# THE YEAR THAT SCIENCE WENT VIRAL



Twelve months in my life as the Covid correspondent By Tom Whipple (our man in a white coat, right)

Tom Whipple, science editor of The Times

PORTRAIT Jay Brooks STILL LIFE Romas Foord



veryone has a moment when they realised this was serious, when they understood that 2020 would be a year unlike any other.

Mine came at a research conference, over a glass of wine with a Nobel-winning biologist. I was at the event in my capacity as the *Times* science editor, and I was

nervous about what the scientists present thought of our coverage. Lockdown had not happened yet, and there were still no deaths in Britain, but I was nevertheless writing several coronavirus stories a week.

Somewhat apprehensively, I asked him whether the press was over-egging this new virus. Were we scaring people unduly?

He took a crisp from a nearby plate of nibbles and looked me directly in the eye. "I've got a house in the country with a moat," he said, "and I'm stockpiling corned beef."

So it was that I truly began my year in Covid, and the biggest story I will ever cover (if it isn't, then God help us all).

And, like much of the country, I also did so while trying to keep the rest of my life together. I listened to the Downing Street press conference while bathing a baby; I set up an interview with the prime minister of Sweden while home schooling a six-year-old. During a telephone call with the head of the UK vaccine taskforce I coughed loudly in order to cover the sound of my two boys fighting.

Like everyone else, I prayed for the world to soon return to normal. Unlike everyone else, every day I chatted to people who told me just how unlikely that was.

#### **JANUARY It begins**

If you are going to ask a stupid question, you can at least console yourself if you are the first to do so. Why, I ask a panel of Britain's leading virologists, immunologists, and epidemiologists, is this new "coronavirus" any more worrying than flu? "After all," I say, proudly brandishing a printout of hospital statistics, "in the first week in December, flu hospitalised 500 Britons and 8 of them died. That did not make headlines in China, so why are we worried about this?"

The scientists wearily pull the microphone over to answer. It will not be the last time they have to explain to a journalist why this isn't just another flu. I see from the name tags one of them is called Professor Neil Ferguson.

The pandemic arrives slowly. The first mention in *The Times* is on the foreign pages, in a short article on January 10. That article is positioned – appropriately, you might say – alongside a longer one about the bushmeat trade in central Africa.

From then on the articles on coronavirus grow exponentially – the numbers doubling, like the virus itself, about every four days.



# HAD THEY REALLY SAID THERE COULD BE 260,000 DEATHS? FERGUSON'S PAPER CHANGES EVERYTHING

Most of the initial articles are by our foreign staff, charting the progress of this Asian disease. The first time I write about it is almost three doublings later, and coincides with a press conference put together by a group called the Science Media Centre.

The SMC, based at research charity the Wellcome Trust, thinks the country's science journalists might appreciate a background briefing on this new respiratory disease, and they pull together a few experts to talk to us. The SMC, a kind of science PR organisation backed by charities and industry, is an organisation of many virtues, not least among them that it always offers journalists cookies. As a consequence, it gathers a good crowd.

On this day in late January, each of us has a different objective. One of the possible mooted sources of the virus is reptilian and my colleague on a tabloid is very keen to get a scientist to call it "Snake Flu".

"It needs a good name," he says, "or we'll never get it in the paper".

To understand why the scientists were so worried, why even then this was clearly not "just flu", you need to understand what a virus wants.

A virus does not, of course, have a mind or desires. Some biologists would argue a virus is not even life. But, if it is life, it is the simplest kind possible. It is a replication machine: a little packet of genetic material, enclosed in a Trojan horse of protein, that hijacks you for its own ends.

This is important: a virus does not benefit from killing you; it benefits from using you. Your death is almost as much an inconvenience for it as it is for you.

The most successful viruses are not the bigname killers – ebola, HIV. They get famous because they kill you, and so we notice them. But a virus doesn't want to be noticed. The most successful viruses are the ones, like the common cold, that are at worst an annoyance.

This particular coronavirus was probably, until late 2019, a bat cold. For aeons it had evolved to be supremely adapted to replicating in bats, and the bats had adapted to it – gaining the immunity that meant it caused merely a bat sniffle.

Then, one day, it mutated. That genetic code inside the packet of protein changed, and did so in such a way that it could pass between humans. Suddenly, in this new species – us – neither the host nor the virus were adapted. The malign symbiosis that ordinarily guarantees both survive had broken down. A new virus in humans unadapted to it is a potential catastrophe.

