Covid-19 and man's best friend

The sniffer dog has joined the drive to pin down the novel coronavirus

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As means of containing Covid-19, economic pressures are making it impractical to continue lockdown and meaningful isolation. And as long as people travel, and mix, spread of the disease is inevitable. Lockdown, in any case, is an onerous measure that mostly keeps healthy people away from other healthy people. Workable control needs to find and draw aside the infected ones. For this, having methods of rapid testing is the only way.

The "gold standard" test for Sars-CoV2, the Covid-19 virus, is RT-PCR. As traces of the virus in sample fluids taken from patients are very sparse, RT-PCR works by getting these particles to multiply till they are easier to identify. The method, unfortunately, is time consuming and expensive.

An easier method is to look for the body's immune reaction – the antibodies, which can signal the presence of the virus. The method, however, is not accurate, and healthy persons could be labelled as infected, or infected persons allowed to go free. The best efforts to locate where the infection is present are hence not good enough and the pandemic continues to rage.

As a measure to fill the gap, the London School of Hygiene & Tropical Medicine, in collaboration with Medical Detection Dogs, an organisation that trains dogs to detect disease, and Durham University, which trained dogs to give early warning of malaria, have set out to see if dogs could step in. The study has received over half a million pounds from the UK government and if it is successful, "the dogs could provide a fast and non-invasive detection method... potentially screening up to 250 people per hour each," a press release says.

Detection with the help of dogs is to leverage their amazing sensitivity to smell, and the fact that most organic entities exude some kind of odour. Nature, in fact, makes extensive use of odour for communication – this is both because odours are easily dispersed and that it is economical, as only infinitesimally low concentration is needed. Most animals declare their readiness to mate and reproduce by an odour – there are insects that can attract a mate many kilometres away – rodents and insects use smell to locate sources of food; the ability is found even in fish, in all creatures, from molluscs to mammals. In fact, even some kinds of plants exude vapours when under stress, like grass when a lawn is mowed, to induce drooping or closing of leaves, or to discourage a predator.

The dog, among mammals, is again known for its acute sense of smell, and over centuries of domestication, this sense has been made to work in many ways. The dog, with its pack instinct, identifies closely with humans, and has been trained, as a watchdog, to tend sheep, draw sleds and lead the blind, for instance. And with its sense of smell, as a tracker and police dog. The odours of a missing person, or a fugitive, remain for a time at the place where she was last seen. A trained dog can then follow the scent to show its handlers the right places to look. Again, organic substances or chemicals, used as drugs, have odours that dogs have been trained to detect -- and they are used to find contraband, even securely sealed in baggage.

In disease, also, the presence of bacteria or viruses, causes changes in the body and the body's aura of chemical emissions. Detecting disease by analyses of the breath or body odours is now regularly practiced. While there are protocols and procedures, and devices like electronic noses, detection with the help of animals has been established, by dogs for lung or colorectal cancer, by rats for tuberculosis, for instance. Volatile compounds, or odours, from breath, blood, skin or urine are found as biomarkers of metabolic, genetic, or other disease, like diabetes, kidney or liver failure, multiple sclerosis, Parkinson's disease and bacterial infections.

In the case of malaria, it has been discovered that the mosquito, in taking a blood meal, selects infected persons over persons free of malaria. The reason appears to be that the blood of infected persons, which is depleted in red blood cells, is easier to feed on, and it may be an adaptive feature of the malaria parasite. As it looks like the medium of signalling the presence of malaria is through smell, researchers in Durham University, UK, tried out using trained dogs to detect malaria through smell.

Dogs are readily trained by conditioning, by exposing them to mixed stimuli, with a reward whenever they make a correct choice. This is the method used to train dogs even in complex tasks like detecting drugs or explosives. In the same way, the Durham University team trained a pair of dogs to make out the scent of children infected with malaria from those who were not. The dogs were then presented with samples consisting of 175 used nylon socks of schoolchildren from West African Gambia, shipped to the UK. 30 of the 175 socks were of children infected with malaria. The dogs could successfully detect 70 per cent of the socks of infected children and tell that 90 per cent of the others were clean.

