find out more about our Groups on our website: **www.immunology.org/about-us/our-people/regional-and-affinity-groups.**

Congratulations

This is the section of the magazine where we celebrate the achievements of our members. Our congratulations to all who are mentioned here.

Congratulations to new Fellows

Both the Academy of Medical Science and the Royal Society have announced their lists of new Fellows for 2020. Congratulations to the following BSI members on being elected as Fellows in recognition of their outstanding contributions to the discipline.

Royal Society

Gordon Brown, Professor in Immunology, MRC Centre for Medical Mycology, University of Exeter. Gordon's research focuses on understanding the role of C-type lectin receptors in immunity. He has provided important insights into how CLRs enable immune cells to sense pathogens, and how these receptors control innate and adaptive immunity. He has translated his discoveries into human benefit, leading to a novel therapy that was successfully tested in patients.

Academy of Medical Sciences

Menna Clatworthy, NIHR Research Professor and Professor of Translational Immunology, University of Cambridge and Associate Faculty, Wellcome Sanger Institute. Menna's research focuses on regulation of antibody generation and effector function in kidney transplantation. She was awarded an NIHR Research Professorship in 2018, is an active participant in the Human Cell Atlas Project, and was awarded the British Renal Association Raine Award and the Academy of Medical Sciences/ Medical Research Society Young Investigator Award for her PhD.

Stuart Elborn, Pro-Vice Chancellor for Medicine, Health and Life Sciences, Queen's University Belfast. Stuart's work has led to major clinical breakthroughs in the treatment of people with cystic fibrosis; in 2013, he received a CBE for services to healthcare in Northern Ireland. Stuart has served as president of the European Cystic Fibrosis Society, as trustee and chair of committees of the Cystic Fibrosis Trust, and currently sits on the scientific advisory board.

Gerard Graham, Gardiner Chair of Immunology, University of Glasgow. Gerard has a long-standing research interest in chemokines and their receptors and has

Sophie Hambleton

publishing widely in this field. He served on the Medical Research Council's Infections and Immunity Board and is Chair of the Wellcome Trust Expert Review Group on the Immune System in Health and Disease. Gerard is a Fellow of the Royal Society of Edinburgh and holds a Wolfson-Royal Society Research merit award.

Sophie Hambleton, Professor of Paediatrics and Immunology, Newcastle University. Sophie is a consultant on the immunology and infectious diseases team at the Great North Children's Hospital and leads a research team at Newcastle University working to discover the genetic causes of immunodeficiency in patients. Sophie is also a member of the UKPIN Genomics Steering Group and the MRC Infection and Immunity Board.

Muzlifah Haniffa, Wellcome Trust Senior Research Fellow in Clinical Science, Newcastle University, Associate Faculty, Wellcome Sanger Institute. Muzlifah is a dermatologist and immunologist pioneering applications of single-cell genomics technologies to understand tissue homeostasis, immunity and disease pathogenesis. Muzlifah has received numerous awards and fellowships and leads a Wellcome Trust funded public engagement programme called Inside Skin, in collaboration with the Newcastle Centre for the Literary Arts and Culture Lab.

Emma Morris, Professor of Clinical Cell & Gene Therapy and Honorary Consultant, UCL, UCLH and Royal Free London Hospital. Emma's research group explores the specificity and the function of gene-modified immune cells which can then be used to treat cancer, infection or immune system disorders. Emma is secretary of the Clinical trials Committee of the British Society for Blood and Marrow Transplantation, a member of the NCRI Low Grade Lymphoma Subgroup and director of the NIHR UCLH/UCL Biomedical Research Centre Inflammation, Immunity and Immunotherapeutics research programme.

Hugh Willison, Professor of Neurology, University of Glasgow. Hugh leads the Neuroimmunology Research Group within the Glasgow Biomedical Research Centre. He has a specialist interest in peripheral nerve disorders, and directs a clinical diagnostic laboratory that conducts immunological tests for peripheral nerve disorders. Hugh holds an Honorary Clinical Consultant Neurologist contract with the South Glasgow University Hospitals NHS Trust.

We would love to hear from you about your achievements. Have you or a colleague recently received grant funding, passed your PhD viva or accepted a new appointment? If so, let us know by emailing **media@immunology.org** or tagging **@britsocimm** on Twitter.

©Shutterstock/Vjom

Sir James Gowans CBE, FRS, FMedSci, FRCP
1924–2020

Sir James Gowans, CBE FRS FMedSci, died peacefully at home in Oxford on 1 April 2020 at the age of 95. He was a towering figure, literally in his height as well as in his science, from the period of the great blooming of British immunology in the 1950s and '60s when the BSI was founded. Our Society offers its sympathy to his widow, Moyra, to his children and to all his family.

