

Debate Pack

Number CDP 2021/0135

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24 August 2021

The role of immunology research in responding to the Covid-19 outbreak

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1 Immunology

1.1 Overview

Immunology is a branch of medicine and the biological sciences that focuses on the function of the immune system – the body’s defence system against infection and disease. Immunologists diagnose, manage and treat patients who have immune system disorders, including immunodeficiency disorders, autoimmune diseases (where the body mistakenly attacks its own, normal cells, rather than ‘foreign cells’), allergies (such as anaphylaxis, a potentially life-threatening allergic reaction to a substance or food) and cancer. Some immunologists also support the organ transplantation process, to reduce rejection in organ transplant patients.¹

The Royal College of Pathologists (RCP) note that immunology is both a clinical and laboratory discipline, with most immunologists having a “dual role as both a pathologist in the laboratory and a clinician”. It adds, however, that some immunologists will be research scientists / academics pursuing research careers who do not see patients directly.²

¹ NHS, [Immunology](#), not dated

² Royal College of Pathologists, [Become a clinical immunologist](#), not dated

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Immunological research

The RCP has also set out why immunology, and immunological research, can be important to the overall advancement of medicine and patient care:

Immunological research is central to our understanding of many diseases, as most involve some immunological mechanisms. Ongoing research can lead to breakthroughs in immunotherapy; for example, manipulating the immune system to treat cancer, and developing vaccines for emerging pathogens, such as Ebola.³

Similarly, the British Society for Immunology (BSI) emphasises that immunological research can improve our understanding of how to treat, and prevent, certain health issues. It has also been responsible for developing valuable research techniques:

immunology has changed the face of modern medicine [...] From Edward Jenner's pioneering work in the 18th Century that would ultimately lead to vaccination in its modern form (an innovation that has likely saved more lives than any other medical advance), to the many scientific breakthroughs in the 19th and 20th centuries that would lead to, amongst other things, safe organ transplantation, the identification of blood groups, and the now ubiquitous use of monoclonal antibodies⁴ throughout science and healthcare.

[...]

Advancing our understanding of basic immunology is essential for clinical and commercial application and has facilitated the discovery of new diagnostics and treatments to manage a wide array of diseases. In addition to the above, coupled with advancing technology, immunological research has provided critically important research techniques and tools, such as flow cytometry and antibody technology.⁵

2.1

Covid-19

Research questions

Towards the start of the Covid-19 pandemic, the BSI worked with the Academy of Medical Sciences to establish what was already known about the SARS-

³ ibid

⁴ The [National Cancer Institute](#) in the United States defines monoclonal antibodies as “a type of protein made in the laboratory that can bind to substances in the body, including cancer cells [...] They can be used alone or to carry drugs, toxins, or radioactive substances directly to cancer cells”.

⁵ British Society for Immunology, [What is immunology?](#), not dated

CoV-2 virus and to identify research priorities. Its findings were set out in [COVID-19 immunology research](#), published in May 2020. Thirteen priority areas, where “immunology research could deliver significant public health impacts either quickly [within 12-18 months], or in the future”, were identified and split into 3 groups (see Box 1 below).

As the BSI emphasises, understanding the immunological response to the SARS-CoV-2 virus can help to develop “successful treatments and vaccines, identify vulnerable groups, and help inform public health measures to control the coronavirus outbreak”.⁶ Others have noted that immunology can also help to “reduce reinfection, tackle variants and [...] design future vaccination strategies”.⁷

1 Immunology research priorities during Covid-19 pandemic

Group 1 Rapid learning about immunity for public health impact

Research about immunity that could be delivered in 12-18 months

- What, if any, antibody properties confer protection against the virus, and what proportion of antibody responses are protective?
- What are the roles of immune cells from the adaptive (T-cells) and innate systems, such as Natural Killer cells⁸ and T-cells, in protective immunity?
- What is the sero-prevalence⁹ of SARS-CoV-2 antibodies? What proportion of individuals mount either an antibody, or a cellular response or both after infection?
- How can laboratory-based antibody tests be safely scaled to reliable commercial equivalents that are not confounded by cross-reactivity to other coronaviruses?

