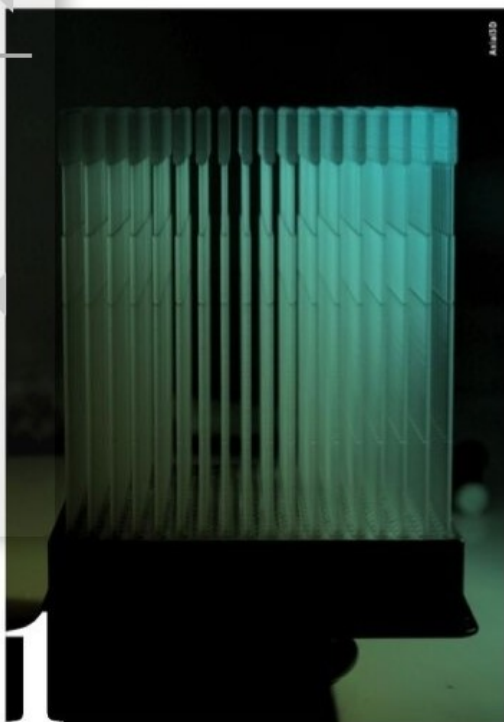


## TECHNOLOGY

# Ten innovations in the fight against COVID-19

Around the world, organisations are deploying tried-and-tested technologies and developing new ones to accelerate healthcare innovation and fight the coronavirus. From revolutionary CRISPR techniques to 3D printing of personal protective equipment, here are ten of the most exciting examples

Rachel Jones



## 3D-printed swabs designed with AI

Belfast-based Axial3D, an artificial intelligence software company specialising in medical 3D printing to create anatomical models, has deployed its 3D capability in new ways to print face shields, ventilator parts and nasopharyngeal swabs for testing.

Following clinical trials in New York and Florida, it has sent hundreds of thousands of specially designed swabs to capture COVID-19 samples across the United States, Europe and Asia. Measuring around 15cm, these are produced on Formlabs printers on surgical guide resin

and keep samples more intact than traditional swabs; they can also be condensed into tubes. Each printer produces 1,000 a day.

"3D is sometimes seen as a [slow] last resort, but the function of a printed swab can be better than the traditional swab," says Axial3D's chief executive Roger Johnston. His firm employs just 30 people, but local partnerships helped expedite regulatory approval and scale up this healthcare innovation.

"Our primary market has been the US, where demand is huge," says Johnston. Acceptance of 3D printing for personal protective equipment and clinical applications is accelerating. "There won't be a turning point backwards," he says.

## Over-the-counter COVID-19 tests

CRISPR, the new class of molecular tools, is being used in multiple ways as a prophylactic strategy and to increase vaccine yields, for example. CRISPR-based platforms are also being employed to develop diagnostic tests as a scalable means to address disease detection, since the standard technique, RT-PCR, is too limited to offer the mass testing epidemiologists say is needed.

US-based Mammoth Biosciences, co-founded by CRISPR pioneer Dr Jennifer Doudna, is now collaborating with GSK with the aim to deliver "extremely accurate and robust tests in a rapid format" by early next year. "People think of CRISPR as an editing tool, but we think of it as a search engine for biology," says Mammoth co-founder and chief executive Dr Trevor Martin.

The test, which could provide results in 20 minutes from a nasal swab, uses guide RNA and a programmed sequence specific to SARS-CoV-2, the current strain of coronavirus, with viral evidence triggering a "molecular shredder" that creates a release of colour to display a read-out. "CRISPR diagnostics can have a large impact in this space," says Martin, "particularly in a pandemic."



## Applying AI to real-time patient data

The Patient Status Engine (PSE) automates the collection of raw patient data and decision-support tools for clinicians, combining wearable sensors with wireless networks and big data to provide high-resolution patient monitoring. Currently used in two NHS trusts and globally, it's a class-2 medical device that's FDA-approved in America and, says maker Isansys Lifecare, the only medically certified end-to-end digital solution of its kind.

"Bedside equipment in hospitals gives clinically accurate data, but isn't portable, while wearable products generally don't provide information accurate enough to make

clinical decisions," says chief executive Keith Errey. He likens the PSE to an app store for healthcare. "People are developing their own artificial intelligence to run within our platform," he says.

Installed behind hospital firewalls, this healthcare innovation includes wireless connections as part of its design, with patients connected through an Android "gateway" running Isansys applications that receive incoming data from sensors via doubly encrypted Bluetooth. High-dependency isolation wards can be created rapidly, says Errey.

"With COVID-19, the needs we've been talking about for years have become very apparent. This is smart tech, but the key is usability and meeting customer needs," he says.



## Monitoring social distancing

Chris Stretton and Adam Bykowski met while studying telecoms engineering and founded Locilabs last November to develop a precision tracking product based on ultra wide band (UWB) technology.

As the COVID-19 pandemic began, they pivoted to an application for social distancing, launching their SafeSpace system. Via badges and watches, this measures how closely and for how long individuals come into contact, by monitoring the time of flight of radio signals between units. It also triggers alerts and real-time feedback via a cloud platform to identify those at risk of COVID-19.

"With UWB, we can define a distance with a 10cm margin of error, which is more accurate than Bluetooth or radio-frequency identification," says Stretton, who previously worked on big telecoms and major infrastructure projects. "We can say definitively when contact occurred and give total exposure time. Tangible data could help to avoid use of quarantine."

Its (ingress protection) IP67-rated hardware, European CE and FCC (US Federal Communications Commission) approval mean major organisations are already trialling the innovation. Stretton believes their system offers potential to track COVID-19 cases in healthcare systems.