Even so, we have been here before and it has ended up as nothing. Like my colleague hoping to call it snake flu, I can't yet see a clear news article coming from the press conference. But I do want to write something.

My own scientific background is in mathematics, not virology. This outbreak seems like a good excuse to describe one of the more interesting parameters we learnt in disease modelling. So it is that which I go back to the office and write an analysis piece on

- an obscure statistical concept known as "R".

### FEBRUARY What a really scary pandemic looks like

Stephen Chu, a Nobel laureate and President Obama's former energy secretary, has invited me to breakfast. He has also, admittedly, invited 100 other members of the press to breakfast too – this isn't an occasion where we get to swap tips about how we like our eggs. I squint over a muffin at him, from the back of the room.

We are in a conference centre in Seattle, for the annual meeting of the American Association for the Advancement of Science. Just writing those words now, it feels like madness. Ten months on, this meeting of scientists feels less like a geeks' convention, more like the lurid tale of some last-days-of-Rome bacchanal.

We arrived on planes. We packed into rooms together. We mingled. At one point I took a swig from a beer bottle I thought was mine, then realised that *The Economist's* science correspondent had already drunk from it. But that was fine: we all have immune systems – even on *The Economist*.

In the breakfast meeting, one of the journalists asks Chu about the pandemic. Is he concerned? A few weeks later Seattle will be the coronavirus epicentre of the US – whether the arrival of thousands of delegates, including me, from around the world helped that, we don't know.

Chu's answer, though, is not about coronavirus at all. He instead talks about a different outbreak of avian flu, reported north of Wuhan. "This is something even more worrisome, if you'd like to worry," he said. "If you get it you have a 60 per cent chance of dying." It has not, yet, learnt how to spread from human to human in a sustained way, but if it did, "this is big-time serious stuff. You're talking about a fraction of the world's population."

#### **FEBRUARY Disease X**

The virologists call this a "Disease X situation". The scariest pathogen is the unknown unknown, the one we know literally nothing about – the one that suddenly appears one day, by a mink farm or a wet market.

If that pathogen turns out to be, like the Black Death, a bacterium, then that would be where it stayed. Modern medicine has no problems with most bacteria. A few people would end up in hospital, they would be treated with antibiotics and would get better. The world could easily not even know it had stopped a plague.

But there is no virus equivalent of an antibiotic. Bacteria are big, squidgy and complex – they are easy to kill. Viruses are very small, very simple and have almost no moving parts to interfere with.



# I FLY TO A CONFERENCE IN SEATTLE. A FEW DAYS LATER, IT'S AMERICA'S CORONAVIRUS EPICENTRE

To beat a virus you need a vaccine, and that vaccine has to be precisely idiosyncratic to the virus. This means that developing it takes time. Traditionally, you need to get the virus itself and deactivate it somehow – a little like taking the engine out of a car. Then, when you inject this husk of a virus into people, their bodies learn to recognise the real thing – so that when it arrives with its V8 revving, the immune system is ready to respond.

A few years ago, I spoke to a team trying a different approach. Was there a way to make a generic vaccine, ready and waiting to be adapted to a new disease? This team, at Oxford, had created a vaccine "platform".

It was a general method for tricking human cells to make little spikes of protein to order. Protein spikes are to viruses what logos are to cars, their unique identifier, emblazoned on the outside. If you inject this Oxford vaccine into people, their cells become little protein factories. Tweak the genetic code in the vaccine, and you tweak what proteins they make. If, for instance, you knew the genetic code of a new virus, you could instantly adapt your vaccine so that it made the spikes on that virus's surface. Then, you would train your immune system to spot those spikes – a little like recognising a car from its logo alone.

Remembering that earlier interview I send an email to Professor Sarah Gilbert, one of the lead investigators in the Oxford team, to find out what they were doing about this new coronavirus.

I am lucky to get in early. A month later Gilbert will have set up an autoreply that roughly translates as, "Journalists, please leave me alone. I'm trying to save the world." Today, though, she is still happy to chat. She tells me that they have a vaccine, that animal trials are imminent, and this is exactly what they had been preparing for.

Still, she suspects this will be simply be an academic exercise. Even if the vaccine is made in record time, will anyone need it in a year?

On the plane back from Seattle, breathing the exhaled air of 200 people for 9 hours, I make a start on an essay I had been asked to write for the Saturday newspaper. The comment editor wants me to produce something a bit more expansive about the virus. This pandemic may not come to anything, he suggests, but is it the warning we need to make sure we are prepared for the next one?

