Written Evidence Submitted by J Karl Simpson, Director, JKS Bioscience Limited
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About the author

JKS is keen to support the government in measures to prevent a future pandemic from catching us unprepared as Covid-19 has done. He believes that control measures have been inadequate and that with strong scientific data we could provide more informed decisions about future lockdown, quarantine and protective measures. These might include guidance on face coverings, social distancing, diagnostics, vaccines, antivirals, plasma and other therapeutic measures. JKS is particularly concerned about the need for the UK to rebuild a world class vaccine production capability as part of a revitalised life sciences manufacturing industry.

JKS has worked for many years in the life sciences. He began as an academic research scientist in molecular biology, working with the European Molecular Biology Laboratory. He became independent , moving to consulting work in 1985. He was Editor of several influential journals and newsletters including the Financial Times Biotechnology Business News. In 1990, JKS moved to the vaccine area, planning a spin-out of vaccines activity for Medeva. In 1992, while working on a review of WHO vaccine goals, JKS suggested it might be possible to make a thermostable oral polio vaccine. With support from the Institut Pasteur and the UK National Institute for Biological Standards and Control (NIBSC) he demonstrated this, patented the invention and licensed it to Chiron/Biocine (now GSK) and Pasteur Mérieux Serums & Vaccines (PMSV, now Sanofi-Pasteur.
JKS has continued to support development of vaccines in the infectious disease and oncology areas. Between 2016 and 2019 he worked as a consultant for DHSC, reporting on emerging epidemic/pandemic disease threats. A synopsis of this work was published in the journal Vaccine in 2019, co- with Chris Whitty and others. Most recently with Bavarian Nordic a Danish/German company, JKS has worked on novel vaccine vector systems and the potential emergence of monkeypox and related diseases. See JKS credentials on polio: https://doi.org/10.1016/0264-410X(95)00068-C ;
on emerging/re-emerging epidemic/pandemic threats: https://doi.org/10.1016/j.vaccine.2019.09.009and:https://doi.org/10.1016/j.vaccine.2020.04.062 and on the funding landscape; 2018 in a report to DHSC (**Vaccine funding landscape for emergent/re-emergent epidemic/pandemic threats)** conducted by JKS Bioscience Limited, available on request

Summary

The writer has reviewed challenges with diagnostics in the current Covid-19 crisis. The need for vaccines is also considered. In both areas the UK is reliant on foreign suppliers, who might be preoccupied with domestic needs at a time of crisis. The UK must build a better capability in both diagnostics and vaccines, taking advantage of our world class science. A **Minister for Life Sciences** might once again be appointed to champion such endeavours in government, academia and industry. **We must plan to move from "just coping" to planning**

for tomorrow building life science capability in a new manufacturing revolution. These are the main thrust of this document

Introduction

Covid-19 has tested the UK's resilience to an infectious disease and unfortunately has found us wanting in terms of preparedness and response. The past is history and tomorrow is a new day that presents new opportunities. We have realised that forces beyond our control, can leave the UK dependent on foreign countries to supply us with personal protection equipment, essential medicines, diagnostics and the capacity to manufacture vaccines at scale.

Perhaps it is time to reappoint a **Minister for the Life Sciences.** Let us take a bold step and use our "best in the world" life sciences capability to create new jobs and wealth in innovative manufacturing to protect us from infectious disease. Many of the world's leading companies in diagnostics and vaccines rely absolutely on skilled staff trained in the UK. For example: Paul Hudson CEO of Sanofi was trained here as was Emma Walmsley, CEO of GSK. Many more British managers and scientists sit on top management or Board roles in international pharmaceutical and vaccine ventures. Maybe it is time to create more opportunities to retain top managers here and provide new jobs for all in vaccine, pharma and other life sciences companies based in the UK. Some ideas are outlined below.

Let us take advantage of historically low interest rates to invest in new capabilities that will once again make the UK a leading manufacturing nation.
We can build on our academic and translational vaccine assets, to be found in many institutions including: Defence Science and Technology Laboratory (Porton Down), National Institute for Biological Standards and Control, Pirbright Institute, Public Health England (Colindale and Porton Down), Universities of Birmingham, Glasgow, Liverpool, London (Kings, Imperial, Royal Veterinary College, School of Hygiene and Tropical Medicine, St Georges, University College), Oxford and Southampton. Many other universities and medical schools have capabilities in anti-viral therapies diagnostics, epidemiology, hygiene and immunology,

In early 2020, the UK was simply not ready to cope with a pandemic. Assumptions were based on influenza, which is not comparable to Covid-19. This was despite former Prime Minister Cameron's 2015 commitment to ensure UK preparedness for new epidemic/pandemic treats.

