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Upcoming BSI elections

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Welcome to the March 2018 edition of Immunology News. It’s been a busy few months for us. We were delighted to see so many of you at our Congress in Brighton in December. Although the weather wasn’t always our friend, the conference stood out for its scientific content and we hope you enjoyed it as much as we did.

The BSI is keen to encourage our members to directly engage in our work. Nominations are currently open for a number of vacancies on our committees – it’s an excellent opportunity to get more involved in our work and shape the future of the Society and immunology in the UK – read more on page 8. Please do consider standing for election – we need members from all backgrounds and career levels to get involved with new ideas to help formulate our activities. Please also make sure you vote when the election process opens in April – information on how to do this will be emailed to you.

Our members do fantastic work bringing immunology to different communities. In this issue, we feature two success stories in this: Dan Davis tells about his new popular science book ‘The Beautiful Cure’ on page 16, while on page 20, you can read about the work of the inaugural winner of our Immunology Teaching Excellence Award, Andrew Foey.

Best wishes,

Jennie Evans
j.evans@immunology.org
I hope you’ve had a good start to 2018, and it’s been a busy time here at the BSI, building on many of the activities you may have seen at Congress. We were pleased to welcome more than 1,200 delegates to Brighton in December and particularly gratified that so many of you came to our stand to talk to us about the work the Society does. Thank you for your time and for suggesting new ideas.

This will be my last news piece, as I am leaving the BSI to take up a new role as Chief Executive of the Royal College of Paediatrics and Child Health. The College is the body which sets standards in paediatrics, runs examinations and training for doctors in the UK and abroad, and works to further the case for improvements in the way we care for children and young people. It was not an easy decision for me to take, but I know that I’m leaving the Society in very good health. I’m proud of the great team we have here in the office in Holborn, and of the many different activities we now run which make a difference to you as members, supporting research, careers and communications with policy-makers and the public.

Over the past three years, I have learned so much about immunology thanks to the time that members have given me, and I think that there is so much to build on. The challenges are great: Brexit is going to test international relations as never before, and whether you work in academia or industry, the landscape for funding and collaboration will change and is changing as I write. This means that the role of a society such as ours becomes even more important within the science landscape because of the complex mesh of relationships and networks – UK and international – that underpins projects and partnerships, essential for the prospect of continuation in spite of the external pressures.

The Society is strong because so many of you volunteer to help on regional groups, committees, policy work, meetings and Congress to name but a few. Without this great altruism, it would fail to thrive.

On 27 April, we will mark World Immunology Day, a time to celebrate the discipline and those who have given so much to it. This year, an evening discussion, entitled ‘Immunology of the gut’ will be held at the Francis Crick Institute and the guest speakers are Fiona Powrie, Gitta Stockinger, Anne Cooke, Vassilis Pachnis and Holm Uhlig. This event, led by Anne O’Garra, is supported by BSI and Nature Publishing Group, and the tickets will be free, going out on Eventbrite shortly. I hope to see many of you there.

With best wishes,

Jo Revill
Chief Executive, British Society for Immunology
Email: j.revill@immunology.org

UPCOMING BSI MEETINGS

We have lots of upcoming meetings covering a vast array of immunological topics. Find out more at www.immunology.org/events.

BSI meetings

IMMUNOLOGY OF DIABETES SOCIETY CONGRESS 2018
25–29 October 2018
London, UK

BSI Regional and Affinity Groups

BSI Oxford Immunology Group
OXFORD IMMUNOLOGY SYMPOSIUM
16–17 April 2018
Oxford, UK

BSI West Midlands Immunology Group
INTESTINAL INFLAMMATION AND MICROBIOTA
18 April 2018
Birmingham, UK

BSI London Immunology Group
IMMUNE CELL METABOLISM IN HEALTH AND DISEASE
30 May 2018
London, UK

BSI Mathematical Modelling Affinity Group
MATHEMATICAL MODELLING: CHALLENGES IN HUMAN IMMUNOLOGY
7–8 June 2018
Cambridge, UK

BSI Infection & Immunity Affinity Group and London Group
INFECTION AND CHRONIC DISEASE
12 July 2018
London, UK

BSI Histocompatibility & Immunogenetics Group
29TH BRITISH SOCIETY FOR HISTOCOMPATIBILITY AND IMMUNOGENETICS ANNUAL CONFERENCE
5–6 September 2018
Cardiff, UK

BSI sponsored meetings

WORLD IMMUNOLOGY DAY
27 April 2018
London, UK

BRITISH SOCIETY FOR RHEUMATOLOGY ANNUAL CONFERENCE
1–3 May 2018
Liverpool, UK

EUROPEAN CONGRESS OF IMMUNOLOGY
2–5 September 2018
Amsterdam, The Netherlands
Welcoming our new Associate Editor

We are delighted to announce the appointment of Tanja de Gruijl as Associate Editor of the Society’s official journal, Clinical & Experimental Immunology (CEI). Tanja brings over 25 years of experience and expertise in the field of tumour immunology to the journal. Her research ranges from preclinical topics to immune monitoring of Phase I–III clinical trials, and her current focus is the in vivo targeting and modulation of dendritic cells. Further topics of research in her lab include tumour-mediated immune suppression, nanobody-mediated targeting of (NK)T-cell subsets, and the immune potentiation of tumour-draining lymph nodes and the tumour microenvironment.

Honorary members

At the recent British Society for Immunology Congress, we were delighted to award Lifetime Honorary Membership of our Society to three immunologists in recognition of their outstanding contribution to the discipline and the Society. They are Don Mason, Bridget Ogilvie and Herman Waldmann. This honour is awarded after rigorous discussion and a vote by the BSI Trustees.

We were pleased that Bridget and Herman were able to join us at the Congress opening ceremony, where tributes to all three were led by BSI Vice-President, Anne Cooke. You can read a summary of this at www.immunology.org/new-honorary-members.

Immunology Undergraduate Prizes

The next round of applications for our Immunology Undergraduate Prizes is now open. These awards aim to promote excellence in the study of immunology at undergraduate level, and to encourage gifted students to pursue further postgraduate study and a career in immunology. The application deadline is 28 April 2018 and further details can be found at www.immunology.org/immunology-undergraduate-prizes.

Changes at Congress Committee

Leonie Taams (King’s College London) finished her term of office as Congress Secretary at the end of 2017. During this time, she oversaw the running of several highly successful BSI Congresses, including our most recent event in Brighton and the joint meeting with the Dutch Society for Immunology in 2016. The Society would like to extend a huge vote of thanks to Leonie for the dedication and leadership she has shown whilst in this role.

We now welcome our new Congress Secretary, Gary Entrican (Moredun Institute), who commenced his term of office in January 2018. With a background in veterinary immunology, Gary brings a new perspective to our meetings and we’re delighted to have him on board. We also are pleased to welcome Jim Brewer (University of Glasgow), Deena Gibbons (King’s College London) and Linda Wooldridge (University of Bristol) to the committee as general members and Martina Colicchia (QMUL) as early-career representative.

The next BSI Congress will take place in Liverpool on 2–5 December 2019. The committee is already hard at work to deliver an event that serves all our members. Watch this space for more information on how you can get involved and submit your ideas.

Virtual Network of Immunology Educators

The BSI is setting up a Virtual Network of Immunology Educators to help raise the profile of immunology teachers within higher education. The virtual group will allow educators to discuss teaching pedagogies, share resources and learn from each other. This is the first time the BSI have set up a group of this kind as we hope to give teachers a greater voice within the Society and enable us to hold sessions and events focusing on education. The BSI recognises the importance of those who educate the next generation of immunology researchers and wish to support them in their teaching, ensuring the security of the immunology jobs pipeline.

As an initial step, we have set up a Basecamp group to facilitate discussion and the sharing of resources between group members. If you are a BSI member and wish to be added to this group, please get in touch with our Education & Career Officer, Glyn Jones, at g.jones@immunology.org.
**SOCIETY NEWS**

**Brighton highlights: BSI Congress 2017**

2017 saw BSI Congress visit the vibrant city of Brighton for our flagship event, highlighting the best immunology from the UK and around the world. From 4 – 7 December, a warm immunological welcome was to be found in the Congress centre where delegates benefitted from a huge array of cutting-edge science, lively debates and a convivial atmosphere.

“Great variety of speakers and presentations – very interesting to hear from PhD students all the way through to senior professors that are leaders in their field”

“Excellent combination of international and national research scientists plus ample opportunity for postdocs and students to present and feel involved in the immunology community”
“Thanks @bsicongress for a great conference with inspiring talks and networking at #BSI17 – enjoyed those four days of #immunology!”

“I am a junior group leader with a growing group of young scientists who couldn’t have benefitted more from the opportunity to hear inspiring talks from leading figures in UK and international immunology sharing new data. The relatively low cost made attendance by my whole group feasible and the quality of material both in plenary lectures and in short talks was at a similar level to any international conference I’ve been at. All in all, the meeting was excellent all-round.”

Find out more online:
You can get the latest information on upcoming Society events at www.immunology.org/events.

Save the date!
BSI CONGRESS 2019
2 – 5 December 2019
Liverpool, UK
SOCIETY NEWS

Get involved in our work – join a BSI Committee

The BSI will shortly hold elections for positions on its Board of Trustees as well as its policy-making Forum. This is a fantastic opportunity for members to get involved in the work of the Society, to help the next generation of immunologists and to make a difference to the field.