In researching the piece, I visit the *Times* archive, and look at our coverage of the Spanish Flu. At first, we treated it as a diversion from the Great War. Later, it became simply numbers. "At the epidemic's height, the novelty long gone, we simply published weekly tables of deaths," I write. "London County, 2,458; London outer ring, 1,705; Sheffield, 465; Leicester, 260; Hull, 220..."

The idea that weekly deaths in their thousands would be dispassionately tabulated in a national newspaper seems horrific.

#### MARCH Lockdown: the phoney war

On the train to the office, I have a realisation. For quite possibly the first time in my career, I'm covering a story that verifiably and immediately affects the people reading it.

It's not that past stories I've written have been unimportant. I've reported on four general elections; I spent a month in the US for Obama's election; I bagged the first broadsheet interview with Jedward.

It's just that, currently, the train I'm on is only half-full – and the reason why is the pandemic. Politics is important, but how often do you wake up with a new government and actually feel the difference in your commute? For all the backstops, red lines and Malthouse amendments, and millions of words of

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commentary, how many people have yet had their lives changed in a clear way by Brexit?

Yet, someone has bat soup in China, the press writes about it, and suddenly I can get a seat on the 8.47 to Waterloo.

Mind you, there is a downside to this. If, as we hear, Britain's virus plan is to get herd immunity, then by the looks of this train it is not going well.

"Herd immunity" is a bad term for a perfectly respectable concept. By infection or injection, herd immunity is how we learn to live with every infectious disease. To calculate it, you need to know about the statistic of the year: R.

R is a measure of how many people each newly infected person passes the disease onto. If R is 3, then it means that if I get infected, on average I sneeze on three others and give it to them too. They give it to 9 people, those 9 give it to 27, those 27 to 81.

This cannot continue indefinitely, and this is where herd immunity comes in. Imagine that coronavirus has been spreading unchecked through the population. At some point, I will sneeze on three people but two of them will have already got it and be immune. R will be 1, and the disease will stop spreading – it will reach a steady state in the population.

That, then, is herd immunity: in this case, it kicks in when two thirds of the population are immune. Oddly though, judging by how empty the train is, everyone in Britain seems rather more willing to be in the third that remains uninfected than the two thirds taking one for the team. There may be a political lesson there.

Irrespective of the epidemiological ramifications, the seat is welcome. We moved out of London to the suburbs six months earlier. The upsides were a bigger house, a garden and being closer to family. The downside was a much longer commute. When I moved I made a calculation: I predicted that, slowly but surely, home working would be encouraged. Maybe, one day, I would only be commuting in three days a week?

#### Lockdown: first shots

When the virtual press conference is over, I feel drained. In the kitchen, my wife is making tea. Upstairs my children are playing. Everything is unchanged, for them – for now.

I sit back on the sofa. Did I mishear? I have the whole conference recorded, but I still email the science correspondent of another paper to double-check. Did they really just say what I think they said? Did a government adviser just announce, calmly and without ceremony, that the current course of the country would result in 260,000 deaths?

He did, my colleague says.

This conference, on March 16, is the moment the country pivoted. It would take a week of dithering until full lockdown, but it is clear that after the release of Neil Ferguson's Imperial College paper, everything will change. I walk into the kitchen.

"That was the most extraordinary press conference of my career," I say.

"Does this mean schools will close?" my wife asks. It's unlikely, I tell her – the government has pledged to keep them open.

For the next day's paper, the front-page story writes itself: it's not every day a government is told it risks the deaths of a quarter of a million of its own citizens. But there is another part of the Imperial study I find almost as shocking – a caveat that, even months later, I will find people haven't truly appreciated.

If we shift course, from mitigating to suppressing the virus, the Imperial paper explains, interventions "need to be maintained – at least intermittently – for as long as the virus is circulating in the human population, or until a vaccine becomes available. In the case of Covid-19, it will be at least 12-18 months."

#### Lockdown begins

Even after the press conference, we now know, debate continued. Scientists had spent their careers developing exquisite models of how diseases spread – with infection patterns and behaviour described using differential equations. Now they wanted to apply them.

Could we tweak the behaviour of the population to spread the curve of infections – to "squash the sombrero", as Boris Johnson puts it, and have the pandemic over with in the summer? If we did so, could we keep the number of serious infections at any one time under the NHS capacity to deal with them?

In the end, the answer is clear: no, not even close. A week after Ferguson's paper is published, Britain joins most of the rest of Europe and locks down.