The idea of clonal selection as the cellular basis for acquired immunity developed during the 1950s. Preliminary formulations by Talmage and Jerne culminated in Burnet's famous monograph in 1959. It raised two overarching questions. First, how could mono-specific, very infrequent clones be certain to promptly encounter their cognate antigen, wherever it might enter the body? Second, how could diversity be generated, even before antigen had arrived?

The recirculation of lymphocytes from blood to lymph to blood, round and round the body through all secondary lymphoid organs in perpetual procession, compellingly answered the first question.[i] It was the physiological experiments by Sir James (Jim) Gowans that established this, published from 1957 onwards while he was a postdoc and subsequently as Director of the MRC Cellular Immunology Unit. He took the millions of pure lymphocytes that drain hourly from a cannula placed in the thoracic duct of a rat, then followed their fate when returned intravenously to that rat. Most re-emerge from the cannula within a couple of days, having left the blood via high endothelial venules within lymphoid organs into efferent lymph. When an antigen is administered, it or its fragments lodge in a nearby rendezvous, such as a draining lymph node or the spleen. Then, within less than a day, it engages and extracts the rare, matching lymphocytes from the recirculating population. Gowans and his co-workers showed that the three main states of readiness of the specific adaptive immune system are wholly due to the properties of the body's small, non-dividing lymphocytes: (1) unimmunised, naïvely awaiting antigen to trigger a primary response; (2) primed, by prior exposure to antigen to inculcate memory; or (3) specifically tolerised, for example by neonatal exposure to transplantation antigens. Recirculating lymphocytes 'underwrite' (his favourite word) the body's adaptive immune readiness.

He also noticed that, among the minor population of large lymphocytes in the thoracic duct, some migrate in a once-through, non-recirculating transit to the lamina propria of the gut wall. These were B lymphoblasts recently stimulated by corresponding antigens in gut-associated lymphoid tissues. With colleagues, he explored the subsequent IgA responses there. The scope of his immunology was therefore very broad: not just the induction of antibody formation but also mucosal immunity, graft rejection and graft-versus-host reactions. We owe to Gowans more than to anyone else the core dogma that lymphocytes fulfil the central cellular role in the induction and development of adaptive immune responses.[ii]

Gowans was the only son of a lab pathology technician and a mother who was Swedish by birth.[iii] He grew up in south London and studied medicine at King's College London. He joined the student volunteer group providing medical relief at the concentration camp at Bergen-Belsen immediately after its liberation in 1945. On completion of his medical training he studied for a DPhil supervised by Sir Howard Florey at the Dunn School of Pathology in Oxford, researching whether the therapeutic efficacy of a bacteriostatic antibiotic in mice depended on concurrent inflammation. An exchange scholarship to the Pasteur Institute, Paris, in 1952–3 generated an interest in immunology. On return to the Dunn School, Florey put to him the problem of the lymphocyte. "If you can find out where they go, Gowans, you can find out what they do... The lymphocyte problem has blunted the wits of a lot of people in the lab, Gowans, and I don't see why you should be spared a similar fate."[iv] Gowans later fulsomely acknowledged his debt to Florey: "It was from Florey that I learned that scientific problems are never solved by polemics but by trying to perform simple, decisive experiments". The other course-setting influence on his scientific career was his friendship with Medawar, joint recipient of the 1960 Nobel prize for the immunology of transplantation tolerance. Gowans himself received for his lymphocyte work a Royal Medal, a Gairdner prize, the Paul-Ehrlich prize and a Wolf prize.

In 1977 he chose to terminate his lab work, becoming the Secretary (Chief Executive) of the MRC, for ten years. This period gave him satisfactions despite turbulence over many issues, including, for example, the unjustified put-down by prime minister Thatcher about the MRC not patenting monoclonals; the emergence of the HIV epidemic; policy on human IVF and embryo research; controversial clinical trials of folate supplementation during pregnancy. From 1988 to 1993 he was the first Secretary-General of the international Human Frontiers Scientific Programme, working from Strasbourg. He served as adviser to numerous charity and commercial bodies, including Celltech.

But above all, he gained his chief intellectual pleasure by developing contacts with, and strongly supporting, promising young scientists. His imprint continues through his many intellectual descendants, the researchers who themselves learned the value of performing "simple, decisive experiments".