Our Trustees have the chance to make an active and dynamic contribution to the Society through their responsibility for setting and overseeing our strategy, governance and finances, and by working closely with our CEO and staff to support all our members. At the 2017 AGM, on the recommendation of the Board, members passed a special resolution to add two Early Career Trustees to the Board to ensure that it is representative of our membership.

Forum is the Society’s ‘think-tank’ and charged with developing policy and overseeing other areas of activity for the Society. These activities include education and careers work, public engagement, media, policy and public affairs, which includes helping to formulate responses to external consultations. The membership of Forum is designed to be representative of the Society’s membership, including individuals from all career grades and immunology sectors. The Chair of Forum reports to the Board of Trustees each quarter on Forum’s work. Forum also receives quarterly reports from staff on the Society’s activities.

The role of the Public Engagement Secretary will also be up for election. This position oversees the delivery and development of the BSI’s public engagement initiatives, working with members, Trustees and staff. A core part of the Society’s strategy is to inform and engage the public to raise awareness and understanding of the immune system functions and how our members’ work helps to drive scientific understanding and improve human and animal health.

The nomination period is currently open. Please check your emails and the BSI website for details on how to nominate yourself. Nominations will close on Tuesday 20 March. Voting for all positions will be open from 3 to 27 April and full details on how to vote will be circulated to members shortly. The election results will be announced on the BSI website on 4 May.

Vacancies

BOARD

President – Peter Openshaw is stepping down at the end of 2018. The President holds the most senior position within the Society. He/she is responsible for providing strategic leadership and works with the Board and senior officers to establish long-term goals, plans and policies. The President plays a pivotal role in representing UK immunology’s interests to a range of external bodies in science and healthcare and is the spokesperson and chief ambassador for the Society. In this four-year role, the President is charged with leading the development of the Society in close collaboration with the other Trustees to meet its purpose and uphold its values. A broad biomedical and scientific vision is essential to the role. The President must be resident in the UK.

Chair of Forum – Anne Cooke retires from her role as Chair of Forum at the end of 2018. The Chair of Forum is responsible for leading on the development of policy work, in collaboration with the President and other Trustees, Forum members, the CEO and staff, as well as feeding into the Society’s strategy for public engagement, careers and education, media and other externally facing activities. The role-holder must be a member of the BSI and based in the UK. They will chair four meetings of Forum per year in London as well as attending the quarterly Board of Trustees’ meetings.

General Trustee – Sheena Cruickshank finishes her term of office as Trustee at the end of 2018. Trustees make active and dynamic contributions to the Board, using their wide-ranging skills, knowledge and experience to ensure good governance and the development of strategy for the Society. They feed into wider activities which help enhance the work of immunology. Trustees are appointed for four years, may be elected for a second term, and may not serve more than two consecutive terms. They are expected to attend Board meetings in London four times a year.

Early Career Trustees (two vacancies) – The Society has created two new Trustee positions for early career immunologists. Applications are invited from postgraduate and postdoctoral immunologists within 8 years of award of PhD (provided they do not hold a tenured position), clinical immunology trainees up to consultant level (unless within 6 months of CCT) or clinical research fellows. Applications are also encouraged from immunologists with PhD or doctoral training who work outside academia or the NHS. Trustees must be members of the BSI. Allowances are made for career breaks.
Why should I stand for election?

We are looking for committee members from all backgrounds and career grades and are very keen to encourage nominations from across the spectrum of our membership. For most positions, you don’t need to have previous experience of sitting on a committee, but you do need lots of enthusiasm and a willingness to get involved to help formulate our activities and policies. This is an exciting time to be involved with the BSI, as we move forward with our strategic plan to support members at every stage of their career and broaden our external profile.

Getting involved with a BSI committee provides a platform, and gives you the opportunity to have your say and help shape the future of the Society and immunology in the UK.

‘Getting involved with a BSI committee provides a platform, and gives you the opportunity to have your say and help shape the future of the Society and immunology in the UK.’

Why should I vote?

Your vote really does count. Your elected representatives will make numerous decisions on your behalf, such as fees for membership and congress registration; which issues are lobbied on at a government level; how funds for travel awards are apportioned; which meetings are funded; and many more issues besides, so engaging with the elections genuinely does make a difference.

You can only vote if you are a current member, so please ensure that your membership is up to date.*

*N Voting is open to all paid categories of membership. Please note, this excludes undergraduate members and low income economy overseas members who do not have to pay a membership fee.
Being the President of the BSI has turned out to be one of the most exciting jobs in immunology. When I took on the role, I thought it would just be a quiet stewardship post with little to do other than turn up and chair the occasional meeting, but it turned out to be much more dynamic than that. There were major issues of strategy, governance and compliance that had to be addressed. The past five years have been busy. We have revamped the senior management, restructured the office, moved to excellent new premises in central London and held our largest and most successful BSI Congress ever. The Society is undoubtedly in great shape with a wonderful team running it.

We are very keen to have a dynamic and diverse Board of Trustees. We don’t want just to represent senior immunologists with an academic background. We also want to hear from immunologists with alternative careers, and to appoint Trustees expert in areas that have not been fully represented in the past. Please do apply to be a Trustee or to join Forum and contribute fully to our core decision-making processes.

‘Our Trustees have the chance to make an active and dynamic contribution to the Society through their responsibility for setting and overseeing our strategy, governance and finances.’
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Brexit: One year since triggering Article 50
What has happened for immunology?

One year since the Prime Minister triggered Article 50 and almost two years since the country voted to leave the European Union, the Brexit decision continues to loom large over the future of science and research. While the Government has continued to voice its recognition of the importance of current EU partnerships to research, there is still no forecast for funding, collaboration and regulation for just over a year from now.

June 2016:
Treasury underwrites Horizon 2020 grants

One of the earliest reassurances made following the referendum was when the Chancellor announced that the Treasury would underwrite Horizon 2020 funding granted before the official exit date, even where the project extends beyond our departure. While this news still reassures those wishing to bid for European funding in the meantime, it does little to answer questions about our future access with EU funding framework programmes.

January 2017:
Industrial Strategy launched

Without doubt Brexit was a driving force for the development of a new Industrial Strategy, a long-term plan to sustain and boost the national economy, which amongst other things included the announcement of an additional £2.3 billion investment for research and development. The life sciences sector was also identified as one of five sectors of key strategic importance to the national economy identified as an area with enormous economic potential. The sector was given the task of delivering a Life Sciences Industrial Strategy, which would help form a Life Science Sector Deal.

January 2017:
Prime Minister makes science a Brexit priority

The Prime Minister set out that Britain must continue to be one of the best places in the world for science and innovation.

June 2017:
Negotiations begin

Almost three months after the Prime Minister triggered Article 50, Phase 1 negotiations began. Phase 1, which took place over six stages, focused on citizens’ rights, the Irish border and the financial settlement. Sufficient progress was made in Phase 1 and both sides agreed to progress to Phase 2.

August 2017:
Life Sciences Industrial Strategy published

The Government commissioned the publication of a Life Sciences Industrial Strategy, led by immunologist Professor Sir John Bell, to recommend how to utilise existing strengths to boost economic growth while bringing increased benefit to patients. Recommendations, such as ensuring an efficient immigration system that allows the recruitment and retention of the talented and skilled individuals, are essential to maintaining UK science’s reputation and success.

September 2017:
DExEU publishes science position paper

A Government policy paper, published by the Department for Exiting the EU (DExEU) outlines its aims for post-EU UK science. Reiterating previous indications, the Government stated Britain’s intention to participate in the EU funding framework, Horizon 2020 and its successor, and that the UK will look to continue working closely with the European Medicines Agency (EMA), and that existing agreements between the EMA and third countries such as Switzerland, USA and Canada provide a precedent which the UK could build on.

September 2017:
Prime Minister reiterates importance of continued EU partnerships to benefit science

In her most significant speech since January, the Prime Minister stated the UK’s financial willingness to remain part of specific policies and programmes that are to the UK and the EU’s joint advantage, including those that promote science.

October 2017:
Brexit Department appoints Scientific Advisor

Chris Jones, a senior civil servant with experience in the Home Office and Department for Justice, was appointed Scientific Advisor for DExEU.

November 2017:
The EMA to relocate to Amsterdam

In November, the EU Council announced that Amsterdam will be the new host location for the EMA. In a joint letter to the Financial Times, the Health Secretary and Business Secretary, said that the UK is fully committed to a close working relationship with the EU, and that the aim is to maintain access to innovative medicines and a strong regulatory framework. The letter stated that the ‘UK would like to find a way to continue to collaborate with the EU, in the interests of public health and safety’.
December 2017:
BSI Congress Brexit debate

Speaking at BSI Congress, local Hove MP, Peter Kyle, and Deputy Director of the Campaign for Science and Engineering, Naomi Weir, discussed a range of topics from citizen rights to funding to science’s place in the current negotiations. The take home message for the audience was that a concrete solution for science is non-existent as of yet so it is as important as ever for scientists to engage with their constituency MPs and other influential bodies, such as the BSI.

March 2018:
Phase 2 of negotiations begins

The second phase of negotiations covering transitional agreements after March 2019 and the future cooperation between the two parties to begin.

The ticking Brexit clock puts continued pressure on the Government. Lead EU negotiator, Michel Barnier, has made it clear that the agreement between the two parties needs to be ready by October 2018 to be ratified by the 27 members states and European Parliament by March 2019. Having taken six months to sufficiently converge on three fundamental issues, it is difficult to envisage a situation where several outstanding issues, including a vision for the future UK–EU relationship, will be determined in 10 months. In any case, there will be lots more to report on over the coming months and the BSI will endeavour to keep you up to date on developments while representing the views of our membership. We encourage you to get engaged in the ongoing debates. If unsure how, please do get in touch!