There are, it seems to me, two kinds of people in lockdown. There are people who have more time than they have ever had – sitting at home with Netflix, feeling guilty about not learning a language, eating snacks.

Then there are people with less time than they have ever had – juggling jobs and children, home schooling and cooking, continually refreshing Ocado in case a slot becomes available. It isn't great to be either kind of person, but I'd take the second every time.

Our days begin at 6am. My wife and I tiptoe into the kitchen hoping that we don't wake our eight-month-old son. Between 6 and 7 both of us work.

At 7am, when our two older sons come down, she leaves, and I start the first shift. We begin with PE, then maths, then English. Sometimes, we take a diversion into Lego, *Horrible Histories* and, "Daddy has to phone someone on Sage, so please be quiet." At llam, there is the formal child handover and I start my second shift. One of the privileges of my job is that I can phone up the best academics in the land and effectively ask them for a one-on-one tutorial about virology. Tragedy is all around me but intellectually, as I navigate a world of T cells and protein shells, it's thrilling.

Eventually, after one call too many, I get the sense that the thrill of these conversations may be one-sided. Some thank-you bottles of *Times* gin are hastily dispatched to some of Britain's top virologists.

At 7pm, the children go to bed and we both start the third shift. Guiltily, I work through most of the Thursday claps.

It is still not clear how well or how badly we are doing. Neil Ferguson says that 20,000 deaths would be a good result. On the other hand, a mathematician at Oxford thinks we might have already reached herd immunity. Who is right?

The thing about models is that they depend on your assumptions. Change those assumptions and the outputs can change profoundly too.

Ferguson's approach is, very roughly, top-down. From what we know about infectiousness, susceptibility, severity, what is the likely future spread of the virus? When you put those values into the equations, what do you end up with?

The Oxford team is more bottom-up. They started with a standard outbreak model, known as "susceptibility-infected-recovered", then altered its parameters to see which version best matched the current data. Their conclusion is startling: the best fit comes from assuming as many as half of us got infected without realising. This suggests, says the Oxford professor, that the pandemic will end "with a whimper, not a bang".

In the media the two groups are pitted against each other: Oxford v Imperial. Presumably if we pass 20,000 deaths, everyone will accept Ferguson was right – and the Oxford professor's burgeoning media career will come to an abrupt end.

#### MAY

Between articles, I go out to look at our rose. It is the first spring in our new house, the weather is beautiful, and each week, somewhere in the overgrown garden, there is a new plant to surprise us.

None more so than the rose. I first see it, a small bush at the back of the garden. Then I look up – and up and up. An entire tree, 40ft tall, is covered in the same rose – a great bloom of yellow. My eyes adjusting to the overgrown gloom, I realise this single plant has twisted and crept over an area the size of a badminton court. Former adviser Sir David King, now of Independent Sage



# IF A TRACING APP CAN'T FIND MY TORTOISE SOPHOCLES, HOW IS ONE GOING TO STOP COVID?

Early on in the pandemic I had interviewed Jeremy Farrar, the head of the Wellcome Trust. "What we're doing now is living through history being made," he said. "And it's very, very, very uncomfortable, and it's very hard. Sometimes, when you read history books and documents, you forget that for the people living through it at the time, it was devastating."

I take solace in the rose and the fact that, for us, so far the pandemic is not devastating – just boring.

Other than a weekly trip to Waitrose – my "special treat", I find myself unironically calling it – on only one occasion do I travel more than three miles. Sir David King, a former chief scientific adviser, has set up a shadow advisory group, that he calls Independent Sage. He agrees to a chat in his Cambridge garden.

Putting on a mask for the first time, I step onto a train, and travel through a fractured country: an empty Paddington, an empty Tube system, an empty King's Cross,

an empty railway scything through villages whose residents, like medieval peasants, never leave these days.

King believes it need not still be like this. If we had gone into lockdown a week earlier, he argues, we would be out of it by now – and with a quarter the deaths. Instead, he says, Johnson was too focused on the economy and Brexit. "He was playing with death. He wasn't taking it seriously." Over the course of the pandemic, Independent Sage divide the scientific community. Many scientists praise it for forcing the official Sage to be transparent. Many also hint that, perhaps, King secretly wishes he was the current adviser, in place of Sir Patrick Vallance.

He vigorously denies this. "Sir Patrick has been given what we in rugby call a hospital pass. There's this ball floating through the air towards him and he's got a 15-stoner pounding in his direction, about to knock him to the ground."

