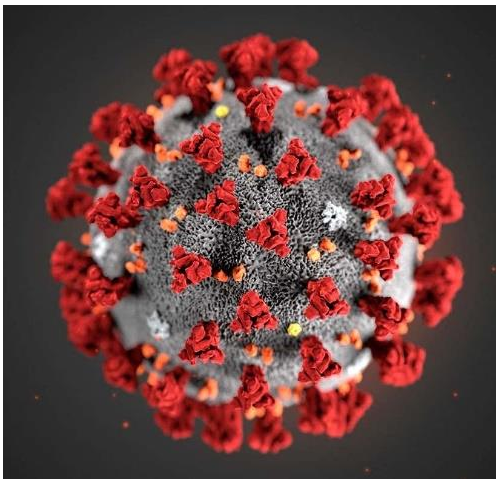
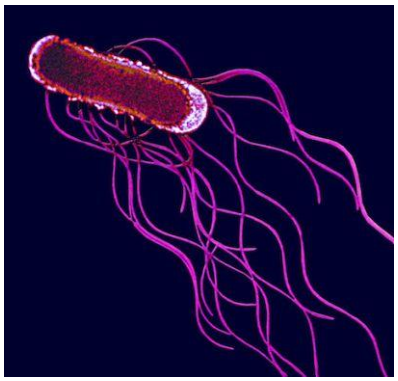
Going viral



Not much doubt about the choice for topical science this time round! The 'novel coronavirus SARS-CoV-2' that causes the disease Covid-19 has an impact on every single one of us, and there's a huge amount of misinformation, ignorance (even at high levels) and resulting fear making the situation worse. So let's take a look at some facts about viruses in general and this current troublemaker in particular.

A virus is a submicroscopic infectious agent that has no independent life of its own but has to invade the cells of a living host in order to replicate (make copies of itself) to continue to exist: it is a parasite. The host can be human, animal, plant, or lower form of life such as a bacterium. Viruses and bacteria (among other agents) can both cause disease and death, though by no means all of them do, but they are quite different beasts: bacteria are independent one-cell organisms, they are far more complex, and they are big enough to be seen through an optical microscope. Bacterial infections include salmonella (food poisoning), tuberculosis (TB), and cholera. The Black Death of the 14th century, sometimes compared to the 1918 flu pandemic and the present problem, was in fact not viral but bacterial.



A virus, by contrast, is essentially just a relatively small piece of genetic material (double-strand DNA or the simpler single-strand RNA) wrapped up in a protective coating of protein; some viruses, including SARS-CoV-2, also have a layer of lipid (a kind of fat) on the outside – that's why thorough handwashing with soap is so important, it really does destroy the virus. Spiky parts of the protein attach to a host cell and enable the virus to get inside, where the RNA (or DNA) hijacks the cell's normal operation and forces it to produce copies of the virus instead of copying its own DNA. The virus population then leaves to continue spreading, usually destroying the host cell.

There are actually millions of different kinds (families) of virus, a few thousand having been studied and described in detail, but only a very small number are harmful to humans; others attack different species of animals and plants (such as foot-and-mouth disease or tobacco mosaic virus, the first one to be identified at the end of the nineteenth century). Some viruses that are harmful to bacteria can even be used as medicines (bacteriophages) instead of other antibiotics. Most viruses are harmless, and some of them, like many bacteria (probiotics), are beneficial and important for our health – we live in harmony with them. Examples of human viral infections are measles, norovirus, herpes simplex (a cause of cold sores), HIV, and Ebola. The coronavirus family causes flu and some colds as well as SARS-related respiratory diseases including Covid-19.

The two factors that set the danger level of a particular harmful or 'pathogenic' virus are these: how infectious is it (how easily is it passed on), and what damage can it do? Some well-known viruses are rather infectious but do little harm, like most colds; others can be fatal but do not spread easily, like rabies. Unfortunately SARS-CoV-2 has a high infection rate for close contacts and is potentially life-threatening for certain vulnerable types of people. Hence the lockdowns and other severe methods adopted worldwide to reduce its spread while effective medical treatments are sought.