Shannon Lacombe
Policy and Public Affairs Manager
Email: s.lacombe@immunology.org

Further information:
You can find further information on the BSI’s work on Brexit in the Brexit Briefcase on our website: www.immunology.org/brexit-briefcase.

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You can download a free copy of the BSI’s report Immunology and the UK’s life sciences industry, which looks at the importance of immunology to this sector and makes recommendations for actions the Government should take to support life sciences. The report is available at http://bit.ly/2uMr5vb.
Immunology is a truly global endeavour, and the UK and the BSI benefit enormously from the way in which researchers share ideas, and resources, across boundaries. The rich heritage of immunology in the UK has helped the country to attract many highly talented individuals, and many postdocs and immunologists in industry will work abroad at some point during their career.

How then, does the BSI respond to the shifting landscape of international politics to ensure that our members, and the wider community, continue to enjoy the best possible access to overseas labs, careers, funding and networks?

Careers survey highlights internationalism
Our recent ‘Careers in Immunology’ report included two pieces of work which tell the story of immunology abroad. The first, which looked at the career destinations of some 650 researchers who had completed a PhD in immunology in the UK, showed that these thesis authors are now working in 59 different countries. Two-thirds of them currently work in the UK, with the USA the most popular overseas destination at 10%.

The survey we carried out as part of the project asked over 1,000 people who currently work, or used to work, in immunology what they want from their career – we found that 52% of them have worked abroad at some point in their career. The ability to work in different countries is highlighted as a vital careers step by a significant proportion of our members, and many tell us that it changes their life in terms of giving a wider perspective on the work, learning new techniques and introducing them to new networks and collaborators.

International networks
The BSI is part of a strong interconnected network of groups, a member of the European Federation of Immunological Societies (EFIS) and of the International Union of the Immunological Societies (IUIS). Our flagship Congress attracts speakers from across the world and we also provide travel awards that enable early career researchers to go abroad for key meetings. We maintain good links with our American and Australian counterparts, and the editorial boards for our two journals, *Immunology* and *Clinical & Experimental Immunology*, reflect the global nature of the discipline.

Chinese connections
This summer, the BSI will hold our second joint symposium with the Chinese Society for Immunology (CSI) in the city of Chongqing, with the focus falling on how we foster collaboration and partnership between immunology labs in both countries. This is no easy task, as researchers in the UK and China often know very little about how immunology is supported in the other country, and will almost certainly not have had a chance to visit or form any formal collaboration previously.

At Congress in December, Xuetao Cao, Secretary-General of the CSI, gave a plenary talk on his research, much of it focused on epigenetic regulation of the immune system. His role in biomedical science is a pivotal one. In 2010, he became President of the Beijing-based Chinese Academy of Medical Sciences (CAMS), and spearheaded a new approach to develop biomedical research in China. This more outward facing approach, supported by a strong government strategy to invest in life sciences, involved enabling scientists to work more easily across different disciplines, to secure the funding they needed for their labs to be world-class and to develop international collaborations. It is now envisaged that the UK and China will be able to attract fellowship funding for several post-doctoral researchers to study in both countries over a two-year period.

European links
This September sees the European Congress of Immunology, to be held in Amsterdam. The BSI has helped with the scientific programme planning, and we support this four-day conference with travel awards to enable members to attend it. René van Lier, the President of EFIS, has done much to ensure that the UK and China have regular meetings and feeds in ideas to all their work. Despite Brexit, he sees the collaboration
between ourselves and the European umbrella body continuing to be a strong one and the potential for more collaboration around public engagement, policy initiatives, and so on.

### Internationalism at the heart of BSI policy-making

The internationalist spirit that has always been at the heart of the discipline is reflected strongly in the policy work we do, which usually begins with a discussion at Forum, our policy development committee. Back in June 2016, we produced a report setting out how immunology is a huge asset for the UK, dependent on attracting the best and brightest minds from around the world. Addressed to policy-makers and politicians, it begins: ‘Scientific knowledge, like air, water or even disease, does not respect borders drawn on a map... researchers have always discovered more working together than in isolation, and have worked hard to build a strong, global scientific community.’

The recommendations in this report hold as true today as they did nearly two years ago. Firstly, that immunology needs a high-quality workforce, with our institutions able to attract the brightest and the best to work here. Secondly, that funding for high-quality science should not just be maintained but expanded. We also argued for more to be done to showcase existing partnerships between international bodies, and that global health issues where immunology can make a lasting difference, should be prioritised for discussion at international political summits to ensure that all communities benefit from the discoveries.

Matthias Eberl, a Trustee of the BSI, has worked with staff on policies that support our international approach. He feels strongly about the issue, as a German national who has worked across Europe before settling in the UK to set up his lab at Cardiff University. ‘Immunological mechanisms underlie the pathology in conditions spanning infection, cancer, autoimmunity, cardiovascular disease and dementia, and interventions utilising immunotherapy, monoclonal antibodies and novel vaccines have revolutionised medicine.’

‘As such, research on the immune system is of pivotal relevance for facing the challenges for global health in the 21st century, and requires a concerted effort of scientists, clinicians, funders and politicians.’

Matthias points out that a large proportion of BSI members trained abroad at some stage of their career and have acquired international expertise and social and professional networks; these form the basis of collaborative efforts to investigate basic biomedical pathways and efforts to exploit them for new interventions and diagnostics.

Jo Revill  
CEO, British Society for Immunology  
Email: j.revill@immunology.org
**The Beautiful Cure**

A showcase of immunology

As immunologists, we are well aware of the power, beauty and intricacy of the immune system; how it weaves together a myriad of molecules to deliver the elegant symphony of our body’s defences. Informing and engaging the public with this knowledge is an area close to the BSI’s heart. We know, given the complexity of immune interactions, that this is no easy task, but it is one which Daniel Davis, BSI member and Professor of Immunology at The University of Manchester, has taken to with aplomb. He saw great success with his first popular science book, *The Compatibility Gene*, which discussed the minutiae of the major histocompatibility complex (MHC) and the stories of the scientists who discovered it. Davis is now back with his follow-up book *The Beautiful Cure: Harnessing Your Body’s Natural Defences*, which scrutinises the wider immune system and its role in how our bodies function, considers how our increased understanding of immune system logistics is leading to medical breakthroughs, and takes a critical look at what it means to be healthy. The BSI’s Jennie Evans met up with Daniel at the BSI Congress to find out more about his new book.

“The immune system is unbelievably complex and wondrous,” says Davis, enthusiastically. “The marvels of evolution, space physics, particle physics are already out in public culture but I think immunology is a part of us where our understanding is only now reaching a point where the wonder becomes accessible to the general reader and you gain some sense of the power of immunological science. Hopefully, my book gets across that this is an amazing thing that’s going on inside your body and there is some solace that can be gained from that.”

*The Beautiful Cure* takes us on a tour of the immune system, ranging from classic basic science stories, such as the discovery of the dendritic cell and the role played by cytokines, through to innovative clinical applications, such as checkpoint inhibitors or CAR T cell therapy. For Davis, “the book is about two things. Firstly, the wonders of how the immune system works and understanding this fascinating realm of human biology. On another level, it’s about how this knowledge is leading to a revolution in health, where we can nudge the activity of the immune system up and down to deal with all types of different diseases, from autoimmune disease to cancer.”

Davis is as fascinated by the scientists who carried out the research as he is with the discoveries themselves. While luminaries such as Charles Janeway or Ralph Steinmann are familiar within immunology circles, they are not household names outside our field. However, Davis is a natural storyteller who brings these scientists’ achievements to life for readers through vivid descriptions of their personalities and the forces that drove them to their discoveries. While researching *The Beautiful Cure*, Davis read a lot of research papers “to understand how the science came about”, but he also spoke to the people behind these advances. “I interviewed lots of the people who did the seminal experiments, as well as people working in those labs, to get a sense of what it was like at that moment. It’s a bit like going to a conference – you go to the talks and then discuss with people at the bar afterwards and all that gives you a sense of the big picture of what’s going on.”

“The story of immunology is an amazing tale of human endeavour and adventure that all immunologists are part of. We get caught up in the structure of science as a career, which often involves lots of humdrum activities – metric analysis of our performance, impact factors – and yet really what we do is quite soulful in trying to understand a fundamental part of how the body works. Interviewing the people involved in this work brings to the foreground the fact that we are all passionate about our work. It also tells you that no one person’s contribution is overpoweringly enormous. Even those who have won Nobel Prizes still contributed only a small piece of the puzzle.”

*The Beautiful Cure* successfully debunks the notion that there is any one kind of person who becomes a scientist, or more specifically an immunologist – the variety of routes by which key discoveries are made reflects the enormous diversity of those who are engaged in the search. From the “meeting of minds” between Marc Feldmann and Ravinder Maini to the complementary personalities of Jean Lindermann and Alick Issacs, Davis conveys the huge diversity of characters with inventive, innovative and idiosyncratic approaches that immunology attracts. “There are different ways in which we get to breakthroughs. It’s sometimes
serendipitous, sometimes a lot of planning involved, sometimes a large consortium, sometimes there’s just one person following their nose – each person tackles a problem in their own way,” Davis explains. “Even the people who followed a hunch and were wrong, that’s actually still part of the process. I use the example in the book of how we got to anti-TNF therapy by blocking a particular cytokine. So many personal connections were needed for that to happen – it wasn’t guaranteed that it would work from the outset. All the people who tried other things that didn’t quite work out also deserve credit for what they did just as much as the people who did the thing that did work out. It’s a collective enterprise – it takes one individual and a whole village to make a new medicine and it’s really important that comes across.”