When I get home my mum calls, gleeful. She has identified the rose. "I found out where it's from originally," she says, barely suppressing giggles. "Wuhan."

#### JUNE

Sophocles, my tortoise, has been missing for three days, and he shouldn't be.

On moving to a bigger garden, I had placed a Bluetooth tracker on him. The idea was, if I lost him, I need only press a button on my phone and provided I was within a few metres of Sophocles, he would play a little fanfare. If I lost my phone, I need only press a button on the tortoise and it would ring too.

But I can't find him. Each day I walk slowly through the undergrowth, listening for his tune – but it doesn't come.

On the fourth day, I am in the garage when I hear a rustling. Sophocles has got caught between some logs and is waggling his legs uselessly. I free him, but am troubled. I must have been within feet of him many times, but my phone never activated.

Our great hope – or, rather, this month's great hope – is that an app could revolutionise contact tracing, telling us whom infected people had met and efficiently telling them to isolate. This is what troubles me – if Bluetooth can't find a tortoise, why should it stop Covid?

#### JULY

The office rises Ozymandias-like above the skyline. Around its shimmering glass base, the lone and level sands of London Bridge station stretch bare.

This is my first trip into the office since March, and it is almost empty. In my drawer, there is a lot of mail, two invitations for events that never happened, and a pair of gym socks I half-heartedly promise myself I will remember to take home.

Need it be like this? Across the North Sea, there is a standing rebuke to the claims of people like David King: Sweden.

Sweden has, by now, become an argument as much as a place. If you like chloroquine, don't like masks and perhaps do like Brexit, then Sweden is the exemplar of a nation that kept its head. Here, people still go into work, still go into coffee shops – still live. And, contrary to the predictions of the modellers, there are not bodies in the street.

If you like making NHS murals and reporting on your neighbours when they have too many guests at their barbecue, then Sweden is a cautionary tale. Its laissez-faire policy may not have overwhelmed hospitals, but the death rate is far higher than Norway or Denmark, and the economic hit the same.

I chat to Stefan Lofven, the Swedish prime minister, about what it is like to be the world's political Rorschach test. "We get into debates where everybody needs to defend their own choice. That's to some extent understandable," he says.

What they did in Sweden is not, he argues, so different. Both sides – there are definitely "sides" – have appropriated its policies for their own claims and it makes him uncomfortable. "We didn't choose a totally different path. If you have symptoms, stay at home. Keep the distance. Don't be in crowds."

In Sweden they have a saying, when someone has made a mistake: "To shit in the blue cupboard." Lofven refuses to condemn the responses of other countries, but I can't see how everyone can be right. Someone has done a shit in the blue cupboard; we just don't know who.

Luckily, no one has done the same in my desk cupboard – although the festering socks are certainly not fragrant. Carefully, I close the door and leave them behind. I haven't been back to smell them since.

#### AUGUST

There is, in the entire spring and summer, a single week of bad weather. That is the week I go on holiday.

On most days we stand on the beach in a fleece and wellies, while my sons make sandcastles wearing gloves and balaclavas. On the worst day, waves send spray crashing and there is torrential rain. All that is left for us in Norfolk is the Sea Life centre in Hunstanton.

Sheltering in the reception, with 45 minutes to go until our allotted slot, I exchange sympathetic looks with other dads. Our breath condenses on the doors and windows. Is there virus among it?

After its summer hiatus, this is what coronavirus has been waiting for.

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Counterintuitively, so too has the vaccine trial. A trial does not end after a set period of time; it ends after a set number of infections. You give 20,000 people the vaccine you want to test, 20,000 people a placebo – then you wait until around 150 people are infected. If most of those people are in the placebo group, the virus is a success.

The Oxford scientists had hoped to have a result by September, but lockdown was too effective. Without the virus swilling around, the cases barely ticked up. Now, though, winter is coming and the world is moving inside. The virus is spreading but its success could, paradoxically, be its downfall. If, that is, any of the vaccines work.

#### SEPTEMBER AND OCTOBER

The coronavirus is a test of human psychology. First come cases, which happen a week after infection. Then come hospitalisations, which happen another week later. Then, after a month, come deaths.

To stop the deaths, you have to act when there are cases. You have to act when things don't seem bad – and using hazy data. A successful policy must always look like it had been an overreaction.