The same Durham University, and LSHTM, which was also part of the malaria trial, and Medical Detection Dogs, are now set to see if infection by Sars-CoV2 also gives rise to odours that dogs may be able to detect. As respiratory diseases are known to affect body odour, it is felt that Covid-19 would have this effect. It really does not follow, as the early stages of the disease – which is when we are looking for a method of detection – have still not descended to the respiratory organs, but it is still quite likely that there is an odour.

The experiment is under way, with a team of six dogs, Labradors and Cocker Spaniels, undergoing training with samples collected from London hospitals. If the dogs are able to make out an odour that is unique to Covid-19, they can be trained to pick out infected individuals. They could then be stationed at places like airports, where every incoming traveller could be instantly screened, as she goes past.

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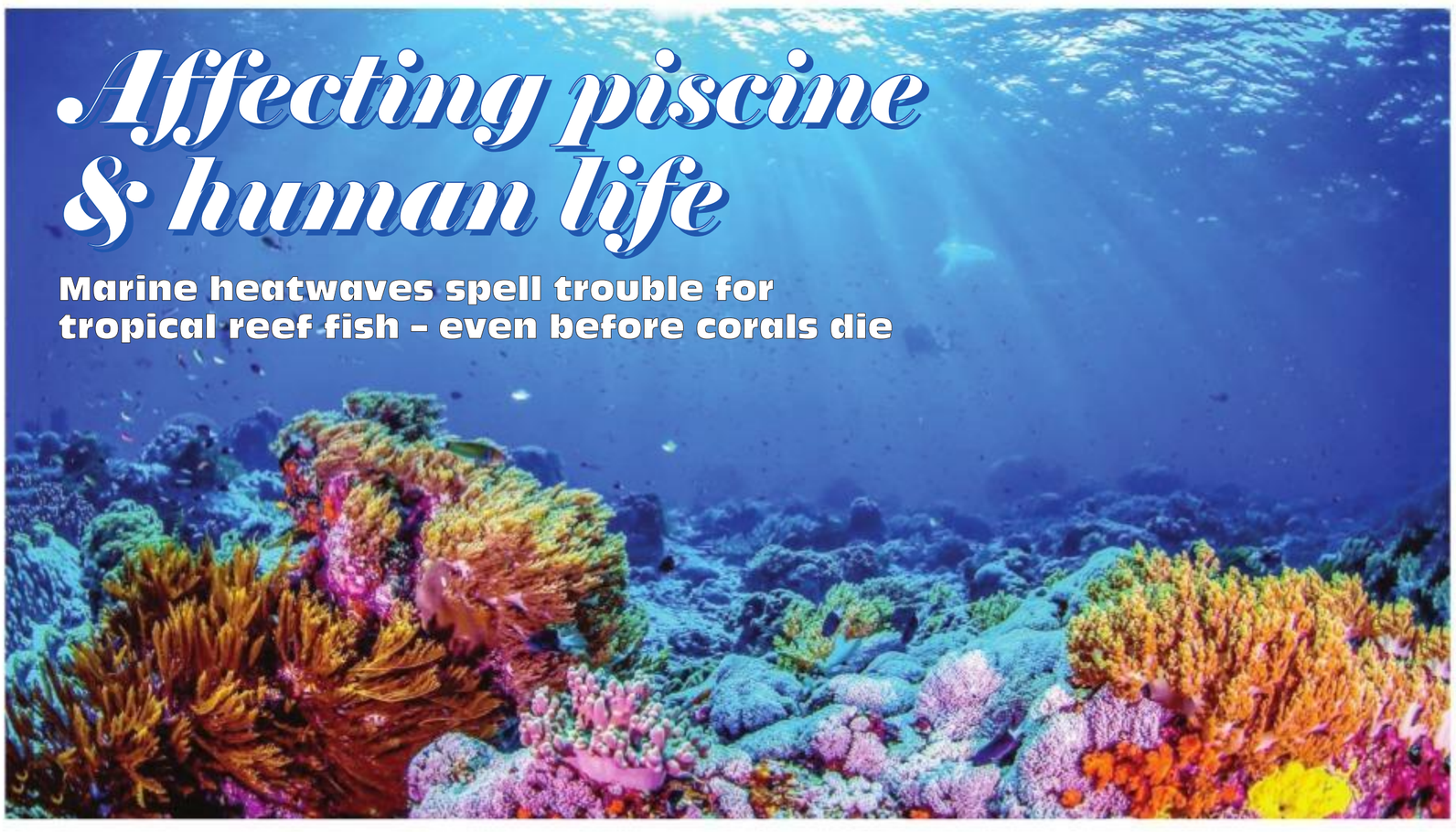
The canine apparatus