It’s also evident from reading The Beautiful Cure that not all of the scientists highlighted took years to make a seminal discovery. Take Shimon Sakaguchi for example: during his PhD research he discovered a method by which mice could be prevented from developing autoimmune disease. “People spend their whole lives on a problem and things can happen at any moment that work out well,” comments Davis. “One of things that Ruslan Medzhitov said about Charles Janeway was that he was brilliant because he just had so many ideas and he wasn’t afraid of getting it wrong sometimes, and that’s important.”

I was curious to know what discoveries Davis had made while researching this book. He pauses a moment. “If you read biographies of superstar star scientists, you start to think ‘what is the point of my own contribution’? We know that not all members of the BSI are going to win Nobel Prizes. However, from working on this book, the thing that comes across is that there’s no question in my mind, the outcomes we get, it’s still true that you need thousands of papers and people behind it to get to that point. All of the little contributions each of us make are really important to the overall endeavour. That’s the heart-warming thing I get personally from studying how we get to understand how the immune system works.”

“The Beautiful Cure has received high praise in its early reviews, with The Times stating it’s a ‘sweeping tour d’horizon that never shies from complexity but manages, impressively for a science book by a scientist, to remain lucid and entertaining enough to take the reader with it’,1 and The Guardian praising Davis for his ‘culturally literate description of how science is done, by people trying to push egos out of the way to answer fundamental questions’.2 With the current rise in popular science books, The Beautiful Cure opens up the elegance of the immune system to a brand new audience, surely a good thing for immunology as a whole. In these days of ‘fake news’ with a myriad of unfounded celebrity health claims, it’s warming to see a book on immunology that doesn’t shy away from the complexity, but instead takes its reader on a journey into the meticulous detail of how our bodies function, to experience the years of endeavour and collaboration that bring about these new discoveries, and to look forward at what the future may hold.

“We’re at a very interesting time in immunology for many reasons,” comments Davis. “Although there are still many gaps in our understanding, we’re now at a point where the knowledge we have is leading to new medicines, which brings up a lot of new questions. For example, it’s quite hard to be clear about what disease is – we don’t want to strive towards any kind of human perfection – there has to be a diversity of health and disease and it becomes hard to define this in many situations. There’s also issues around the cost of medicine, which are really important. The latest CAR T cell therapy is about $475,000 per patient treated, and, in a world where the average income is much lower, that becomes a problem. So, although this health revolution has moved us forward in terms of the medicines that we can or soon will be able to provide, we now have new questions raised that society as a whole needs to tackle.”

Interview by Jennie Evans

REFERENCES
2.  Rutherford A. The Beautiful Cure by Daniel M Davis review – how our immune system has shaped world history. The Guardian, 31 January 2018

The Beautiful Cure: Harnessing Your Body’s Natural Defences is published by Bodley Head and is available in all good book stores and online.
Immunology News | March 2018

When immunology meets metabolism... a match for immune disease?

Until recently, immunology and cellular metabolism have been considered distinct disciplines; the only time most of us thought about metabolism was during undergraduate examinations, where the Krebs’ cycle was memorised, and promptly forgotten. However, a recent explosion of research has led us to the inescapable conclusion that cellular metabolism and immunity are intertwined and must be considered together; thus, the foundation of the burgeoning field of immunometabolism.

Cellular metabolism – a refresher

Immunometabolism is the study of how intracellular metabolism underlies immune cell function and activation. The biochemical pathways leading to the generation of cellular energy from carbohydrates and fatty acids, derived mainly from the diet, were first defined early in the 20th century by pioneers such as Hans Krebs. Glycolysis consists of a 10-step process by which glucose is converted into pyruvate, yielding two molecules of adenosine triphosphate (ATP), the cellular currency of metabolism. When oxygen is available, cells tend to generate the majority of their ATP through the Krebs’ cycle and oxidative phosphorylation (yielding 30–36 ATP molecules from a single glucose molecule), a process which occurs in the ‘powerhouse of the cell’, the mitochondria.

The Warburg effect

Although metabolism through Krebs’ cycle is more efficient in terms of energy yield, during times of oxygen deprivation, cells may use glycolysis to generate energy (anaerobic glycolysis). However, in the 1930s Otto Warburg made the stunning discovery that cancer cells rely on glycolysis for the generation of energy, even when sufficient oxygen is present, the so-called ‘Warburg effect’. This strange form of metabolism means that cancer cells have a voracious appetite for sugar.

‘If we can understand how metabolic processes are altered during disease, we could potentially use a wide range of currently available drugs to directly target immune cell metabolism in patients’

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Metabolic rewiring

Multiple studies have shown that mounting an immune response has a definable ‘metabolic cost’, and that activation of specific immune cells requires distinct metabolic rewiring. However, interestingly, immune cells may repurpose the products...
of metabolic processes in order to carry out their basic functions more effectively. For example, neutrophils have relatively few mitochondria and consume little oxygen, preferring to depend on aerobic glycolysis for energy production. This unusual metabolic setup leads to the production of hydrogen peroxide, which can be repurposed for pathogen killing. In contrast, another ‘metabolic rewiring specialist’ is the macrophage; after activation through toll like receptor 4, the metabolite succinate, derived from the mitochondria, stabilises the transcription factor HIF-1α, leading to production of pro-inflammatory IL-1β.

As metabolic rewiring within a cell after activation can drive inflammation, so too the local environment can have profound effects on immune cell metabolism. Inflammatory conditions may alter the microenvironment, driving changes in immune metabolic signatures. Likewise, systemic metabolism and metabolic diseases are very much influenced by immunity. For example, metabolic syndrome is mediated in part by dysregulated immune cells similar to inflammatory and autoimmune disease states; although, whether this is due to the ‘chicken or the egg’, is very much to be defined.

Targeting cellular metabolism in immune disease

It is now evident that the basic functions of immune cells may be regulated through the metabolic pathways that are necessary to support energetically demanding functions. It is therefore not a great leap to consider that manipulation of cellular metabolism can have profound effects on immune cell function, survival and proliferation. Rather than being a purely academic curiosity, targeting cellular metabolism has become an attractive target area for therapeutic purposes. As new and exciting discoveries in the field of metabolism continue to reveal novel and unexpected links between immunology and metabolism, the key question is, how can this knowledge be translated into innovative ways to treat immune-driven disease?

Recently, it has been shown that manipulating metabolic pathways of cancer cells, T-cells or immune suppressor cells can enhance anti-cancer immunity and suppress tumour growth. For instance, metformin, an anti-diabetic drug, enhances the development of memory T-cells by switching cellular metabolism from glycolysis to mitochondrial respiration. These findings have led to an exciting possibility of re-invigorating anti-cancer immunity by small molecules targeting cellular metabolic pathways. But what of other chronic and acute diseases?

A promising future

If we can understand how metabolic processes are altered during disease, we could potentially use a wide range of currently available drugs to directly target immune cell metabolism in patients. Undoubtedly, as this fascinating area develops, and as understanding of the links between metabolism and immunology grows, new opportunities will arise for novel and unexpected therapeutic avenues to control metabolism and disease.

Adam Byrne
Lecturer in Chronic Lung Disease
NHLI, Imperial College London
Launching the award

This was the first year the BSI has launched a Teaching Excellence Award and we were happy to have received 10 strong applications from immunologists from across the country. We launched the award with the aim of promoting excellence in immunology teaching and raising the profile of immunology educators. We want to acknowledge the great work lecturers and teachers do to ensure aspiring immunologists are well trained and skilled, feeding the immunology jobs pipeline. Without these excellent teachers, the state of immunology research would be much weaker.

Our panel of judges was very impressed by the high standard of nominations, which made it a tough competition to judge. We would like to acknowledge the great work lecturers and teachers do to ensure aspiring immunologists are well trained and skilled, feeding the immunology jobs pipeline. Without these excellent teachers, the state of immunology research would be much weaker.

During the 2017 BSI Congress, the inaugural BSI Immunology Teaching Excellence Award was presented to Andrew Foey from Plymouth University. Andrew was ‘gob-smacked’ when he heard the news that he had won the award as he was unaware that he had even been nominated. After taking time to reflect on his achievement, he commented, “What a pleasure it was to have won the award from the BSI, as they drive excellence in immunology research, making winning the award a real honour.”

We were delighted that Andrew was able to join us at the BSI Congress in Brighton to pick up the award in person and it was great to hear that he is planning on using the prize to benefit his students.

Career progression

We spoke with Andrew after he was presented with the award, to learn about some of his experiences teaching immunology and to gain insight into the work he does. Having been at Plymouth University for over a decade, Andrew’s teaching contributions span several departments and faculties at the University. He teaches immunology to students on several courses including Dentistry, Biomedical and Healthcare Science and Applied Biological Sciences. A particular highlight for his students is a final year module on ‘Cellular Immunity’ that Andrew leads. The module is consistently given excellent comments from student feedback, with particular praise going to Andrew’s teaching methods and enthusiasm for the subject.

When speaking with Andrew, we were interested to hear how he first got involved with immunology teaching. “I wanted to make sure that I didn’t end up being ‘the oldest postdoc’, therefore, I had to make the transition to start a fellowship or a lectureship. Pursuing a fellowship didn’t allow me to progress in the way I wanted, so I took up a lectureship position at Plymouth. The position allowed me to continue with my research in a teaching environment, giving me the opportunity to directly enthuse and inspire students. Presenting my work as well as the work of other immunologists to my students meant that they were exposed to the latest immunology research as well as ensuring I myself was keeping up to date with the latest developments in the field.”