Simon Hunt
Emeritus Lecturer in Immunology at the Dunn School of Pathology, Oxford University.
Email: simon.hunt@path.ox.ac.uk

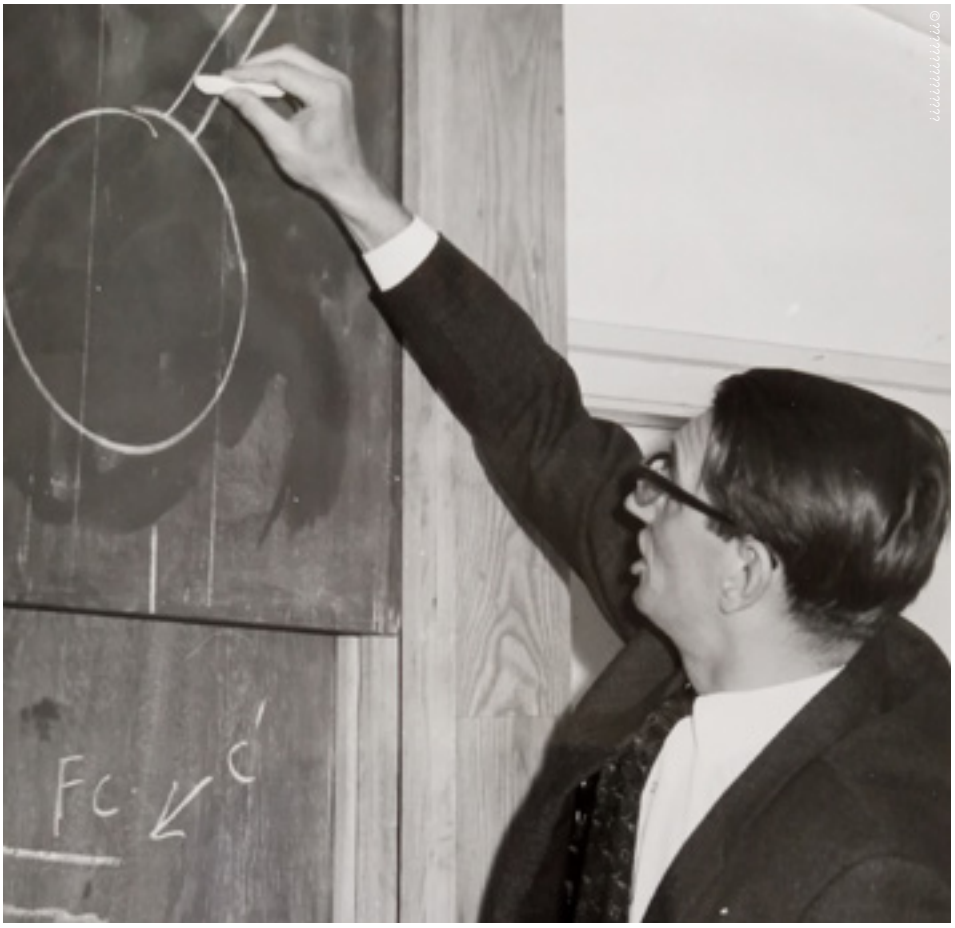
The author gratefully acknowledges help from Jonathan Howard to improve this article.

NOTES

i. The answer to the second had to await the development of molecular biological analysis of V region gene segments.
ii. The overview by Weissman (2010) provides much fuller context and detail: *Nature Immunology* **11** 1073–1075
iii. See his papers deposited at the Bodleian Library: **https://bit.ly/3d4qbjA**
iv. Max Blythe interview 5 with Gowans, 1998. The series of five interviews begins at **https://bit.ly/3guQAcq**

Denis Raymond Stanworth PhD DSc FRCPath 1928–2020

Denis Stanworth, retired immunochemist who spent his entire academic career at the University of Birmingham, UK, has died, aged 91. He was a major international figure in immunology and a pioneer in the study of immunoglobulin structure and function.[1]



Denis graduated with a degree in chemistry from the University of Birmingham, where he also earned a PhD for his work on the physico-chemical characterisation of reagin to horse dander, under the then head of the Department of Experimental Pathology (the late Professor John Squire). This seminal work on reagins during the 1950s[2] put him in a key position to participate in the momentous events which culminated in the discovery of IgE.[3] In his lab in Birmingham, he carried out the functional characterisation of a rare myeloma protein, IgND, which was discovered in 1967 in Uppsala, Sweden, by Johansson and Bennich.[4, 5] He found that IgND could block the Prausnitz-Kustner test for reagin[6] and that this activity was mediated by the Fc fragment.[7] In 1968 the World Health Organization named IgND and its equivalent, γE, described by the Ishizakas in Denver, Colorado,[8] the fifth human immunoglobulin class, IgE.[9]