The insides of the canine nose consist of folds of skin, which contain 300 million smell-sensing nerve endings, compared to just six million that humans have. The area in the brain, dedicated to smell, is 40 times larger than that of humans', and the dog's nose is said to be a hundred thousand times more sensitive. Research by Medical Detection Dogs shows that trained dogs can detect the odour of disease at the equivalent dilution of one teaspoon of sugar in two Olympic-sized swimming pools of water. This amounts to one part in six billion!

Affecting piscine & human life

Marine heatwaves spell trouble for tropical reef fish – even before corals die



JENNIFER MT MAGEL & JULIA K BAUM

Despite the many challenges facing the world's oceans today, coral reefs remain strongholds of marine biodiversity. Thousands of species of fish of all shapes and sizes call these colourful, complex and economically important ecosystems home. Impending ocean warming, however, spells trouble for these fishes.

Ever since the first global coral bleaching event devastated reefs in the late 1990s, scientists have worked to document the effects of these catastrophic phenomena on coral reef fishes. In the wake of severe bleaching, coral mortality often leads to changes in the community of fish that live on the reef: fish that feed on corals decline, while those that feed on algae increase as the latter proliferates. But what happens to fish during a severe heat stress event – that is, when water temperatures rise, but the corals have not yet bleached and died? It seems that very few scientists have tried to find out.

Our new study, published in *Ecological Applications*, surveyed reef fish communities before, during and after the 2015-16 El Niño on Kiritimati, a coral atoll in the Pacific Ocean, which is part of the country of Kiribati. Our research suggests that short-term increases in water temperature may have devastating impacts on reef fish populations and the local communities that rely on them.

Heating up the world's largest atoll

Kiritimati, or Christmas Island, is the world's largest coral atoll – ring-shaped reef – by land mass. The nearest major airport is more than 2,000 kilometres away, in Hawaii. The people who live on Kiritimati are highly dependent on reef fish as a source of both food and income.

While the 2015–16 El Niño wreaked havoc on reefs worldwide, its effects were especially catastrophic around Kiritimati. Unprecedented levels of heat stress persisting for 10 straight months led to over 80 per cent coral mortality around the island, but not before triggering a change in the local fish community.

Stressed-out reef fish

After just two months of heat stress, reef fish populations around the atoll had plummeted by half. The number of fish species also declined, with some species disappearing entirely. Five species, including the Chevron butterflyfish (*Chaetodon trifascialis*), which feeds exclusively on live coral, have not been seen since.

One year after the heatwave, however, we found – somewhat surprisingly – that total reef fish biomass and abundance had recovered, rebounding to levels similar to those we'd observed in years prior to the heatwave. This begs the question: What exactly happened during those long, heat-stricken months?

While severe heat stress can lead to decreased fitness and even mortality in reef fishes, we believe that most of the missing fish sought shelter on the deeper, cooler reefs around the island during the heatwave. Once the heat had subsided, they could have easily returned to the shallows.

Yet the recovery of the reef fish community was not the same across the board. Sites on the atoll nearest to the villages, where the reefs have been heavily affected by dredging, fishing and pollution, had impaired recovery relative to areas of the atoll far from villages where the reefs were nearly pristine prior to the heatwave.

This suggests that local environmental protection could help make reefs more resilient to the ravages of severe ocean warming. While it may not be enough to entice fish to stay put during a severe warming event, high-quality reefs may be more attractive to these fish upon their return.

A window into the future

If the reef fish return once the heat stress is over, is their disappearance in the short-term really a big deal? Considering that the survival of millions of people worldwide depends on tropical reef fishes, we believe the answer to this question is a resounding yes.