Andrew gets real pleasure from seeing his students progress and do well. Hearing about the achievements of his former students is a great source of pride for him. With some of his students going on to study PhDs in immunology, win essay writing awards or being chosen to present their research at conferences,
Andrew has helped many students to progress their careers in immunology.

Teaching techniques
The nominations we received for Andrew made clear his use of interactive and engaging teaching methods. He is known for using animations, board games and encouraging students to get up to partake in interactive exercises mid-lectures. When asking Andrew if he had any key messages he tries to get across to his students, he said, "I try to relate with my audience and react to the response I get from them. I start with basic concepts (of immunology) and then the teaching can be built from how students respond to that information. I try to put myself in their situation and appreciate what they will understand. With so much complex, tough nomenclature involved in immunology, I try to deconstruct the subject into its simplest, most basic concepts and build from this."

Being able to guide his students through this complex material, using well designed and innovative learning experiences seems to be one of Andrew’s greatest qualities. A former student of Andrew’s complimented him on his ability to gauge the response of his students to the information he’s presenting and not being afraid to finish a lecture early if he feels that the audience has reached saturation point. This ability to respond to the needs of his audience ensures that he doesn’t overload students with too much information that they are no longer taking in.

We were also told about the innovative way in which Andrew conducts his seminars, allowing them to be mostly student-led discussions, often letting students determine the direction of the discussion, whilst he guides the conversation towards a particularly interesting topic that may be overlooked. These interactive seminars along with his exciting lecturing techniques ensure students remain attentive and engaged in immunology.

Enthusiasm for the subject you’re presenting is something Andrew believes to be one of the most important aspects of being a science teacher. He believes that when a teacher is enthusiastic and passionate about the subject they are teaching, it comes across to the students and helps them engage with the material.

Inspiring immunologists
Another aspect of Andrew’s teaching, which was highlighted, is the importance he puts on familiarising his students with the work of other prominent immunology researchers. He will often introduce his students to the work of researchers he finds particularly inspiring, providing a name and a face to those who work on the content he teaches. As a piece of advice for aspiring immunologists, Andrew says, "Find people who communicate their research in a way that inspires you. Excellent immunology communication induces enthusiasm in people and makes them want to learn more about the subject. I’ve been fortunate to have had the opportunity to work with excellent immunology communicators. Listening to people such as Luke O’Neill and Polly Matzinger has inspired me to engage with immunology and further my enthusiasm for the subject."

Andrew believes that having an enthusiasm for the work you carry out is something that helps you when things don’t always go the right way. One of the biggest challenges facing aspiring immunologists, according to Andrew, is dealing with disappointment, whether that be an unsuccessful grant application, lack of job opportunities or laboratory results not going your way. All these challenges test your resilience and having a passion and enthusiasm for your work helps you persevere through these hard times. Not only an excellent lecturer, we’ve been told about Andrew’s skills as project advisor for students learning practical laboratory and research techniques. He teaches his students to understand the story that the data are telling and is more than happy to spend time discussing possible theories and significance of the data that’s been obtained.

Going the extra mile
Through hearing from his students, it is clear that Andrew is on hand to assist them outside of timetabled teaching hours whenever possible; being happy to hold additional teaching or revision sessions with those who may be struggling with particular concepts or those who are looking to further their knowledge. While maintaining his commitments at the University, teaching immunology modules and carrying out research, Andrew still finds time to visit local primary and secondary schools with his outreach activities, which are

What Andrew Foey’s students say...

“Amazing teacher, tutor & mentor ... inspired me to follow in your footsteps and become an immunologist ... probably the biggest compliment I can give you.”

“After two years of immunology, I have found the field I want to lead my career in – thank you for the inspiration!”
Nominations for the 2018 Immunology Teaching Excellence Award will open on 1 May 2018. Applications can be made by students (including former students), colleagues and via self-nomination. Full details of the nomination process will be available on the BSI website when nominations open.

Further information

From those who nominated Andrew for the award...

“Andy’s lively, interactive, and surprising teaching elements serve to keep students involved and attentive throughout lectures. He has inspired me to pursue a career in immunology. He has instilled in me a love of research through his infectious passion for the subject and his relentless motivation to inspire the next generation of immunologists.”

Helene Stern, Research Masters student in the School of Biomedical and Healthcare Sciences

“I am absolutely delighted on behalf of the School and the Faculty that Andy has won this award, as his teaching methods are both innovative and effective. Amongst traditional lectures, seminars and practical work, he has introduced peer-review and peer-assessment into his modules, as well as journal clubs. He uses animations as well as board games to explain the complexities of cellular immunity. Andy is an incredibly dedicated and passionate immunologist, keen to enlighten as many people as possible in the complex, fascinating, vital world of immunology, and is a hugely deserving winner of the BSI Teaching Excellence Award.”

Andy Evenden, Associate Dean for Teaching and Learning in the Plymouth University Peninsula Schools of Medicine and Dentistry

‘Find people who communicate their research in a way that inspires you. Excellent immunology communication induces enthusiasm in people and makes them want to learn more about the subject.’

When teaching immunology, the content covered at the BSI Congress is a measure of what can be achieved. Being able to interact with these individuals and the concepts they work with allows you to broaden your immunology knowledge. Attending the BSI Congress allows you to catch up with old friends, learn and make new friends.”

It is with great pleasure that the BSI awarded this inaugural Teaching Excellence Award to Andrew Foey and we hope to replicate the high standard of winner when we hold the award in 2018.

Glyn Jones,
Educations and Careers Officer
Email: g.jones@immunology.org

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Congratulations

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

Bright Sparks shine through

The BSI Congress saw the return of our very popular ‘Bright Sparks’ sessions, highlighting exceptional work from PhD students and postdocs. The judges praised the incredibly high standard of presentations across both sessions.

Laura Pallett [University College London] won the postdoc session for her talk entitled ‘Induction of tissue-resident T cells as sentinels for therapeutic vaccination’. Runners-up in this session were Louise Hosie (University of Birmingham) and Felipe Melo-Gonzalez (The University of Manchester).

Meanwhile, the PhD session was won by Tomas Castro-Dopico [University of Cambridge] for his presentation on ‘Anti-commensal IgG augments intestinal inflammation in ulcerative colitis via IL-1beta-dependent Th17 immunity’. Runners-up were Raef Albugami [University of Birmingham] and Melissa Verheijen [University College London].

Our congratulations to all the finalists.

Vaccine campaigner wins John Maddox Prize

Our congratulations go to Riko Muranaka, who won the John Maddox Prize for her work countering misinformation about the Human Papilloma Virus (HPV) vaccine. Riko Muranaka is a doctor in Japan who has stood up to explain the benefits of this vaccine, in a country where scare campaigns have seen the vaccination rate fall from 70% to 1%, and despite considerable hostility, personal threats and legal challenges.

The John Maddox Prize is a joint initiative between Sense About Science, Nature and the Kohn Foundation, to recognise individuals to have gone above and beyond to stand up for science in public debates.

On hearing news, Dr Muranaka said, “It is a great surprise and pleasure to be awarded such an honourable prize, one that commemorates a great editor and writer Sir John Maddox – a champion of evidence who believed in promoting sound science in the public interest, even in the face of hostility. In terms of my own work, I simply cannot ignore dangerous claims that threaten public health. I want people to hear the truth, that’s the reason I continue to write and speak out.”

Poster prize winners

Our congratulations to the following poster prize winners from the 2017 BSI Congress. With 382 posters presented, this year’s competition was exceptionally high. The winners were:

• Katherine Walwyn-Brown [The University of Manchester]
• Jesuthas Ajendra [The University of Manchester]
• Yang Li [University of Sheffield]

New Year’s Honours

Congratulations to BSI member Sir Keith Peters who was appointed a Knight Grand Cross of the Order of the British Empire for services to the advancement of medical science. Sir Keith carried out seminal work on the role of the body’s immune system in kidney disease.

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• Yang Li [University of Sheffield]

Communicating Immunology Grants

The BSI is delighted to have funded one project through the last round of our Communicating Immunology Grants. Iris Mair [University of Edinburgh] received funding for an interactive workshop for 8–13-year-olds to explain how immune cells can recognise and kill both infections and cancer cells. The next grant deadline is 1 April. You can find more information at www.immunology.org/grants-and-prizes.

Travel grant success

The following members were recently awarded BSI travel grants:

Andreas Alber, Fawwaz Ali, Alessandro Barbarulo, Elisa Corsiero, Lynda Coughlan, Rebecca Dookie, Lydia Dyck, Sonja Haupt, Mazlina Ismail, Johanna Knipper, Edward Lee, Laura McCulloch, Nawamin Pinpathomrat, Andrea White and Mieszko Wilk.


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.
REGISTRATION
Benefit from the Early Fee until June 29!
ABSTRACT SUBMISSION
Don’t miss to submit your abstract until April 23!
Hands-on Workshops
Limited availability! Sign up now!

5th European Congress of Immunology
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www.eci2018.org

Under the auspices of EFIS, European Federation of Immunological Societies
www.efis.org
and the Dutch Society for Immunology, NVVI
www.dutchsocietyimmunology.nl
FUTURE FOCUS

Funding your ambitions

The BSI supports the work of our members by offering a range of schemes in the form of grants, awards and prizes. These provide financial support, enabling you to further your career, research interests, and knowledge, as well as affording you recognition amongst your peers for your contributions to immunology.