In the decades that followed, Denis continued his interest in the molecular pathology of IgE, describing a candidate vaccine peptide derived from the Cε4 domain of IgE which might be used in blocking certain allergic reactions.[10] However, this approach was initially dismissed, particularly when the high-affinity receptor binding site was found to lie in the Cε3 domain at the interface with Cε2. But, surprisingly, when the crystal structure of the entire IgE-Fc region was solved,[11] it was found to be acutely bent, and that the Cε2 domain contacted the Cε4 domain – in the very region of Denis's peptide! We now know that the bent IgE-Fc conformation is critical for high-affinity receptor binding, and thus antibodies raised to the peptide, binding to this region of Cε4, would undoubtedly interfere with the bending – perhaps 'unbending' the IgE-Fc. This would prevent receptor binding, allosterically rather than by steric blocking. Interestingly, omalizumab, the anti-allergy therapeutic antibody, is now known to act allosterically to inhibit IgE/FcεRI binding, as demonstrated by solving the crystal structure of the omalizumab/IgE-Fc complex.[12]

> 'We owe Denis an immense debt of gratitude for his guidance and advice, for the rich research discipline he instilled in us and for the continuing friendship we shared over several decades.'

Early in his career, Denis spent a year working in Ed Franklin's lab in New York, where he raised antisera against paraproteins which were capable for the first time of distinguishing the then known classes of immunoglobulins (IgG, IgM and IgA) immunochemically[13] – he often referred fondly to his time there and to the thrill of seeing, at first hand, Kennedy's run for the presidency and Martin Luther King Jr. preach at a local church. During the 1970s and 1980s, Denis published extensively on human IgG subclasses (particularly IgG4) and his interests expanded into the biology and functions of immunoglobulin-interacting cells, especially mast cells, macrophages and B-cells. He also developed broad interests and expertise in the role of rheumatoid factors and complement in immune complex formation and how these elements contributed to the development of rheumatoid arthritis. He forged a strong friendship and research collaboration with the late Hungarian immunologist Janos Gergely, with whom he pursued his research interest in Fcγ

receptors, and he often spoke of his visits to Budapest where he also enjoyed listening to the sound of gypsy violin over dinner!

Denis enjoyed travelling abroad and did so widely, often as a keynote speaker at international conferences. His lab in Birmingham was a magnet for young and seasoned immunologists from all over the world and he would normally have a dozen nationalities represented in his lab at any one time. He was very inclusive and would always bring his distinguished visitors into the lab for a chat with staff and PhD students. He was also a great believer in the social dimension of being part of a research community and through his numerous friendships he advanced science, forging productive research collaborations across diverse scientific and medical specialties. There was always excitement, energy and a new discovery to hear about and enjoy. Denis had a defining and lasting impact on the careers of many immunologists around the world, including us. We were all PhD students of Denis's and like many of his postgraduate students (around 80 in total) we owe Denis an immense debt of gratitude for his guidance and advice, for the rich research discipline he instilled in us and for the continuing friendship we shared over several decades.

Following his retirement from the University of Birmingham, Denis set up Peptide Therapeutics Ltd in Cambridge, where he and his team continued their work on his novel anti-allergy peptide vaccine. In the late 1990s, he was awarded a special professorship by the University of Nottingham in recognition of his exceptional and long-standing contribution to the science of immunology and in particular to our understanding of allergies. He was a prolific author and a member of numerous national and international immunology organisations and committees, and was active in the Medical Research Council (London), the World Health Organization (Geneva) and the Royal College of Pathologists (London). Denis spent his retirement years in his beloved Malvern, Worcestershire and was an avid listener to the music of its famous son, the English composer Sir Edward Elgar.

Denis will be sorely missed by his family and friends. His wife Barbara passed away in 2013 and he is survived by his two daughters, Deborah and Sarah, and four grandchildren, David and Elizabeth, and Daniel and Francesca.

Farouk Shakib, Emeritus Professor of Experimental Allergy, University of Nottingham; **Keith James**, Emeritus Professor of Immunology, University of Edinburgh; **Christopher S Henney**, Former Professor of Immunology, University of Washington, WA, USA; **David W H Riches**, Professor, Pulmonary Sciences & Critical Care Medicine, University of Colorado, CO, USA.

REFERENCES

1. James *et al.* 1964 *Nature* **202** 563–566
2. Stanworth 1959 *Immunology* **2** 384–401
3. Stanworth 1993 *Allergy* **48** 67–71
4. Johansson 1967 *Lancet* **ii** 951–953
5. Johansson & Bennich 1967 *Immunology* **13** 381–394
6. Stanworth *et al.* 1967 *Lancet* **ii** 330–332
7. Stanworth *et al.* 1968 *Lancet* **ii** 17–18
8. Ishizaka & Ishizaka 1967 *Journal of Immunology* **99** 1187
9. Bennich *et al.* 1968 *Bulletin of the World Health Organization* **38** 151–152
10. Stanworth *et al.* 1990 *Lancet* **336** 1279–1281
11. Wan *et al.* 2002 *Nature Immunology* **3** 681–686
12. Davies *et al.* 2017 *Journal of Biological Chemistry* **292** 9975–9987
13. Franklin & Stanworth DR 1961 *Journal of Experimental Medicine* **114** 521–533

Leopoldo Flores-Romo
1954–2020

I first met 'Polo' in 1986 when he arrived fresh from Mexico accompanying his wife Tere who had secured a position in the School of Biosciences at the University of Birmingham.