Group 2 Rapid impacts for COVID-19 treatment

Research about immunity that could be delivered in 12-18 months and tell us more about how to treat Covid-19

- What is the full immunopathology of COVID-19 in the lung and other organs?

⁶ British Society for Immunology, [Connect on Coronavirus: immunology and COVID-19](#), not dated

⁷ PITCH study latest news: [The latest work from the PITCH study looks at the trajectory of the immune response to SARS-CoV-2 after COVID-19 infection](#), 16 June 2021

⁸ Natural Killer (NK) Cells are lymphocytes (white blood cells), in the same family as T and B cells, that work to kill virally infected cells, see BSI, [Natural Killer Cells](#), not dated.

⁹ Sero-prevalence is the percentage of a population of who have antibodies, detected in their blood serum, to an infectious agent (such as a virus).

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

Group 3 Key long-term research investments

Important research questions that will take time to answer

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

Source: British Society for Immunology and the Academy of Medical Sciences, [COVID-19 immunology research](#), published in May 2020

One approach to addressing the types of question outlined above has been to form an immunology consortium. The [UK Coronavirus Immunology Consortium \(UK-CIC\)](#) was launched in August 2020, with 20 UK centres for immunology research brought together to answer key immunological questions relating to Covid-19. These include:

- How long does immunity from COVID-19 last?
- Why are some people's immune systems better able to fight off the virus?
- Why do some people's immune responses cause damage, especially to the lungs?
- How does the virus 'hide' from the immune system and how can this be tackled?

- Does immunity to previous infection with seasonal coronaviruses (which cause the common cold) alter a person's outcome if they're infected with SARS-CoV-2?¹⁰

UK CIC received £6.5 million Government funding, over 12 months, via UK Research and Innovation (UKRI) and the National Institute for Health Research (NIHR).¹¹

Published research

It is not possible, in this short briefing, to list all the immunology research that has assisted efforts to address Covid-19. Examples, however, are provided below.

UK Coronavirus Immunology Consortium (UK-CIC)

[Public summaries](#) of the results of research undertaken by UK CIC – presented using “jargon-free language” – can be accessed via its website.

For example, in March 2021, a paper published in the journal *Science Immunology* presented the results of a study examining patients' inflammatory response to Covid-19. The study contributed to addressing the broader research question of why some people's immune systems are better able to fight off the virus. It identified key biomarkers of inflammation that link to the severity of Covid-19. Two cytokines (proteins released by immune cells regulating inflammation) were particularly associated with more severe Covid-19. The results hold the potential to help researchers identify new therapies.¹² Other studies have looked at how long immunity to Covid-19 lasts, with one reporting that cellular (T cell) immunity against SARS-CoV-2 was present in people six months after they had been infected (but not hospitalised) with Covid-19.¹³

Public Health England

Public Health England has also undertaken / contributed to immunological research into Covid-19. Its SIREN (SARS-CoV-2 Immunity and Reinfection Evaluation) study, for example, is examining whether prior infection with SARS-CoV2, among healthcare workers, protects against future infection with the same virus.¹⁴ Described as the “world's biggest real-world study into COVID-19 antibodies”, preliminary results from SIREN were published in February 2021. They indicated antibodies “would offer some degree of protection for several months after infection”, with 83% of participants having

¹⁰ NIHR, [Unprecedented national effort by UK immunologists to search for answers on COVID-19](#), 28 August 2021

¹¹ Ibid; see also BSI, [UK Coronavirus Immunology Consortium](#), August 2020

¹² UK CIC, [Key inflammatory markers identified in COVID-19](#), March 2021

¹³ UK CIC, [Cellular immunity to SARS-CoV-2 found at six months in non-hospitalised individuals](#), March 2021

¹⁴ Public Health Matters blog (PHE), [The SIREN study: answering the big questions](#), March 2021

some protection against reinfection for at least 9 months.¹⁵ Following the roll out of Covid-19 vaccines, the study protocol was broadened to examine their effectiveness. It found that that healthcare workers were “72% less likely to develop infection after one dose of the vaccine, rising to 86% after the second dose”.¹⁶

The [PITCH \(Protective Immunity from T-Cells in Healthcare workers\)](#) study is a collaboration between PHE and several UK universities. It focuses particularly on the T cell (a type of white blood cell) response following infection with Covid-19 among healthcare workers.

