Written Evidence Submitted by the British Society for Immunology (BSI)

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British Society for Immunology

As an organisation, the British Society for Immunology, the largest immunological society in Europe, represents over 4,200 immunologists working in academia, clinical medicine and industry. Our objective is to promote and support excellence in research, scholarship and clinical practice in immunology for the benefit of human and animal health.

1. The UK is a leader in immunological research and is ranked first amongst G7 nations for both impact and influence, consistently outperforming its peers in the volume and authority of its research[i]. This sound foundation has become self-evident during the COVID-19 pandemic with the UK's immunologists emerging as leading voices on all aspects of understanding and predicting the nature of the virus. This has included the immune response to the novel coronavirus, SARS-CoV-2, pathogenicity, infectivity, immunity and the development of treatment options including a vaccine.

   Immunologists have also been crucial in developing key research priorities for the future that will be vital to enable us to understand all aspects of the virus and our immune responses that have an effect on human health[ii]. This will translate into meaningful patient benefit and ameliorate our ability to treat COVID-19, which in the long run will mean that lives are saved.

2. The immunology community has been instrumental in understanding the virus, how it infects the body, the immune response it triggers, and how these affect human health. Immunologists have been extensively consulted and quoted by the media and have played a major part in informing and educating the public about COVID-19 and the immunological terms and principles being discussed. While the UK is a global leader in immunology research[i], the Government did not fully taken advantage of this large body of scientific knowledge however, with a dearth of immunological representation at SAGE meetings in the early stages of the pandemic. During any future outbreak or pandemic, there should be a greater effort to seek a wider range of informed views and expertise from the outset.

   The British Society for Immunology has subsequently worked with SAGE including presenting an expert summary and expanded paper on what we know so far about COVID-19 immunology and what the key questions for research will be for the future. The BSI has also facilitated witnesses for parliamentary committee inquiries including the House of Lords Science and Technology Select Committee inquiry on 'The science of COVID-19' and indeed this Committee too.

   Immunology underlies much of the technology and many of the methods for diagnostics and testing as exemplified by the COVID-19 pandemic and as such can be used to understand the science behind them and inform the challenges that lie in their use. For example, while antibody testing is one of the best tools that we have for infection surveillance, the limits on its utility are clear: the presence of antibodies do not necessarily confer protection from subsequent infections and we do not yet know how long antibodies will present after an infection. It should also be noted that whilst modelling potential outcomes through a pandemic is a valuable public health tool, if the model is not based on a sound understanding of the basic science, i.e. immunology, then the accuracy of the model will be diminished.

   Immunology is also crucial to the development of vaccines and the UK has been a world leader in this for the past two hundred years, from the first vaccination against smallpox to more recently

tackling the Ebola outbreak in West Africa and the current COVID-19 pandemic. This comes from a broad biomedical ecosystem that successfully combines a rich tradition of academic research with a thriving industrial sector. COVID-19 has shown that the rapid acceleration of ordinary research and testing protocols is possible in the most extraordinary circumstances. The Jenner Institute and the Oxford Vaccine Group, both at the University of Oxford, completed Phase 1 vaccine trials at the end of April[iii] and has begun Phase 2/3 trials in the UK, USA, Brazil and South Africa[iv]. At Imperial College London, Phase 1/2 vaccine trials began in June which is the first time that self-amplifying RNA technology has been tested in humans[v] and these trials have now moved into the next phase[vi]. Imperial College London has worked with the life sciences investor, Morningside Ventures, to form VaXEquity to develop the self-amplifying RNA technology for uses after the current pandemic[vii].

Think should also add in a short paragraph on therapeutics and the importance of keeping up development of these alongside vaccines – can throw in about vaccines potentially not working so well in older people so need to make sure that we keep up the theraupeutic development.