Himself jobless, Polo approached the then Head of Immunology, Ian MacLennan, expressing a wish to 'do some immunology' upon which he was pointed in my direction. In those early days I was certainly grateful for 'an extra pair of hands'. And what 'hands' they turned out to be. Polo integrated seamlessly into the group, rapidly proving to be among the most energetic and passionate of scientists that I have had the privilege to know. A hallmark of Polo was his preternaturally infectious enthusiasm, fostering and engendering highly productive collaborations both locally and internationally.

In 1990, Polo left Birmingham to join the Immunology Division of the Glaxo Institute for Molecular Biology, Geneva, where he further flourished under the guidance of Jean-Yves Bonnefoy. Likewise, a highly productive couple of years at the Schering-Plough Research Centre with Jacques Banchereau in Lyon were followed by more of the same at the M.D. Anderson Center, Houston. Polo eventually returned home, joining in 1998 the Centre for Advanced Research, CINVESTAV-IPN, Mexico City though still engaging internationally, not least as a Visiting Professor to the Rockefeller Institute with the late great Ralph Steinman.

For over 20 years, Polo worked tirelessly to further the cause of immunology in his native country and, calling on his extensive network, promoted the placement of young Mexican scientists in top research establishments throughout Europe and the USA. He organised national meetings of the Mexican Society of Immunology, his name ensuring the participation of stellar speakers from overseas. In recent years, Polo threw himself into outreach and public engagement activities at all levels while also developing a medics-focused immunology update course adopted by several of the universities across Mexico. In the past year, he was elected to the ranks of the prestigious Sinaloa College, a rare and distinguished honour.

Polo's legacy in the field of immunology – and particularly his contributions to our understanding of B lymphocytes and dendritic cells – is, and will continue to be, immense; not least through the cohort of highly talented students he has inspired and championed over the years. His published body of work is legion, including seminal papers in *Nature*, *Science*, *Immunity*, *Journal of Experimental Medicine*, *Blood*, *Immunology* and *European Journal of Immunology*, frequently as first or senior author. Often co-authoring with the leading lights in their field while abroad, there was certainly no let-up in publication rate, or quality, on his return to Mexico.

The greatest legacy, however, is that of the man himself. All who knew Polo speak glowingly of his humanity, his immense passion, generosity of spirit, and of wonderful friendships.

Polo passed away on Monday 23 March with Tere and Paola by his side. Our thoughts and love go out to them.

My thanks to Polo's many friends and colleagues who have shared their reminisces with me, with a particular mention to Jean-Yves Bonnefoy, Abbas Ghaderi, Rizgar Mageed, Thierry Defrance, and the 'other' Polo, Leopoldo Santos-Argumedo.

John Gordon
Emeritus Professor of Immunology,
University of Birmingham

William (Bill) Frankland
1912–2020

I had the pleasure of knowing Bill for over 40 years, and in all that time I have never known him be negative or belittle anyone. He was the perfect gentleman. Bill grew up in the Lake District where he went to St Bees School, after which he did his preclinical studies at Queen's College Oxford and his clinical training at St Mary's Hospital in London. As well as being academically talented he was a great sportsman. He was a county standard middle-distance runner and played rugby for London universities.

At the outset of the Second World War he joined the army Medical Corps and was sent to Singapore in 1941, arriving in November before the Japanese invasion in 1942. Bill and a colleague had to choose between the Alexandra and Tanglin hospitals. It was decided on a coin toss; fortunately, Bill went to Tanglin, as the Japanese soldiers killed all the patients and staff at the Alexandra hospital, including one patient who was under a general anesthetic. As Bill said at least he wouldn't have felt a thing. Bill was initially imprisoned in a camp near Changi. The British soldiers had an impromptu game of rugby against the Australian prisoners. Their star was EE "Weary" Dunlop, a Sydney surgeon. The British team won, Bill said he scored three tries to Weary's one.