TRAVEL AWARDS
Provide funding to BSI members to cover travel costs to attend domestic and international conferences

Value: £500 for travel within the UK; £700 for European travel; and £1,000 for rest of the world.

Upcoming deadlines:
Noon on 1 May, 1 August, 1 November

COMMUNICATING IMMUNOLOGY GRANTS
Provide BSI members with funding to run their own public engagement activities

Value: Up to £1,000

Upcoming deadlines:
1 April, 1 July, 1 October

IMMUNOLOGY TEACHING EXCELLENCE AWARD
Recognise immunologists who use excellent communication skills to convey immunology concepts to a range of students in an engaging and accessible manner and inspire the next generation of immunologists.

Value: £1,000

Upcoming deadlines: Applications open 1 May 2018 and close September 2018

COMING SOON...
TRAVEL GRANTS TO ECI
Check our website for more details

IMMUNOLOGY UNDERGRADUATE AWARDS
Promote excellence in the study of immunology at undergraduate level, and encourage gifted students to pursue further postgraduate study, or a career in immunology. Applications are made by BSI members on behalf of their university/institute.

Value: £100, free membership and a prize certificate

Upcoming deadlines: 28 April

SUMMER PLACEMENT AWARDS
Provide BSI members, who are medical students and postgraduate students (PhDs & MScs), with funding towards a formal placement/medical elective either in the UK or overseas. The placement must have immunological relevance.

Value: Up to £1,500

Upcoming deadlines: Continuous

Further information:
For more information, visit www.immunology.org/grants-and-prizes
Data science for immunologists

As scientific method has evolved, and with the advent of -omics and big data, the ability to analyse large and complex datasets is now a must for all immunologists. However, these skills are not routinely provided in training and, with the increasing complexity of datasets, existing software may prove inflexible and unable to deal with the nuance required. With these developments, perhaps a new approach is needed… enter data science.

While the mere mention of data science and programming may be enough to strike fear into the hearts of many an immunologist, help is at hand. Nic Thomas, a professional data scientist, and Laura Pallett, a postdoctoral immunologist at University College London, have collaborated to produce a new book, *Data Science for Immunologists*, a beginner’s guide to data science, focussing on the practical aspects and providing sufficient theoretical background for researchers to be able to understand and implement the analyses on their own data. We sat down with them to find out more about what data science is and how it could help you.

What is data science?

“Data science is a broad area of analytics that means different things to different people,” explains Nic. “I would classify it as the intersection of mathematical and statistical techniques and the ability to programme those ideas to get an answer to a hypothesis you are trying to test. Essentially, it’s the intersection of maths and programming.”

So, why is it important for immunologists to understand data science? “For a variety of reasons,” replies Nic. “First of all, I know it’s an overused cliché, but big data is only getting bigger. Immunologists need to learn the skills to deal with this deluge of data.” Laura adds that this is definitely her experience. “As immunologists, we acquire data now that routinely has upwards of 50 parameters for each individual sample. For me, it got to the point where the standard analyses I was using weren’t capable of doing a sensible job on it or having the computational power.”

Additionally, Nic highlights the importance of accuracy and reproducibility of any analysis. “Any scientist should want to make sure that their analysis, be it through traditional statistics, or more advanced machine learning methods, is as accurate as possible and based upon the right assumptions. A core understanding of data science is important to be able to ensure that those findings are accurate and that if, for example, we disprove a hypothesis, that this is valid and based upon the right assumptions.”

Two sides

Data science is certainly a growing area and, with their complementary backgrounds, Laura and Nic seem the ideal team for a project such as this, which brings together two different disciplines. Laura has a background in immunology, having initially completed a PhD in viral immunology before taking up a postdoc at University College London on mechanisms of immune dysfunction in chronic hepatitis B infection. “As an immunologist, I continually have to deal with overwhelming amounts of data. The key thing for me was the number of parameters you could record now by flow cytometry. I was unable to analyse the data by eye or by using the standard statistical packages. I needed the confidence and skills to look at big data in a completely unbiased way without any preconceptions from the literature.”

Nic meanwhile comes at the project from a different angle. Having completed a maths degree, he undertook a PhD at University College London in the CoMPLEX department, which aims to train mathematicians and physicists in how

‘The book is designed to provide immunologists with a step-by-step guide to some of the common techniques that could help them analyse their data and really build confidence in their ability to carry out these analyses’
‘Any scientist should want to make sure that their analysis, be it through traditional statistics, or more advanced machine learning methods, is as accurate as possible and based upon the right assumptions’

to apply their skills to medical research. “Towards the end of my PhD, I started collaborating with Laura on a few projects she was working on, and that’s what piqued my interest in seeing there’s a niche for more immunologists to learn data science. I think it’s probably daunting at first for a lot of immunologists to learn data science, just like it’s daunting for mathematicians to go into the lab for a first time and try to work out what you’re trying to do. The aim of our book is to address that need and make maths and programming accessible to immunologists and medical researchers.”

**Analysing complex datasets**

The pair decided to work together to develop a ‘beginner’s guide’ to the intricacies of analysing complex immunological datasets for those of us with little experience in the world of maths and programming. As the name would suggest, *Data Science for Immunologists* provides a tailored approach to the methods and techniques that would be of most use to researchers working in the discipline, including visualisation techniques, building predictive models and frequentist statistics. For example, this includes placing the techniques within common scenarios that immunologists are likely to encounter, such as using clustering techniques to analyse flow cytometry data or using machine learning concepts in the context of developing a clinical patient model.

The book is also accompanied by a website, www.datascienceforimmunologists.com, which provides worked-through examples of key techniques using a published raw dataset. This means readers can take a practical hands-on approach and check they understand and can replicate the methods used.

**Learning opportunities**

“I think very few universities offer their PhD students and postdocs in-depth training in statistical methods or data analysis,” states Laura. This is certainly a trend that the BSI has noticed, with 49% of respondents to our recent careers survey stating that they would like more training opportunities, 14% stating lack of skills in these areas particularly around statistics/data, and 14% stating lack of skills in these areas had been a major barrier to their career. “The book’s primary aim is to give an introduction to what data science is, how you should organise and think about data,” comments Laura. “It is designed to provide immunologists with a step-by-step guide to some of the common techniques that could help them analyse their data and really build confidence in their ability to carry out these analyses.”

“There’s something in there for everyone,” adds Nic, “but specifically I would say the book is aimed at early career researchers, particularly PhD students and postdocs, who might not have had much exposure to different analytical techniques and who might be limiting themselves to techniques they have used previously.”

**Top tips**

And what tips would Laura and Nic give to immunologists faced with a large dataset to analyse? “Read around and see what else has been done,” says Nic. “There’s no point in putting in lots of work to write your own code from scratch if someone in the programming community has already developed code that is available for you to use.” Laura adds that data organisation is also an important skill to master. “In immunology and science in general, there is an issue with data reproducibility at the moment. Having a sensible, well thought through file structure and organisation to your data gives you a level of control over reproducibility and will enable you to run some high-level analyses.” Additionally, Laura emphasises the importance of having a basic understanding of the statistical methods behind any analysis you wish to do. Start with a clear hypothesis and make sure that you run the analysis to fit that hypothesis. Finally, Nic recommends that you experiment with programming. “It’s hard to learn everything at once, so don’t be afraid to play around with programming languages and techniques to understand how they work and how they can be used to best analyse your data.”

Interview by Jennie Evans

*Data Science for Immunologists* is available on Kindle and through the Kindle App for Android, iPhone, Mac and Windows. It can be downloaded at https://goo.gl/deVpzJ.

Visit their website www.datascienceforimmunologists.com, or follow the twitter feed @datasciimmunol, for more information (and updates) and to access examples of how common immunological data sets can be analysed.
Meet the speakers!

After the popularity of the keynote and plenary sessions at our recent Congress, we thought you might like to find out a little more about some of the speakers through our quick-fire questions looking at what enticed them into immunology and what advice they have for up and coming researchers.

LUKE O’NEILL
Chair of Biochemistry, Trinity College Dublin.

Where did you grow up?
Bray in County Wicklow, 12 miles south of Dublin.

Who/what inspired you to study science?
Fran Mooney, my biology teacher in secondary school.

Why did you get into immunology?
A fascination with the process of inflammation led me to immunology. I realised that there was a lot to be discovered, and also that it might be possible to discover processes that could be amenable to therapeutic targeting for inflammatory diseases.

What is your favourite immune cell and why?
The macrophage – a never-ending wonder...

What do you most enjoy about your current role?
The thrill of people in my lab making discoveries.

Who do you most admire?
Myself in 10 years’ time ... joke! In science, my mentor when I was a postdoc, Jerry Saklatvala.

How would you like to be remembered?
If scientists have done a good job they will mainly be forgotten – someone else should take up the baton. Apart from that, maybe as someone who made a difference.

What is the most important lesson you’ve learnt through your career?
Anything worthwhile will be very tough, so stick at it, with the support of your colleagues – camaraderie and collaboration in science is a really important aspect of what we do and it keeps us going.

What advice would you give to early career researchers?
Don’t be put off by all the neg-heads.

ARTURO ZYCHLINSKY
Director, Department of Cellular Microbiology, Max Planck Institute for Infection Biology, Berlin, Germany

Where did you grow up?
Mexico City

Who/what inspired you to study science?
My sister

Why did you get into immunology?
Interested in infectious diseases.