Efforts to develop new vaccines have moved ahead with speed, but control efforts based on diagnosis found us lamentably ill-prepared. We must create a national capability – at scale – in protective equipment and diagnostics, supported by best-in-class logistics as well as track and trace IT systems, that are not almost totally reliant on foreign expertise.

Diagnostics

As we begin to realise the scale of the UK epidemic, as many as 12 million people have been infected say some, it is time to into introduce reliable a nucleic acid and antibody testing at scale.

Nucleic acid testing can accurately diagnose active infection. Most Covid-19 infections appear to be asymptomatic, escaping testing protocols based on symptoms. For an RNA virus like Covid-19 a DNA copy of RNA must be made using an enzyme known as Reverse Transcriptase or RT. That DNA copy can be multiplied – or amplified - by an intervention known as the polymerase chain reaction or PCR, that can say how much Covid-19 RNA was in the original sample. This approach is known as RT qPCR (or Reverse Transcriptase quantitative PCR., Most RTqPCR testing is generally carried out at sites far from the patient or clinic, generating unacceptably long turnarounds, although this might be reduced to less than 12 hours by implementing intelligent use of IT systems. Novel "dipstick" technologies are in development.

Another approach, used in the West African Ebola epidemic, is to squeeze DNA through a molecular pore and read the sequence directly. A British company, **Oxford Nanopore** has developed and commercialised this. The advantage is that results emerge almost in "real time". However, strict preparation protocols must be adhered to, although these raised no insuperable problems in makeshift laboratories in the African rain forest.
Both technologies have been available for over five years now, but the logistics of procurement, testing, data handling and patient contact tracing proved impossible to manage at the scale imposed by the rapid growth of the pandemic, in the early Spring of 2020.

Antibody testing is sensitive, very accurate and can show who has had the disease and has circulating protective antibodies. Both centre-based and dip-stick testing is available. In contrast to most nucleic acid testing, antibody tests do not demand complex preparation protocols. Antibody tests should be validated by national testing facilities before clearance for sale is given. Testing every UK resident might cost£300 Million.

For Covid-19 many antibody tests look for a part of the virus known as the "spike protein". The spikes give corona viruses their name. Fragments of the spike protein known as epitopes are identified by antibody tests.

Several companies have developed laboratory-based tests, available in the UK, that are reliable, sensitive and highly accurate. A small blood or plasma sample (for many a drop from a finger prick) is all that is required. These immunoassays can be carried out rapidly and at large scale in central testing facilities. Results can be returned to a physician within less than 24 hours. Tests conducted on validated instruments in testing centres using high throughput machines are generally excellent.

Dip-stick tests, technically known as lateral flow immunochromatographic assays can yield results at the point of care in minutes. Such tests conducted by qualified professionals and purchased from validated suppliers will also be excellent.

If Nucleic acid testing can be accelerated to cope with potentially 50,000 samples per month, it may become possible to control “R” numbers through track and trace . Today, the delivery infrastructure is not sound, and track and trace has become a national embarrassment.
Antibody testing might allow us to identify as :at risk” those who do not have neutralising antibodies for Covid-19. Today we simply do not know how many people have been infected and who is susceptible. We do, of course know that those in an immune compromised state are “at risk”. We do now understand what factors place certain ethnic and social groups and men, more than women, at particular risk

If we can prove that UK residents are immune to Covid-19 and do not present other risk factors, the idea of a Covid-19 “passport” allowing greater freedom of movement and international travel, might be promoted. If immunity is present, we do not yet know for how long and any passport might be subject to renewal at periods determined by scientific knowledge. Better scientific data is needed to support confidence in Covid-19 testing

Caveats:

- A minority of people recover from Covid-19without significant antibody response. They probably produced a strong T-cell, or cell-killing, response that targets and kills virus-infected cells. T-cell diagnostics are not widely available and need expert laboratory support. This might be warranted for those persons who have recovered without significant antibodies and who have tested Nucleic Acid negative.
- The presence of neutralising antibodies is not absolute proof that an individual is immune to Covid-19, although this is likely to be true in a majority of individuals. We do not know how long neutralising antibodies will be secreted by a person who has recovered, and we do not know if a new mutant Covid-19 might defeat existing antibody protection.
- Free from regulatory controls, the Internet can deliver unvalidated tests without the assurance that these will work as described. Their use before validation by a recognised testing agency must be discouraged. To ensure validation, the UK is fortunate to have the world-class capabilities of Public Health England.
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Vaccines

It may be too late for vaccines to make a big difference to the current pandemic. However, if this disease becomes endemic, recurring at intervals, it will be important to have a stock of vaccines, perhaps in the hope of completely eliminating the virus. Covid-19, or variants thereof, may become a seasonal menace like Influenza. If this happens an appropriate vaccination strategy must be elucidated. This will require manufacturing at scale. **AT SCALE** are two little words with big implications in terms of cost and effectiveness. We have committed money to vaccine production – but too little too late. As we wring our hands over £Trillions we must summon up the courage to spend the £Billions that will save lives and allow an early reconstruction of our faltering economy.

It has been noted that Covid-19, and by inference good vaccines, generate a strong cell killing or T-cell response that complements the neutralising antibody response.

In an existential emergency, leaders of many nations will say, “Our citizens come first”. The UK must be able to meet its own needs for vaccines, perhaps working together with former EU partners. A quid pro quo presents as Europe is suffering badly from the reduced access to the UK’s scientific excellence.

> The UK’s vaccine manufacturing capability has become trivial. To rebuild strategic capability will require an investment of £billions. Let us do it! As cruelly demonstrated by Covid-19, what are a few £billions, when losses to the UK economy are measured in £trillions? These facts were noted in the ***Sunday Telegraph*** *(12 April(*https://www.telegraph.co.uk/business/2020/04/11/britains-ability-make-vaccines-fell-short-vital-moment/***)***, which interviewed JKS on the subject.
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> Our new capability must be platform-based rather than specific product based. A Covid-19 vaccine will be great, but if the disease fades away in 2021, what will we do with a massive and unnecessary production capability and stockpiles of useless vaccine with limited shelf-life? Our manufacturing capability must be flexible, yet capable of producing up to hundreds of millions of doses of vaccine for diverse threats such as Flu, Covid-19, monkeypox or Mother Nature’s next aberration. Manufacturing and stockpiling at-scale will sustain a UK vaccines capability. The current “big four” vaccine producers and 2 leading Indian manufacturers can make the billions of doses historically required to protect the World’s children. Together they spend over US$10 billion on R&D and manufacturing.

We have great R&D competence in the UK, but despite recent commitments, translating this to at-scale manufacturing has not happened. JKS believes that £3 billion spent on three flexible manufacturing sites could be hugely beneficial for the UK. Locations might include Speke near Liverpool, The Scottish Glasgow-Edinburgh corridor and perhaps on the Porton Down site in Wiltshire.) British vaccine experts located around the world, would be delighted to work in such facilities. Our universities and colleges can provide the graduates with the skills and training required.

Despite big spending. operational capacity cannot realistically be established before 2022. However, we would be prepared for “The Next Virus”

The continuing need for better scientific understanding

Perhaps now is the time to adopt a pragmatic, dare one say, expedient, approach. Conflicting issues must be resolved: **The Economy, Public Morale and Public Health**. How many deaths are acceptable to keep a majority of people happy and the economy turning? How many deaths will unhappiness and economic collapse cause? The obligation to wear masks in closed spaces and significant gatherings might allow government to reduce social distancing from 2 metres to 1 metre. Simple home-made masks with 2-layers of washable cotton can stop nearly all droplet spread and cut disease transmission, as the public once again crowds into shopping centres and sporting events.
What is still missing is good scientific information to help epidemiologists, actuarial experts and cost/benefit analysts. Covid-19 strategies have been confused by often conflicting advice from epidemiologists, disease modelers and other experts. We simply do not know

enough for strong consensus to emerge. It seems that Covid-19 kills up to one percent of those infected, although without data on what may be a large majority of symptomless infections, we just do not know. This writer is minded of our experience with polio (where about 1 to 5 infected persons in 100 is symptomatic and paralytic polio is even rarer). That disease remains a threat today, despite best efforts at eradication

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