Bill flew to the Rangoon (now Yangon) and then by ship at the end of the war when he was reunited with his wife, Pauline, and his work at St Mary's hospital. At his 40th wedding anniversary he told me that the greatest moment during his marriage was when he received a letter from Pauline whilst imprisoned in Singapore, and so felt connected to the outside world. On leaving Singapore in 1945, Bill was examined by medical staff at one of the breaks in the journey when he was told he had a mass in his abdomen that was most likely a tumour. Bill gave a huge laugh as he explained he had just eaten a loaf and a half of bread! Back at St Mary's Hospital Bill served as Alexander Fleming's Clinical Assistant. He had several heated discussions with Fleming about the emergence of allergy to Penicillin, particularly as early preparations were not entirely pure.

Bill ran the Allergy clinic at St Mary's that still bears his name. His interest in allergy had been fostered by John Freeman who, with Leonard Noon, started vaccinating patients for hay fever. Together with Rosa Augustin, Bill went on to conduct the first double-blind placebo-controlled study of grass pollen immunotherapy, in 1954. After a distinguished career at St Mary's, Bill retired only to be recruited to Maurice Lessof's allergy clinic at Guy's Hospital which was when I first met him. We collaborated on a study of castor bean allergy in Port Sudan and a follow up study with Raphael Panzani in Marseilles which showed that exposure to castor bean dust sensitized both those with and without a genetic predisposition to allergy, uncovering one of the important immune mechanisms that protect against allergy.

Bill continued working at Guy's for a further 20 years and in his private allergy clinic. Then began a third career as an expert witness. However, Bill's strict adherence to evidence-based medicine meant he sometimes added weight to the opposing counsel. A compromise was reached where he was hired by both sides.

As well as Bill's medical work in the UK he also was called upon by other countries. This is how he ended up treating Saddam Hussein. In common with Maurice Lessof, Bill was acutely aware of the harm caused by cigarette smoking and told Hussein that there was little point helping him medically if he didn't quit smoking.

In 2005 Bill visited Singapore as a guest of the nascent Immunology Programme at the National University of Singapore. Despite flying business class, he arrived with the smallest suitcase I have seen for a week-long stay. I had the honour of taking him to several remembrance events celebrating the departure of the Japanese from Singapore. During this trip Bill explained that a spy had sold secrets to the Japanese about the British defences, which assumed an attack from the Indonesian (not the Malaysian) side of the country. There are too many stories about Bill to mention them all here but an excellent biography by Paul Watkins was published in 2018. Also, you can listen to a podcast of Desert Island Discs from 8 of August 2015.

One could say that Bill was lucky. Surviving the war, dodging several bullets including a ruptured gall bladder on his return from Singapore in 2005. But I think it was above all his positive outlook on life, his faith and his enduring thirst for knowledge about human disease that enabled him to live such an extraordinary life. All of us who knew him were the richer for it.

Mike Kemeny
Professor of Immunology and Microbiology, National University of Singapore

Listen to the podcast of Desert Island Discs about Dr Bill Frankland's life here: **www.bbc.co.uk/programmes/b064x7dv.**

Immune Update

The BSI journals

A round-up of new research published in the British Society for Immunology's official journals *Immunology* and *Clinical & Experimental Immunology*. Members can access these journals free of charge at **www.immunology.org/journals**.

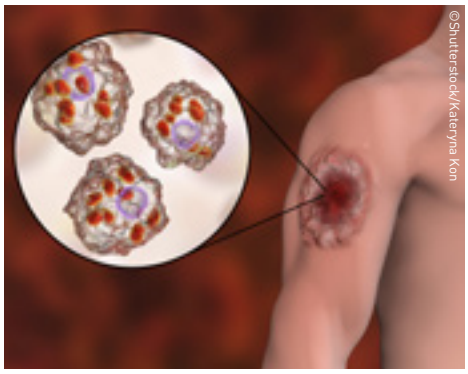
Immunology

Immunopathogenic role for senescent T cells in human cutaneous leishmaniasis

Cytotoxic activity mediated by $CD8^+$ T cells is the main signature of immunopathogenesis of cutaneous leishmaniasis (CL), a neglected parasitic infection, causing skin lesions and ulcers. Covre *et al*. evaluated natural killer (NK) cell phenotypic and functional features during cutaneous leishmaniasis. They show that NK cells display a senescent and highly cytotoxic phenotype. However, unlike the CL $CD8^+$ T cells, NK cells do not express CLA and therefore do not show the same level of skin-homing potential.

While the presence of NK cells in the skin lesions partially correlates with the size of the lesions, these lesions are dominated with $CD8^+$ T cells. The authors conclude that $CD8^+$ T cells and not NK cells are mainly responsible for the non-specific skin lesional pathology. This is the first demonstration of an immunopathogenic role for senescent T cells *in vivo*.