British Society for Immunology

The BSI has also produced several reports, including:

- [Immunity and Covid-19](#) (reviews what we do and don't currently know about immunity to SARS-CoV-2 induced by vaccination), February 2021;
- [The ageing immune system and Covid-19](#), (analyses what we currently do and don't understand about the science behind why the immune systems of older people react differently to SARS-CoV-2 infection), November 2020;
- [Long-term immunological health consequences of Covid-19](#) (reviews current research into what SARS-CoV-2 and our immune response to it does to our health over the long term in a range of individuals, from asymptomatic to severe cases), August 2020

¹⁵ Public Health Matters blog (PHE), [SIREN: One year on](#), 18 June 2021

¹⁶ *ibid*

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PQs

Coronavirus: Vaccination

Asked by: Lord Mendelsohn

To ask Her Majesty's Government whether the Joint Committee on Vaccination and Immunisation is able to commission specific research to inform its considerations; and if so, what specific research has it commissioned since 1 January 2020 regarding the effectiveness of COVID-19 vaccines.

Answering member: Lord Bethell | Department: Department of Health and Social Care

The Joint Committee on Vaccination and Immunisation (JCVI) secretariat is provided by Public Health England (PHE), as set out in the JCVI Code of Practice agreed by the Department. In 2013 the Secretariat was transferred to PHE from the Department as part of the Health and Social Care Act 2012. Membership is determined on merit and in accordance with the principles of the Code of Practice for Scientific Advisory Committees and the Code of Practice issued by the Commissioner for Public Appointments. The Chair and members are appointed based on their suitability for the role through fair and open competition and assessed against specified criteria. The Deputy Chief Medical Officer Professor Jonathan Van Tam is a medical adviser to the JCVI but is not a member of the Committee.

The JCVI has no budget. Members are not remunerated. However, they are eligible to claim expenses in accordance with PHE's rules for travel, subsistence and overnight accommodation. The JCVI's members will not gain financial benefit from their membership. The JCVI cannot commission research but does identify gaps where additional research would be helpful in informing their decision making.

The JCVI's members have a wide range of specialisms, including vaccinology, immunology, paediatrics, adult medicine, respiratory medicine, geriatric medicine, infectious diseases, epidemiology, virology, public health, mathematical modelling, health economics, general practice and health care associated infections. The United Kingdom health departments agreed to take advice from the JCVI on vaccinations and immunisations as the expert body. The JCVI does not have a haematologist member.

The JCVI's COVID-19 sub-committee may, in the course of its work, invite experts in certain specialisms not represented in the membership to attend and contribute to meetings, including experts in haematology. The JCVI works closely with the Medicines and Healthcare products Regulatory Agency and

the Commission on Human Medicines, who have an expert working group that includes invited experts in haematology.

HL Deb 20 April 2021 | PQ HL14790

Coronavirus: Vaccination

Asked by: Stafford, Alexander

To ask the Secretary of State for Health and Social Care, what plans his Department has to commission a long term study of immune responses in people vaccinated against covid-19.

Answering member: Nadhim Zahawi | Department: Department of Health and Social Care

Public Health England's surveillance strategy will monitor how effective the vaccine is at protecting against a range of outcomes, including infection, symptomatic disease, hospitalisations, mortality, and onward transmission. The surveillance strategy is available at the following link:

<https://www.gov.uk/government/publications/covid-19-vaccine-surveillance-strategy>

The National Institute for Health Research (NIHR) and the UK Research and Innovation are jointly funding the UK Coronavirus Immunology Consortium to address key questions around the immune system's response to COVID-19. The NIHR's Health Protection Research Unit in Respiratory Infections is also looking at the size and longevity of the immune response.

HC Deb 05 March 2021 | PQ 151888

Coronavirus: Research

Asked by: Stafford, Alexander

To ask the Secretary of State for Health and Social Care, what steps his Department is taking to support long-term research studies on covid-19 immunity.

Answering member: Edward Argar | Department: Department of Health and Social Care

The Government, through the National Institute for Health Research (NIHR) and UK Research and Innovation are jointly funding the UK Coronavirus Immunology Consortium to address key questions around the immune system's response to COVID-19.