One of the problems with viruses is that they can change their form. The change may be in the genetic sequence of the RNA (a mutation, a process that occurs naturally in all RNA and DNA), and this alters the behaviour and effects of the virus. A virus can also change the structure and shape of its protein coat, which is rather like changing your clothes or going in disguise. This makes it harder to treat them effectively; new flu vaccines have to be developed every year for new virus strains.

How might viruses be treated? As with all diseases, we can focus on cure and/or reducing the physical results and symptoms, and we can aim for prevention. The massive efforts of the NHS in recent months have been most visible in the treatment of those who are already infected, especially where the symptoms are severe. Here the aim is to provide support and relieve symptoms while the body's own natural immune system fights the invader, but help might also be given through specific antiviral drugs that work with the immune system, especially if this is struggling. Effective antivirals have been developed for some viruses including HIV and hepatitis C. The recent clinical trial that showed the anti-inflammatory dexamethasone to provide significant help for severely affected Covid-19 patients is welcome news and many other potential drugs are being tested, but large numbers have already been tried and rejected as ineffective or even dangerous, including the anti-malaria treatment once promoted strongly in the USA. One important fact here is completely certain: antibiotics are not an effective treatment for a viral infection and should not be taken, as this reduces their proper usefulness against bacteria. Nor do antibacterial agents in cleaners kill the virus; just use plain soap and disinfectants.

The big aim, of course, is to do something serious, and preferably medical, about prevention. The emergency imposition of lockdowns and other physical restrictions can provide only a temporary solution. The usual method to prevent, or at least drastically reduce, viral infections is vaccination, a procedure that was first used against smallpox, a disease that has now been completely eradicated as a result: a great success story. Vaccination works by prompting the body to produce a defence against a particular virus by presenting it with something similar enough to it but without the danger. This can be a modified form of the virus (for example, the protein coat but with no RNA inside), or a weakened version, or a closely related but harmless virus from the same family. Once the body has been trained to recognise the enemy, the defence mechanism will quickly kick into play if the real virus comes along later. The immune system can be trained to recognise

and attack the protein or genetic component; these different approaches are being used in the many attempts currently being made around the world in a huge effort of international cooperation marred by only a few selfish agencies and governments wanting to keep results and sales profits to themselves.

The fight against SARS-CoV-2 and the Covid-19 it causes would be more effective if everyone understood and believed the basic science and its medical implications. Unfortunately, as with many aspects of life, significant minorities refuse to accept facts and instead pick up and develop ideas that have no basis at all in real evidence. We live in an age of conspiracy theories, total fantasies that are spread mainly through social media. Among those that are sadly relevant to the current pandemic are that the whole virus spread is a hoax designed to impose greater control over our lives, and that the virus is spread by 5G technology (related to the baseless 5G cancer scare I've addressed in a previous article), perhaps even as a deliberate manmade bioweapon. There's also significant resistance to vaccination, even if and when we do have an effective vaccine, particularly in some supposedly advanced and intelligent societies: the so-called antivaxxers continue to believe discredited reports of links between vaccines such as MMR and problems like autism, reports that are known to be based on deliberate scientific fraud. Some viruses are vastly more risky than any approved vaccination.

As an aside, computer viruses are so called because they behave rather like biological viruses: they invade a host, cause some kind of nuisance or serious harm, replicate themselves, and seek to infect other hosts through electronic contact, often exploiting human ignorance. They are variously treated by disinfection programs and by front-line prevention offered by antivirus software.

The expression 'going viral' describes a piece of information, an idea, a visual image, or something else that – often to the surprise of the person generating it – is widely and rapidly passed around to attract the attention of others who, in turn, transmit it further so that it quickly becomes widespread and often hits the headlines in competition with major news events. Recent examples include the support for 'Captain Tom' in his NHS fundraising garden walks and the responses to the killing of George Floyd leading to Black Lives Matter protests around the world. While it is good for some things to go viral in this way, the spread of ridiculous conspiracy theories that undermine attempts to tackle the Covid-19 pandemic is itself a social viral threat adding to problems of the original biological viral threat. The world would be better off without both of these pests.

Bill Clegg

Modified version of the (extended) article in the Tyne Valley Express for July–August 2020