Covre *et al*. 2020 *Immunology* **159** 429–440 **https://bit.ly/2L751ow**



The role of Toll-like receptor 10 in modulation of trained immunity

Toll-like receptor 10 (TLR10) is the only member of the human TLR family with an inhibitory function on the induction of innate immune responses and inflammation. However, its role in the modulation of trained immunity (innate immune memory) is unknown. Mourits and colleagues assessed whether TLR10 modulates the induction of trained immunity by β-glucan or bacillus Calmette–Guérin (BCG). After BCG vaccination, TLR10 protein expression on monocytes increased, and interleukin-10 receptor antagonist production was increased upon activation of TLR10 *ex vivo*, whereas anti-TLR10 antibodies did not significantly modulate β-glucan or BCG-induced trained immunity *in vitro*. However, *in vivo* induction of trained immunity was not influenced by TLR10 polymorphisms.

The authors concluded that TLR10 has a limited, non-essential impact on the induction of trained immunity in humans.

Mourits *et al*. 2020 *Immunology* **159** 289–297 **https://bit.ly/2L7IB6G**

Clinical & Experimental Immunology

Neutrophil proteases degrade autoepitopes of NET-associated proteins

Neutrophils can form neutrophil extracellular traps (NETs) to capture microbes and bacteria to stop them from spreading. NETs consist of sticky chromatin fibres decorated with anti-microbial proteins. In this study researchers show that neutrophil serine proteases degrade several neutrophil proteins associated with NETs, but the anti-bacterial NET-associated proteins appear less susceptible to proteolytic degradation. NETs may play a role in autoimmune reactions as neutrophils from patients with autoimmune diseases like rheumatoid arthritis (RA) or systemic lupus erythematosus (SLE) were shown to have an increased propensity to form NETs and their antibodies were shown to bind to NETs *in vitro*.

De Bont and colleagues found that degradation of NET proteins reduces their recognition by autoantibodies in RA and SLE patients as neutrophil serine proteases also remove a number of autoepitopes of NET proteins. This suggests that NET-associated proteases may have protective functions against autoimmunity.

de Bont *et al*. 2020 *Clinical & Experimental Immunology* **199** 1–8 **https://bit.ly/2YIGi1J**

Impact of bile acid and body weight on MAIT cell activation in adolescents

Bile acids (BAs), produced by liver hepatocytes, play a critical role in metabolic modulation. Mendler *et. al* investigated the relationship between mucosal-associated invariant T (MAIT) cells in the liver, and BA serum levels, and the impact of body weight. They collected blood samples from 41 normal weight and 41 overweight children and found that higher body weight was linked with reduced MAIT cell activation and expression of NK cell marker (NKp80) and chemokine receptor (CXCR3).

They showed that BA concentrations increased inflammation but inhibited MAIT cell activation. This relationship was slightly weaker in overweight children, suggesting other factors influence BA levels, including age and gender. This showed that conjugated BAs have the capacity to modulate the balance between pro- and anti-inflammatory immune responses.

Mendler *et al*. 2020 *Clinical & Experimental Immunology* **200** 199–213 **https://bit.ly/2W8svjr**

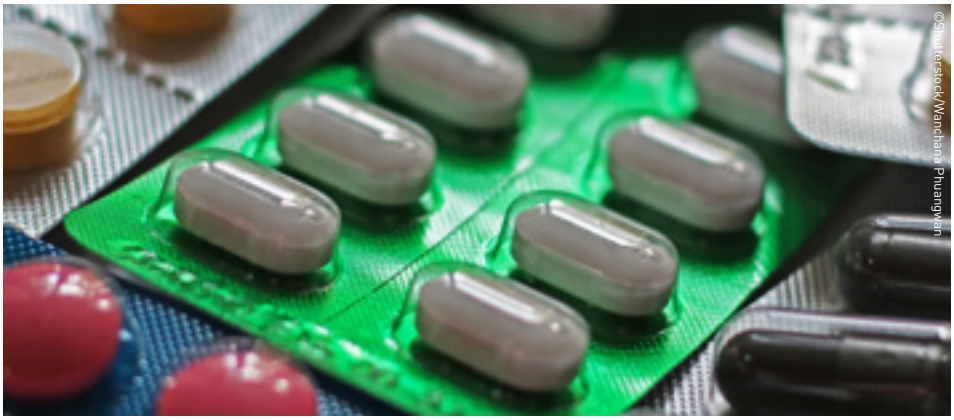
Around the journals

A summary of some of the latest papers from the world of immunology.
Written by Edd James, Louisa James, Donald Palmer and Ushani Srenathan.