3. The Government responded quickly to the need for research into COVID-19; the rapid response research call jointly funded by the UKRI and the Department for Health and Social Care via the National Institute for Health Research made £20 million available at the beginning of February. By the end of March, when the COVID-19 pandemic had reached the UK, £10.5 million of this had already been awarded. This meant that the UK scientific community was on the front foot of novel coronavirus research and included funding for tracking the virus which builds on planning already carried out by the International Severe Acute Respiratory Infection Consortium (ISARIC) over the past eight years, as well separate funding for the development of a vaccine.

   The Government has committed £250 million in total to the Coalition for Epidemic Preparedness Innovations (CEPI) and its key international fund for the development of a COVID-19 vaccine. Another £84 million has been provided in funding to researchers working on the vaccine efforts at the University of Oxford and Imperial College London. The abovementioned fast tracking of the opening of the VMIC saw another £131 million in investment being put into vaccine development and manufacture.

   It should be noted that much COVID-19 research carried out so far has been conducted by scientists who have volunteered while unable to work on other projects because of the pandemic situation. As they return to their normal jobs and the research for which they have grant funding, we need to recognise that while the immunology community has made a fantastic contribution thus far, we need to ensure that there is funding in place for longer term research to ensure that progress made so far is not wasted.

4. One of the most important aspects of vaccine development during a pandemic is guaranteeing that there is the capacity to ensure that it can be manufactured and distributed at the scale at which it is needed. The abovementioned vaccine trial at the University of Oxford has seen a partnership formed with AstraZeneca to ensure large scale manufacture and distribution of the vaccine if it is successful in clinical trials, up to 100 million doses.

   The UK Government also announced earlier this year that it would be accelerating the construction timetable of the Vaccine Manufacturing and Innovation Centre (VMIC) so that it opens in 2021, rather than the previously scheduled 2022. The centre was announced last year and will provide the UK's first bespoke strategic vaccine development and manufacturing capability. In July 2020, the Government announced another vaccine manufacturing facility in Braintree, Essex[viii] that would

open in 2021 to further increase capacity. The Government must ensure that these projects, when finished, is able to cope with future pandemics and outbreaks by having the agility and capacity to create a variety of types of vaccines against novel viruses and then manufacture them at scale. There can be little point in funding world class vaccine research during a pandemic without the manufacturing and distribution capacity to vaccinate potentially a large majority of the population.

The UK was slow to increase testing capacity in the early days of the virus. Several hundred immunologists who were no longer able to work on their day to day research asked the British Society for Immunology to approach PHE on their behalf to volunteer their services to help with increasing testing capacity, but weeks passed before PHE were able to release a system to deal with the offers of help that they received from across the scientific sector. The Government must ensure that there is a proper plan in place in the future, should we ever need to replicate this dramatic increase in testing capacity at short notice.

5. The primary failings from the SARS1 and MERS crises were a failure to continue to fund and conduct longer-term research into these diseases, and then a broader error in not then preparing for a larger scale pandemic. Had research into SARS1 and MERS continued in earnest, we would likely have been in a better position to tackle a novel coronavirus and efforts to develop a vaccine, many of which have been based on this earlier work, would have been further ahead or been able to be accelerated more quickly. It is vital that we learn the lessons of COVID-19 for future pandemics and continue to acquire as much knowledge as we can about the SARS-CoV-2 virus and how it interacts with our immune system.

   We must additionally ensure that there are large cohorts in place that can be followed up through longitudinal studies that examine the long term health consequences of contracting COVID-19. While there is insufficient evidence at the moment to draw any certain conclusions, the evidence we do have suggests that the SARS-CoV-2 virus and the immune response to it affects multiple organ systems in previously unexpected ways and this could have important ramifications for future health. The large number of people who have contracted COVID-19, both worldwide and in the UK, means that any long term damage to health could equate to a significant impact on public health and health provision for years to come. Making sure that we have the research infrastructure in place to study these long term implications is paramount therefore to ensuring that we are prepared.