What is your favourite immune cell and why?
Neutrophil: it has a cool nucleus.

What do you most enjoy about your current role?
Interacting with students and postdocs.

Who do you most admire?
Johan Sebastian Bach

How would you like to be remembered?
I don’t need to be remembered.

What is the most important lesson you’ve learnt through your career?
Think simply.

What advice would you give to early career researchers?
Do it with passion.
What is your favourite immune cell and why?
As with my children, I cannot possibly have a favourite immune cell. As a clinical translational investigator, I seek to integrate immune pathology and to understand it to the point of rational intervention. To choose wisely, and impartially, in terms of therapeutic targets, I suspect that it is sensible to have no preferred cell or molecule in mind a priori!

What do you most enjoy about your current role?
Its diversity – to treat people with chronic disease, to investigate the pathogenesis that afflicts them, to teach and mentor bright minds, to engage with wise colleagues in my College, and on an international basis most days – what is not to enjoy?

How would you like to be remembered?
As curious and kind.

What is the most important lesson you’ve learnt through your career?
Don’t worry so much about being ‘wrong’ – if our thinking is truly original and if we are challenging the status quo, then our pathways to discovery will often mislead, but occasionally, they will remarkably illuminate our understanding.

What advice would you give to early career researchers?
Continue to read, think, and ask new questions – then let the data inform the answers. Above all, enjoy the privilege of discovery, and remember that great science is delivered by great teams.

‘Enjoy the privilege of discovery, and remember that great science is delivered by great teams.’

IAIN MCINNES
Muirhead Professor of Medicine and ARUK Professor of Rheumatology, University of Glasgow.

Where did you grow up?
I grew up in the beautiful, interesting and exciting city of Glasgow.

What inspired you to study science?
Medicine has always been my passion and thus was my first career ambition – my interest in science grew from a desire to understand disease mechanisms. I firmly believe that understanding pathogenesis is the optimal route to improving outcomes for people with inflammatory diseases.

Why did you get into immunology?
The medical discipline that fascinated me most was rheumatology – its diseases pose such fearsome disability upon people and are almost all chronic and incurable. Immune and inflammatory function sit at the core of their pathogenesis and clinical progression. Immunology was thus the obvious scientific discipline to pursue. Over time, I have come to love immunology for itself. It is an extraordinary fusion of cellular and molecular activity, operating and integrating across so many mammalian systems to provide the necessary complexity and agility that permits host defence and tissue homeostasis. Ironically, as we understand more about immune-mediated inflammatory diseases, and develop ever more ambitious and effective immune-targeted therapeutics that are shared across diseases, I suspect I shall soon find myself a clinician of many disciplines!

GITTA STOCKINGER
Principal Investigator at the Francis Crick Institute

Where did you grow up?
I grew up in Mainz, Germany.

Who/what inspired you to study science?
After an initial venture into studying arts, I thought science would be more decisive and exact (hmm...).

Why did you get into immunology?
I worked at the blood transfusion centre in the holidays and was involved in HLA typing of mothers and their newborns, which triggered my first interest in immunology. Then, I gate-crashed a course in the medical faculty at Mainz which had immunology as a topic (immunology was not taught in the biology faculty at that time). I was immediately smitten.

What is your favourite immune cell and why?
Had you asked me a few years ago, I would have said a T cell but I have changed my mind. There are so many fascinating immune cells and they all work together – it’s not good to be too obsessive about just one type.

What do you most enjoy about your current role?
The excitement of unravelling biological processes. It never gets boring and every time you discover something new a new horizon opens.

‘Enjoy the privilege of discovery, and remember that great science is delivered by great teams.’

Continued on p30
Who do you most admire?
All the staff in our support facilities that keep us afloat and running.

How would you like to be remembered?
I don’t really care.

What is the most important lesson you’ve learnt through your career?
Keep an open mind and look out for the unexpected.

What advice would you give to early career researchers?
Don’t let the tedium of routine, paperwork and experimental failures get you down. Keep your excitement about the science you are doing – it will carry you through dark times.

‘I enjoy the excitement of unravelling biological processes. It never gets boring and every time you discover something new a new horizon opens.’

WILLIAM COOKSON
Professor of Genomic Medicine, National Heart and Lung Institute, Imperial College London.

Where did you grow up?
I was born in England, but I spent most of my childhood in Africa, living in Malawi when I was a little boy and then in Zimbabwe. The family moved to Australia when I was 12, where I finished school, drank beer, played rugby, and studied medicine. I moved to Oxford when I was 30 because I wanted to make a career in research.

What inspired you to study science?
My father ran the Pathology Department at Harare Hospital. He used to take me in with him out of hours, when he was doing his research on schistosomiasis. I still remember the equipment, the warm smell of laboratory animals, the tanks for snails, the microscopes, and the darkrooms and chemical solutions where we developed films. It was love at first scent!

What advice would you give to early career researchers?
Don’t let the tedium of routine, paperwork and experimental failures get you down. Keep your excitement about the science you are doing – it will carry you through dark times.

‘I enjoy the excitement of unravelling biological processes. It never gets boring and every time you discover something new a new horizon opens.’

What is your favourite immune cell and why?
Eosinophils, because an epigenome-wide association study showed enormous effects on IgE levels and atopic asthma, and discovered new markers for eosinophil activation. The study quantifies that eosinophils are the most important cells mediating atopy, in a way that would be impossible from standard cellular immunology.

What do you most enjoy about your current role?
Being progressively surrounded by enthusiastic, clever and creative young scientists.

Who do you most admire?
Sir David Weatherall, who was Nuffield Professor of Medicine in Oxford. He is a great clinician, with a brilliant intellect and was enormously powerful in UK science. Even though I was very junior, he always had time to meet me and give advice and practical help. He was the same with all of us. He has china-blue eyes and puffed at his pipe in his office, so our discussions resembled consultation with a deity in an incense-filled temple.

How would you like to be remembered?
For having made an outstanding discovery 18 months from now.

What is the most important lesson you’ve learnt through your career?
Persistence. If you are not upsetting the occasional reviewer, you are not doing anything original.

What advice would you give to early career researchers?
Go to the best lab that you can. To be successful you need to learn from the best people and be exposed to the best ideas. Work as hard as you can, at least some of the time. Scientific disciplines are called so for a reason.
ERAN ELINAV
Professor of Immunology, Weizmann Institute of Science, Israel

Where did you grow up?
I grew up in southern Israel, then moved as a teenager to New York following my father’s relocation and moved back to my home country at the age of 18 for the mandatory army service.

What inspired you to study science?
I began my career as a physician, specialised in internal medicine and then gastroenterology. I was intrigued by the complexity of the human body and human disease, but was frustrated by our lack of deep understanding of many of the common diseases I encountered as a doctor. This was my main motivation to move into science at a relatively late stage of my clinical training.

Why did you get into immunology?
Immunology was always an intriguing system to me that constantly decided between induction of ‘tolerance’ to our surroundings, to initiation of an explosive response once a threat such as infection or cancer is encountered. The immune system is also the main system that deals with the huge ecosystem of bacteria constituting our microbiome. For all of these reasons, immunology for me was the discipline most interesting and most challenging.

What is your favourite immune cell and why?
The intestinal epithelial cells. While this cell is not perceived by many to be ‘immune’, we and others discovered that it possesses many critical innate immune functions such as inflammasome machineries, toll-like receptor responsiveness and anti-microbial peptide secretion capabilities. Intestinal epithelial cells form 99% of the surface that interacts with the microbiome and, as such, are critically important in initiating tolerance and support to the microbiome at times of peace, or initiating an explosive innate and adoptive immune response when pathogens are introduced into the system or when the microbiome breeches the epithelial protective layer.

What do you most enjoy about your current role?
I love interacting with my students and postdocs on both a personal and scientific basis, discussing science and making discoveries that may one day benefit mankind.

Who do you most admire?
I admire early day immunologists such as Élie Metchnikoff, Paul Ehrlich and others who were able to reach amazing and ground breaking discoveries based on very simple observations and very primitive technologies. They are role models for me in observing nature and trying to learn more about the unknown in our surroundings.

How would you like to be remembered?
As a person who tried his best to advance science and medicine, and who nurtured a successful new generation of young scientists.

What is the most important lesson you’ve learnt through your career?
To trust your intuition and never give up. Some of the discoveries I reached were achieved after years of failures and hard work. Following the leads and believing my findings despite scepticism from around helped me finally reach understanding and insight.

What advice would you give to early career researchers?
Follow your dreams, don’t be deterred by hard work, initial failures and slow progress. If you’ve got the ‘fire’ inside you to do science and explore the unknown – just do it! You’ll end up being successful. Also, be thankful to your supporting family. While scientists, and especially young scientists, often make a huge sacrifice in doing science, their families make equally big sacrifices in supporting them. Without my wonderful family, I would never have been able to devote so much of my time and energy towards science.

CLAIREE BOOTH
Senior Clinical Lecturer in Gene Therapy at UCL Great Ormond Street Institute of Child Health & Honorary Consultant in Paediatric Immunology at Great Ormond Street Hospital, London

Where did you grow up?
I was born in Sheffield, grew up close to Aylesbury in Buckinghamshire, and moved to London when I was 16.

What inspired you to study science?
I’ve always been interested in understanding the human body and fascinated by disease so it came naturally to me to study medicine; it had been my plan from about the age of 5.

Why did you get into immunology?
Actually, I was initially more interested in bone marrow transplant but took an immunology job, and the rest is history...and over the past decade or so the importance of the immune system in health and disease is becoming more evident. It is such an exciting field to be part of.