Important role for T-bet memory B cell in immune surveillance

There is an emerging appreciation that memory B cells (MBC) comprise distinct subsets with differing roles in protective immunity. In this paper, Johnson and colleagues use transgenic reporter mice to characterise a subset of MBC that express the transcription factor T-bet. Their analysis reveals that T-bet$^+$ MBC emerge from a common naïve B cell pool but following antigen encounter, diverge from T-bet-counterparts to form a phenotypically discrete subset that occupies distinct anatomical compartments, with long-term residence in the blood, spleen and bone marrow. Analysis of T-bet expression in B cell subsets across different human tissues demonstrated similar compartmentalisation with a notable absence of T-bet$^+$ MBC in secondary lymphoid tissue and lymphatic circulation. The positioning of this phenotypically distinct subset, along with their prominence in response to influenza infection, point to an important role for T-bet$^+$ MBC in immune surveillance.

Johnson *et al.* 2020 *Immunity* **52** 842–855



Potential role for alcohol withdrawal drug disulfiram in inflammatory disease treatment

Gasdermin D causes pyroptosis by formation of pores in the plasma membrane allowing IL-1β release and subsequent pyroptotic cell death. GSDMD has been investigated as a potential target for inflammatory diseases. In this paper, a high throughput fluorescent screening system was used to assess inhibition of GSDMD. The most potent inhibitor from over 3000 compounds was disulfiram – a drug already used in the treatment of alcohol withdrawal. Disulfiram inhibited pyroptosis *in vitro* by prevention of GSDMD pore formation, thereby preventing IL-1β release and pyroptosis. Dilsulfiram pre-treated mice were more resistant to LPS-induced sepsis, with a reduced inflammatory cytokine profile.

Given the safety profile of disulfiram from decades of clinical use, disulfiram could be investigated for the treatment of inflammatory diseases.

Hu *et al.* 2020 *Nature Immunology* doi: 10.1038/s41590-020-0669-6

CD300f immunoreceptor linked with major depressive disorder in females

The involvement of immune responses and immune cells, in particular microglial cells and regulation of their phenotype, in neuropsychiatric diseases such as major depressive disorder (MDD) has been proposed. Here, Lago and colleagues examine the role of CD300f immune receptor in the regulation of microglial phenotype and MDD. They identify that a single nucleotide polymorphism (rs2034310) is associated with protection against MDD, only in women. Furthermore, female, but not male CD300f-deficient mice display a similar behavioural phenotype to MDD without displaying neuroinflammation. In addition, increased microglial numbers, increased IL-6 and IL-1R expression together with alterations in synaptic strength and impaired metabolic fitness of microglia was observed.

These findings show that CD300f function is associated with MDD and the development of similar behaviours in female mice. Why this only affects females will be an important question to answer.

Lago *et al.* *PNAS* 2020 **117** 6651–6662

Novel population of T cells that coexpress αβ and γδ TCRs in mice and humans

T cells express either αβ or γδ TCRs, with lineage divergence occurring during development within the thymus, which are viewed as distinct peripheral T cell populations. In this study, Edwards and colleagues reveal by flow cytometry a proportion of lymph node T cells in mice coexpressing both αβ and γδ TCRs, which they further confirmed by confocal analysis and RT-PCR. Functional studies of this novel αβ–γδ-coexpressing T cell, revealed they respond to MHC-restricted peptide antigens, like conventional αβ T cells, and in response to IL-1β and IL-23 produced IFN-γ, IL-17, and GM-CSF, like conventional γδ T cells.

These cells exhibit an activation phenotype and functionally provided protected to *S. aureus* infection in a mouse model, and appear to play a crucial role in the early stages of EAE. Interestingly, the authors also identified αβ–γδ-coexpressing T cells in human peripheral blood.

These findings suggest that the proinflammatory activity of this unique T cell could contribute both towards the front-line defence and also towards the pathogenesis of autoimmunity.

Edwards *et al.* 2020 *Journal of Experimental Medicine* **217** e20190834

MACSQuant® Tyto® Cell Sorter

Sorting infectious materials in your flow core facility?

Unlike conventional droplet sorters, cells sorted by the MACSQuant® Tyto® do not experience high pressure, charge, or decompression, leading to never-before-seen viabilities and no aerosols.

- **Contamination-free sorting due to closed cartridge design**
- **Increased operator safety due to a lack of droplets and aerosols**
- **Sterile, GMP-compliant multiparametric cell sorting in a fully closed setup**

▶ **miltenyibiotec.com**

Miltenyi Biotec Ltd. | Almac House, Church Lane | Bisley, Surrey GU24 9DR | UK | Phone +44 1483 799 800 | Fax +44 1483 799 811 | macs@miltenyibiotec.co.uk | **www.miltenyibiotec.com**

Miltenyi Biotec provides products and services worldwide. Visit **www.miltenyibiotec.com/local** to find your nearest Miltenyi Biotec contact.

Miltenyi Biotec