6. As previously mentioned, it is vitally important to open up the advisory process, such as through SAGE, to expert voices that may not be on the traditional 'list' of parties that the Government consults, such as immunologists – the UK is a world leader in immunology and the Government should make use of this to its benefit. This will ensure that a diverse cross section of the scientific community is represented, and that Ministers can make decisions with a full knowledge of scientific opinion. This will reinforce the fact that there is rarely such thing as 'following the science' in an emerging situation such a pandemic, but that scientific opinion is likely to be caveated, nuanced, and in some cases conflicting. This needs to be better explained to the public: scientists can offer advice, but Ministers must make decisions and be accountable for them.

7. As discussed previously, the current COVID-19 pandemic has highlighted the failure to learn from previous epidemics such as SARS1 in 2002/03 and MERS in 2012. Both of these were caused by coronaviruses and whilst SARS-CoV-2 is a novel virus, much of what we are working on in terms of, e.g. vaccine development, could have been sped up had we continued research following these previous outbreaks. Coronaviruses are a particular problem as they are able to replicate so

efficiently on entry to the human population, so this illustrates the gap that exists between public health and basic science. Research needs to be acted on properly for it to have a tangible effect. There has also been a tendency for the level of urgency with which the government has acted on a disease outbreak has historically been dependent on the proximity of the outbreak – an approach which is not realistic in today's globalised world – and a focus on pandemic influenza at the expense of novel viruses.

There is a major role for wide horizon scanning to play: a clear majority of diseases which evolved into pandemic status at the through the 20th century can be traced back to a zoonotic leap between species, HIV originating in chimpanzees[ix] and Ebola originating in bats[x] are just two. USAID's PREDICT programme is a $200 million global project which carries out surveillance for new pandemic threats in so called 'hot spot' countries in Africa, Asia, and Latin America, focusing on wildlife, predominantly non-human primates, bats, and rodents[xi]. This type of proactive approach is the outward facing approach that the UK should be investing in. It is not a new approach, a Rockefeller Foundation funded virus hunt discovered the Zika virus in 1947, sixty years before the first large scale outbreak in humans[xii]. Studies have found that modern dynamics including climate change, ecological degradation, population pressures, and globalisation are all making it more likely for zoonosis to occur and for there to be rapid spread of the disease in humans afterwards. It has never been more important for the UK to contribute to such an important body of work by investing in a worldwide system of surveillance of diseases spread by human to human transmission and those deemed likely to make the 'zoonotic jump' from animals. Co-operation with our foreign partners will be vital for this, as will using the existing extensive UKAID/DfID network.

The EcoHealth Alliance focuses on this meeting place between conservation and health, with the identification and prevention of emerging infectious zoonotic diseases being at the core of its work. As human populations increase and encroach on the natural habitats of animals which act as vectors or reservoirs for disease, the likelihood that novel viruses will transmit across species into the human population increases. This is one of the reasons why bats in particular are a cause for concern.

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[i] British Society for Immunology, 2020, Protecting the world: Celebrating 200 years of UK vaccine research
[ii] British Society for Immunology and Academy of Medical Sciences, 2020, COVID-19 immunology research, What do we know and what are the research priorities
[iii] Folegatti *et* al., 2020, Safety and immunogenicity of the ChAdOx1 nCoV-19 vaccine against SARS-CoV-2: a preliminary report of a phase 1/2, single-blind, randomised controlled trial, The Lancet.
[iv] University of Oxford, 2020, COVID-19 Vaccine Trial
[v] Imperial College London, 2020, First volunteers receive Imperial COVID-19 vaccine
[vi] Imperial College London, 2020, Imperial's COVID-19 vaccine moves to next phase
[vii] Imperial College London, 2020, Imperial social enterprise to accelerate low cost COVID-19 vaccine
[viii] UK Government, 2020, Over £100 million cash boost to manufacture millions of doses of COVID-19 vaccine
[ix] Cold Springs Harbor Perspectives in Medicine, Origins of HIV and the AIDS Pandemic, September 2011
[x] WHO, Origins of the 2014 Ebola epidemic, January 2015
[xi] USAID, Emerging Pandemic Threats
[xii] Smithsonian Magazine, Can Virus Hunters Stop the Next Pandemic Before It Happens?, January 2018

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