We are also supporting immunity studies in specific groups, including the SARS-CoV-2 Immunity and Reinfection Evaluation (SIREN) study in health care

workers and the Vivaldi study in care home residents and workers. The NIHR's Health Protection Research Unit in Respiratory Infections is also looking at the size and longevity of the immune response.

HC Deb 17 February 2021 | PQ 144882

[Coronavirus: Vaccination](#)

Asked by: Webbe, Claudia

To ask the Secretary of State for Health and Social Care, what assessment he has made of the report of the British Society for Immunology for studies on the efficacy of the Pfizer/BioNTech covid-19 vaccine after altering the dosing interval of that vaccine.

Answering member: Nadhim Zahawi | Department: Department of Health and Social Care

The British Society for Immunology report provides an expert review of current research on immunity and COVID-19 and recommends research to add to our knowledge about the immune system's response. The National Institute for Health Research (NIHR) and UK Research and Innovation are jointly funding the UK Coronavirus Immunology Consortium, which will address key research themes on immunity to COVID-19.

In addition, the NIHR has contracted the National Immunisation Schedule Evaluation Consortium to gather immunological evidence on 28 day and 12 week dosing intervals for the Oxford University/AstraZeneca and Pfizer/BioNTech vaccines. Public Health England is also monitoring the effectiveness of vaccines on disease, infection and transmission including the impact of dosing intervals on effectiveness.

HC Deb 15 February 2021 | PQ 148962

[Coronavirus](#)

Asked by: Lord Watson of Invergowrie

To ask Her Majesty's Government what assessment they have made of the report by the British Society for Immunology The ageing immune system and COVID-19, published on 10 November.

Answering member: Lord Bethell | Department: Department of Health and Social Care

The British Society for Immunology's report was shared with the Department and reviewed by officials alongside other insightful academic studies into COVID-19 immunity. Research into the immune response of the ageing population is ongoing and is currently being expanded.

For example, last week the Government announced the expansion of the current Vivaldi 2 study that will test thousands more care home staff and residents for their immune response to COVID-19. By tripling its size, this expanded study will provide a detailed picture of coronavirus infection in care homes in England. These findings will help improve our understanding of these vulnerable groups' immune response to COVID-19 and help inform future treatments for the virus.

HL Deb 30 November 2020 | PQ HL10463

Coronavirus: Research

Asked by: Baroness Goudie

To ask Her Majesty's Government what steps they are taking to support studies (1) in a community setting, and (2) that extend into the convalescent period, to establish factors that affect the duration of effective immunity to COVID-19.

To ask Her Majesty's Government what steps they are taking to support studies investigating the effect of (1) co-infection, and (2) vaccination against other pathogens, on COVID-19 immunity.

Answering member: Lord Bethell | Department: Department of Health and Social Care

The National Institute for Health Research (NIHR) and UK Research and Innovation (UKRI) are jointly funding the United Kingdom Coronavirus Immunology Consortium with £6.5 million, which will address key research themes on immunity to COVID-19 including cross reactivity with seasonal coronaviruses.

Other relevant NIHR-UKRI funded studies include the STORY study to understand the severity of COVID-19 disease in children and evaluate antibody responses; Virus Watch looking at household transmission; and the INSTINCT study investigating the epidemiology and immunology of COVID-19 infection in households.

The NIHR's Health Protection Research Unit in Respiratory Infections is also looking at the size and longevity of the immune response.

HL Deb 07 December 2020 | PQ HL10808; PQ HL10809

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Articles and press releases

Times [subscription]

19 August 2021

[Link between long Covid and ME could transform the lives of sufferers](#)

UCL

11 May 2021

[Study investigates immune response to Covid-19 in patients with antibody deficiency](#)

Science

5 February 2021

[Immunological memory to SARS-CoV-2 assessed for up to 8 months after infection](#)

British Society for Immunology

3 February 2021

[COVID-19 immunology report: What we know about immunity to COVID-19 and priorities for research](#)

National Institutes of Health

26 January 2021

[Lasting immunity found after recovery from COVID-19](#)

BMJ

17 September 2020 (cite as BMJ 2020;370:m3563)

[Covid-19: Do many people have pre-existing immunity?](#)

National Institute for Health Research

28 August 2020

[Unprecedented national effort by UK immunologists to search for answers on COVID-19](#)

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