What is your favourite immune cell and why?
There are so many now with new ones characterised every week! I have a soft spot for T follicular helper cells – it stems from my work in XLP, where patients have non-functional TFH cells, but one of my PhD students is obsessed by them so it’s been a bit contagious! Their journey through germinal centres is so elegantly choreographed and they can give you some stunning images.
**What do you most enjoy about your current role?**
I’m very lucky that my role involves so many different areas and no two days are the same. In the same day I can see patients in immunology clinic, meet with my group to discuss pre-clinical lab data and enrol a patient on a clinical trial of gene therapy. Being able to combine research and clinical care is what I enjoy the most.

**Who do you most admire?**
Emma Morris and Siobhan Burns at the Royal Free Hospital who work in immunology and transplant (and some gene therapy too). They have been great role models in how to progress a clinical academic career, juggle politics, family, research and clinical work (not necessarily in that order!) and maintain a cheery disposition and wicked sense of humour at the same time.

**How would you like to be remembered?**
As a generally positive and effective person who developed some novel therapeutic approaches to ultra-rare immune deficiencies.

**What is the most important lesson you’ve learnt through your career?**
Learn to say no, and listen to advice (although perhaps not always take it!).

**What advice would you give to early career researchers?**
Start to write grants early, even small ones during your PhD or early career. It takes time to be able to write a decent grant and understand what is required.

‘I’ve always been interested in understanding the human body and fascinated by disease so it came naturally to me to study medicine.’

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**BSI at Brighton Science Festival**

A fun time was had by all when the BSI attended the ‘Bright Sparks’ weekend at Brighton Science Festival in February.

This family fun event caters for the local community by providing interactive and accessible science activities to inspire the whole family. The BSI stand focused on our ‘Immunity in your community!’ toolkit with interactive games to show how the immune system and vaccines work and the opportunity to talk to our experts. Activities included herd immunity skittles, create your own plasticine antibodies and germs, and play our antibody matching game. Our huge thanks to our volunteers Natalie Edner, Jennifer Oloedu, Mariea Parvaz and Nazia Thakur.

**Jennie Evans**
Head of Communications & Engagement, British Society for Immunology

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**Immunology News | March 2018**
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**Immunology**

**Alemtuzumab depletion failure can occur in multiple sclerosis**

Alemtuzumab is a lymphocyte-depleting antibody and one of the most effective treatments for relapsing multiple sclerosis. However, it also causes loss of immune-tolerance, leading to secondary autoimmunity and marked anti-drug antibody responses. Dubuisson et al. hypothesised that these anti-drug responses affect the depleting capacity and treatment response in some individuals. At the population level, they found a lack of influence of ‘ever-positive’ alemtuzumab-specific antibody responses on lymphocyte depletion, clinical efficacy and adverse effects. However, at the individual level, neutralising antibodies (NAbs) led to poor lymphocyte depletion. Importantly, it was evident that 31% of people had NAbs and 75% had binding antibodies at the end of treatment-cycle 2, suggesting problems may occur in people requiring additional alemtuzumab cycles. They also identified individuals, following ‘post-marketing’ alemtuzumab use, whose lymphocyte level never effectively depleted after the first infusion cycle.


**Prospects from systems serology research**

Antibodies are highly functional glycoproteins capable of providing immune protection through multiple mechanisms. Small modifications to multiple antibody biophysical features induced by vaccines can significantly alter functional immune outcomes, though it is difficult to predict which combinations confer protective immunity. To give insight into the complex processes that drive effective humoral immune responses, Arnold and Chung discuss recent applications of ‘Systems Serology’, a new approach that uses data-driven computational analysis (‘machine learning’) and high-throughput experimental data to infer networks of important antibody features associated with protective humoral immunity and/or fragment crystallisable functional activity.


**Clinical & Experimental Immunology**

**Alpha-defensins (α-Defs) in Crohn’s disease**

An impaired expression of α-defensins (α-Defs) in the ileal mucosa and, conversely, increased levels in plasma, have been reported in Crohn’s disease (CD). However, the specificity and correlation of these findings with the degree of inflammation are unclear. Cerrillo et al. aimed to characterise the concentration and utility of ileal and plasma α-Defs in CD and to analyse a potential epigenetic mechanism of α-Def expression. They found that plasma α-Defs 1–3 concentrations were significantly higher in aCD with ileal involvement versus iCD or the control groups. The α-Defs 1–3 concentrations were similar to healthy controls in patients with non-CD ileitis.


**Analysis of the regulatory function of natural killer cells from patients with systemic lupus erythematosus**

Natural killer (NK) cells participate in the regulation of the immune response. However, the immunomodulatory function of NK cells in systemic lupus erythematosus (SLE) is not well understood. Cruz-González et al. aimed to evaluate the regulatory function of NK cells in SLE patients and to identify the NK cells involved in the pathogenesis of this complex disease. They analysed the expression of NK receptors and co-stimulatory molecules in peripheral NK cells from SLE patients, as well as the numbers of human leucocyte antigen D-related/CD11c⁺ NK cells. They found that SLE patients showed increased numbers of immunoglobulin-like transcript 2, CD86⁺ and CD134⁺ NK cells. Furthermore, NK cells from SLE patients induced higher levels of DC lysis. They identified a new subset of NK cells co-expressing CD11c and HLA-DR. These atypical NK cells were increased in SLE patients when compared with controls.

**Immunology News | March 2018**

**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.

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**The role of NKT cells in antiviral B cell immunity**

Natural killer (NK) T cells enhance B cell immunity to bacterial infections through cognate recognition of pathogen-derived glycolipids, presented by B cells in a CD1d-restricted manner. Deficient antibody responses following influenza infection in mice lacking NKT cells led Gaya and colleagues to investigate how these cells might contribute to anti-viral immunity. They found that IL-18 production from follicular macrophages primes NKT cells for IL-4 production during the earliest stage of infection, such that NKT cells, localised to the follicular borders, account for as much as 70% of IL-4-producing cells. This early production of IL-4 drives metabolic reprogramming of B cells and regulating seeding of germinal centres; thereafter follicular helper T cells take the helm as principal IL-4-producing cells. The paper demonstrates how NKT cells, by initiating germinal centre responses, play a critical role in B cell immunity to viral infection.

Gaya et al. 2018 Cell 172:517–533

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**Structure of the human MHC-I peptide-loading complex**

The peptide-loading complex (PLC) is a seven protein complex that coordinates the translocation of peptides in the endoplasmic reticulum and their loading onto MHC class I (MHC I) molecules. How these proteins are organised in the structure and the mechanism by which the PLC facilitates peptide loading is unknown. To address this, Blees and colleagues use an engineered viral inhibitor, ICP47, of one of the PLC components fused to a streptavidin peptide. Following isolation of PLC from tumour cells, the authors used single particle electron cryo-microscopy to elucidate the structure of the PLC. The PLC was shown to consist of two editing modules composed of tapasin, calreticulin, ERP57 and MHC I centred around a single TAP molecule. Interestingly, this conformation allows tapasin to clump MHC I, facilitating the editing of bound peptides. These findings provide important molecular insight into MHC I antigen processing and presentation.

Blees et al. 2017 Nature 551 525–528

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**Bim suppresses the development of SLE by limiting myeloid inflammatory responses**

The aetiology of systemic lupus erythematosus (SLE) is still largely unknown. Interestingly, mice deficient in pro-apoptotic factor Bim, develop SLE-like symptoms; in particularly, systemic autoimmunity and end-stage glomerulonephritis. This report further explores the role of Bim in the development of SLE. Using conditional deletion, the authors show that macrophages deficient in Bim (but neither T nor B cell deficient in Bim) develop SLE-like disease, similar to Bim-deficient mice. Moreover, transfer of WT lymphocytes into either Rag− or Rag+ mice that also exhibit deficiency of Bim in myeloid cells, specifically induced systemic autoimmunity in the latter animals. Transcriptional analysis of Bim-deficient kidney macrophages revealed a similar gene expression pattern to kidney biopsies obtained from SLE patients. The authors suggest the results indicate that Bim may offer a potential therapeutic target for treatment of SLE.

Tsai et al. 2017 Journal of Experimental Medicine 214 3753–3773

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**Single-cell transcriptome analysis of human CD4+ cytotoxic T lymphocytes**

Cytotoxic CD4+ T cells (CD4-CTLs) are a less-studied population, enriched in the effector memory CD45RA (TEMRA) population, which contributes to clearing viral infection. Using single cell RNA-sequencing in donors with previous DENV infection, Patil and colleagues identified an enrichment of cytotoxic genes within the CD4+ TEMRA population in comparison with effector memory (TEM) and central memory (TCM) populations, e.g. GZMB, PRF1, EOMES and TFB21. TCR analysis showed greater clonal expansion in the CD4+ TEMRA population versus TEM and TCM populations. The CD4+ TEMRA population was identified as heterogeneous and divided into four distinct subsets based on cytotoxic potential or costimulatory function. Two of four distinct subsets were then identified, for the first time, as CD4-CTL precursors based on IL-7R expression. These data provide an initial insight into CD4-CTL development in response to viral infection.

Patil et al. 2018. Science Immunology 3:eaan8664
Buffy Coat MicroBeads allow magnetic cell isolation by positive selection directly from buffy coat. Leukocyte subsets are purified using the MultiMACS™ Cell24 Separator Plus for automated separation or a MACS® Separator for manual separation. This method results in target cells with high purity at excellent recoveries.

- Fast and convenient cell isolation directly from buffy coat
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