Standing in a café – still a rare treat – over the course of an afternoon, I speak to a dozen members of Sage. All feel that the time is right in England for what is being called a "circuit breaker" – a short lockdown to prevent a longer one later. All know that, politically, it's not going to happen. They are fatalistic about the winter ahead. Coronavirus is a test of human psychology, they tell me, and we are failing.

#### Lockdown 2: the darkest hour

The clocks have changed, the sky is grey, my children are not yet up, and I am having a minor meltdown.

It is 6am, and a desultory dawn is revealing another grim day of a lockdown. The day before, 492 deaths were reported. As the rain drums against my kitchen window, I find I am furious.

Over the summer there was a strange mobilisation on the internet. Climate sceptics and assorted contrarians shifted discipline, like a footballer during a loan move, to apply their skills to coronavirus. An orthodoxy developed that the pandemic was all over, and the experts were lying.

Then cases started rising, and – with a growing audience, including many Tory backbenchers – the sceptics needed an explanation. First, we were told, the test didn't work and it was all false positives. Then, when there were too many, they were a "casedemic" – asymptomatic infections in people who weren't ill. Then when all



## SAHIN HEARD THE TRIAL RESULT: 90% EFFICACY. 'IT WAS AN EXTREME RELIEF. IT JUST MEANS SO MUCH'

the people receiving false positives – like big hypochondriacs – started dying that wasn't cause for concern either. They were dying not of covid but with covid.

It's exhausting.

What excuse will the coronasceptics come up with to minimise this next? "I think you'll find Liverpool's crematoriums are still not at capacity"?

My job, in peacetime, involves writing about all kinds of science. I chat to interesting, clever people about interesting, clever things. I am used to dinosaurs and asteroids, not contrarians and columnists. Suddenly, though, science is political – and the political people don't understand it. Now, as deaths accumulate, it's too late.

The whole summer and autumn has been a failure of science communication.

Amateur epidemiologists with graphs made in Excel briefly became blogosphere celebrities. Moon-landing-hoax-level complexity was deployed in baroque Twitter threads to reassure us it was all fine. Academics nitpicked around the edges, allowed themselves to be misinterpreted, and in doing so undermined the core. Columnists with humanities degrees started throwing around recherché accusations – "You don't understand Bayes' probability theorem." No, you don't understand Bayes.

We have – to give just one example – Desmond Swayne MP claiming the tests can't be trusted as they give a false positive rate of 2.4 per cent. He was speaking at a time when the total positive rate was far less than half that. I don't want to blind you with science, Sir Desmond, but how can you get fewer total positives than false positives?

We needed a debate about policy; instead, we had a debate about reality. Rather than discussing what to do in a mature fashion, we have played whack-a-mole in the carnival of bullshit. And all the while the virus, unperturbed by conspiracies, has spread. More people have died, more businesses have been harmed, because we never got to discuss the pandemic like grown-ups.

It is a comment online below one of my pieces, accusing me, again, of ignorance of false positives, that finally tips me over the edge. In one furious hour as the sun rises I write a 1,000-word comment piece. The last paragraph is, "A hailstorm of bollocks landed in a sea of filth, and the ripples of excrement washed over all of us."

Just as I finish, a child pushes open the kitchen door and the morning begins. My mouse hovers over "send". Is it too strong? I save to drafts. Later.

#### Lockdown 2: light at the end of the tunnel

Ugur Sahin remembers when Albert Bourla, the CEO of Pfizer, rang to tell him they had trial results on the vaccine they had developed together.

"There was an elongation of time," the BioNTech chief executive officer tells me. Bourla was about to pass on the most important number in the world. Holding the phone to his ear, "the anxiety grew and grew". Then came the result: 90 per cent efficacy, far far better than anyone dared hope. "It was an extreme relief. It just means so much."

A week later Tal Zaks, chief medical officer of Moderna, heard a very similar number, relating instead to his vaccine. It was, he said, "one of the greatest moments of my life".

A week after that Sarah Gilbert, not a woman given to hyperbole, was at home when it was her turn. It was, she tells me with some understatement, "very gratifying."

Most vaccines, we know, fail. Most that succeed take years. Very sensible scientists very sensibly warned that we could not rely on a vaccine as our exit strategy.

The very sensible scientists were wrong. They were gloriously, joyously wrong. "We have a vaccine for the world," says Professor Andrew Pollard, who ran the Oxford trial. "This is an incredibly exciting moment for human health." You wait a year for a vaccine, then three come along all at once.

A long winter is ahead, but in the hard and frosty ground of lockdown we can already see the green shoots of spring.  $\blacksquare$