The impacts of climate change on coral reefs are only predicted to worsen in the coming decades. Studying the effects of severe heat stress in the present can serve as a window into the future, foreshadowing the consequences of gradual ocean warming and more frequent and severe marine heatwaves that are predicted to occur. By understanding how fish populations react to elevated water temperatures, we can also attempt to predict and mitigate the effects of ocean warming on highly reef-dependent communities such as those on Kiritimati.

Within the realm of coral reef research, most studies on heat stress to date have focused on the link between heat stress and coral bleaching, and the knock-on effects of catastrophic bleaching on reef fishes. However, corals are not the only animals affected by the heat stress itself. Unless we intervene to limit climate change globally, we may risk losing not only corals but critically important reef fishes as well.

The writers are respectively, research assistant in biology and professor of biology at the University of Victoria, Australia. This article first appeared on www.theconversation.com

PLUS POINTS

Opening up online

Instagram should avoid enforcing a real-name policy in order to support openness about mental health, experts have recommended.

New research by Ysabel Gerrard at the University of Sheffield in the UK and Anthony McCosker at Swinburne University of Technology, Australia, has found that 76 per cent of a sample of *Instagram* accounts sharing content about mental health used pseudonyms to disguise their identity.

The study, published in the journal *New Media and Society*, also showed that 35 per cent of posts about depression used dark humour and memes, suggesting that mental health is still difficult for people to talk about.

The research, which looked at use of the hashtag #depressed and other relevant terms on *Instagram*, found that 38 per cent of posts were designed to inspire hope and encourage people to seek support for mental health problems. Just 15 per cent showed images of people, including selfies and depictions of self-harm. This may in part be influenced by *Instagram*'s policy of marking #depressed posts as "problematic", which means search results for this term are limited.

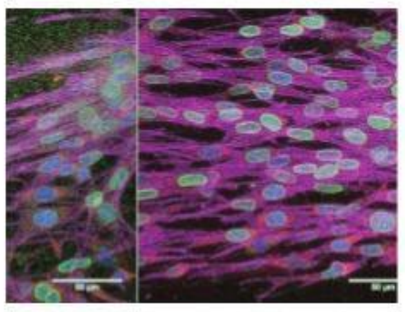
Gerrard, lecturer in the department of sociological studies at the University of Sheffield, said, "Our research has clearly shown that people don't feel comfortable talking about depression using their real name and a public account. If *Instagram* ever enforces a real-name policy, as *Facebook* has, it would wipe out these safe spaces entirely.

"It was interesting to see the extent to which people use dark humour to talk about depression. This suggests we should actually be taking meme accounts seriously in this context, and *Instagram* should avoid overly policing content about mental health -- unless it actively promotes acts like suicide and self-harm.

"While there has been progress around the way we talk about mental health, our findings show conditions like depression are still difficult to talk about. Allowing people to disguise their identity on social media is crucial to helping them open up."

Gerrard is a member of the *Facebook* and *Instagram* Suicide and Self-Injury Advisory Board – providing expertise to the companies about how potentially harmful content should be regulated. Her findings have led her to recommend that content about mental health, while potentially triggering for some, should not be overly policed.

Beautiful science



These images are of fibroblasts, the most common connective tissue cells. They produce the structural framework for tissue, synthesise the extracellular matrix and collagen, which support cells, and play a critical role in wound healing. But during the cellular ageing process, fibroblasts lose their ability to contract, leading to stiffness.

A study by the Mechanobiology Institute at the National University of Singapore has shown that these fibroblasts can be rejuvenated, or redifferentiated, by being geometrically confined on micropatterns – tiny patterns that direct cell growth and division.

The microscopic images show a group of control (left) and rejuvenated fibroblasts (right), with fluorescent labels highlighting the nucleus (blue), nuclear envelope – the membranes surrounding the nucleus (green), and cytoskeleton which gives the cell its shape (magenta).

The presence of more contractile proteins (in red) in the rejuvenated fibroblasts indicates that they have recovered their ability to contract. These rejuvenated cells were observed to have reduced DNA damage, and enhanced cytoskeletal gene expression.

The results of this study have been published in the *Proceedings of the National Academy of Sciences*. The research team believes that these mechanically rejuvenated fibroblasts could potentially be used as clinical implants in regenerative medicine and stem cell engineering.

– The straits times/ann