# THE ENVIRONMENTAL ISSUE

The first newspaper to clean air and help people with neurological conditions


INSIDE TODAY'S EDITION



# THE IMPACT OF CLIMATE CHANGE ON HEALTH NEEDS TO BE IN FOCUS TODAY, NOT TOMORROW

Many things that disrupt the way the brain works can cause epilepsy. Some causes can be largely environmental like head injury; in other people, a single letter change in your genetic code, which seems a small thing, can have a huge effect causing quite bad epilepsy.

For thirty years, Professor Sanjay Sisodiya, Professor of Neurology at UCL Queen Square Institute of Neurology and UCLH consultant neurologist has been researching and helping people with epilepsy. "Over time," he says, "I became interested in the genetics of epilepsy and how changes in genes lead to some of the rare and severe epilepsies. Where I work is a national referral centre for people with difficult to treat epilepsies. Over time it became clear that some of the people with the most severe epilepsies had a genetic cause."

Understanding more about epilepsy means that experts like Dr Sisodiya can understand better how to manage or treat the disease in its different forms, find out more about how it arises, what complications emerge and how to best help people. "With some of the genetic epilepsies there are some very specific treatments," he explains. "Now there are some treatments that can reverse the disease process or treat what it causes to go wrong in the brain. We now have some precision treatments because we know so much more about what is happening."

In his work, Dr Sisodiya often gets to know patients and their families over a long span of time. You begin to understand not just the seizures but other things that are going on related to the epilepsy. Some families had noted that seizures and other things like lethargy were worse during heat waves.

Dravet syndrome is one of the most common of the rare epilepsies and one that is affected by changes in ambient temperature. When Dr Sisodiya contacted other colleagues and experts about their observations of heat waves and epilepsy, they reported similar observations.

"That got me thinking about what the effects of climate change could be on these severe epilepsies," he says. "Even if we stopped all carbon emissions now, there would still be some embedded changes in the climate. So what would happen to people with these bad epilepsies? If you have these conditions, your resilience may already be compromised. So it could make big changes in our environment much harder to deal with."

Most people with epilepsy have seizures that can be fully or mostly controlled, but for at least one in three people, current treatments do not fully control seizures, and there can be an impact on their wider family and support. Families and partners can dedicate a huge amount of their lives to helping their loved ones who have epilepsy. It's not just the 60 million people who have epilepsy that may be affected by climate change, but their networks and families too.

Once the idea had occurred to Dr Sisodiya, he brought it to other experts for a sense check. "When I first started thinking about it, it seemed like a weird idea but when I asked colleagues around the world, they were interested and made the same links, and this led to the first short article being published in the Lancet Neurology in 2019. This raised the issue and led to the formation of Epilepsy Climate Change (EpiCC), now a group of more than a hundred people including other neurologists, paediatric neurologists, other scientists, epilepsy nurses and representatives from industry and charities supporting people with epilepsy."

## A VIRTUAL EXCHANGE OF IDEAS ON THE HORIZON

Back in 2019, before the pandemic, we were going to have a virtual conference, which felt like a novel thing before we all started meeting on video calls regularly. We were going to be UCL's first ever virtual conference, and we were even trying to find a platform to make it work. COVID hit and many medical teams were on the front-line so the event was put on hold. Finally, the conference is going to take place on November 25th.

The event has prominent speakers on climate change in general, climate change on health and related topics. Aimed at neurology experts who are climate curious, the point of the event is to help people working in the area of neurology learn more about possible climate impacts. Although most medically-trained researchers and experts work hard to keep across information in their field, they may not always have the opportunity to look more widely at important developments apparently outside their own field, but that might have far-reaching consequences for their work.

While face-to-face medical appointments are vital for monitoring and treatments, the COVID-related lockdowns proved to be an opportunity to measure the benefits of not having to be at a specific location. "For just one facility in one hospital over six months, we worked out that travel saved by not physically coming in was the equivalent of driving a car five times around the equator. This is a sizeable amount of carbon emissions," says Dr Sisodiya, "and, in appropriate circumstances, could contribute to the aim of the NHS to be carbon-zero by 2040."

The virtual appointments had other unexpected benefits. For example, people who had had a seizure on the morning of the appointment might not be able to travel to an appointment, but could still make a virtual appointment; older relatives and families who might not have been able to attend with people who would have had face-to-face appointments could still take part in a virtual appointment - so it's more accessible for families and loved ones to be in attendance more frequently.

As leaders gather in Glasgow for the COP26 meeting, it is surprising that health issues of any kind are hard to find on their agenda. Dr Sisodiya says it is vital that leaders don't just pay lip service to climate change issues or those related to its impact on health. "They need to act to reduce carbon emissions and adapt to the inevitable changes ahead. This is important for everyone," he says. "That has to be the most important thing. But along with this, in all the calculations, we also have to think about health as part of this. People with diseases and people with neurological diseases will probably be amongst the first of those to be affected, and may be least able to respond."

"There has to be more attention paid to health and the effects of climate change and we have to think about further research. Some of the vast amounts of money being pledged and spent has to be focused on diseases, because this can tell us more about what is going to happen to human health: it's like an early warning system for everybody."

Professor Sanjay Sisodiya


*About this issue*

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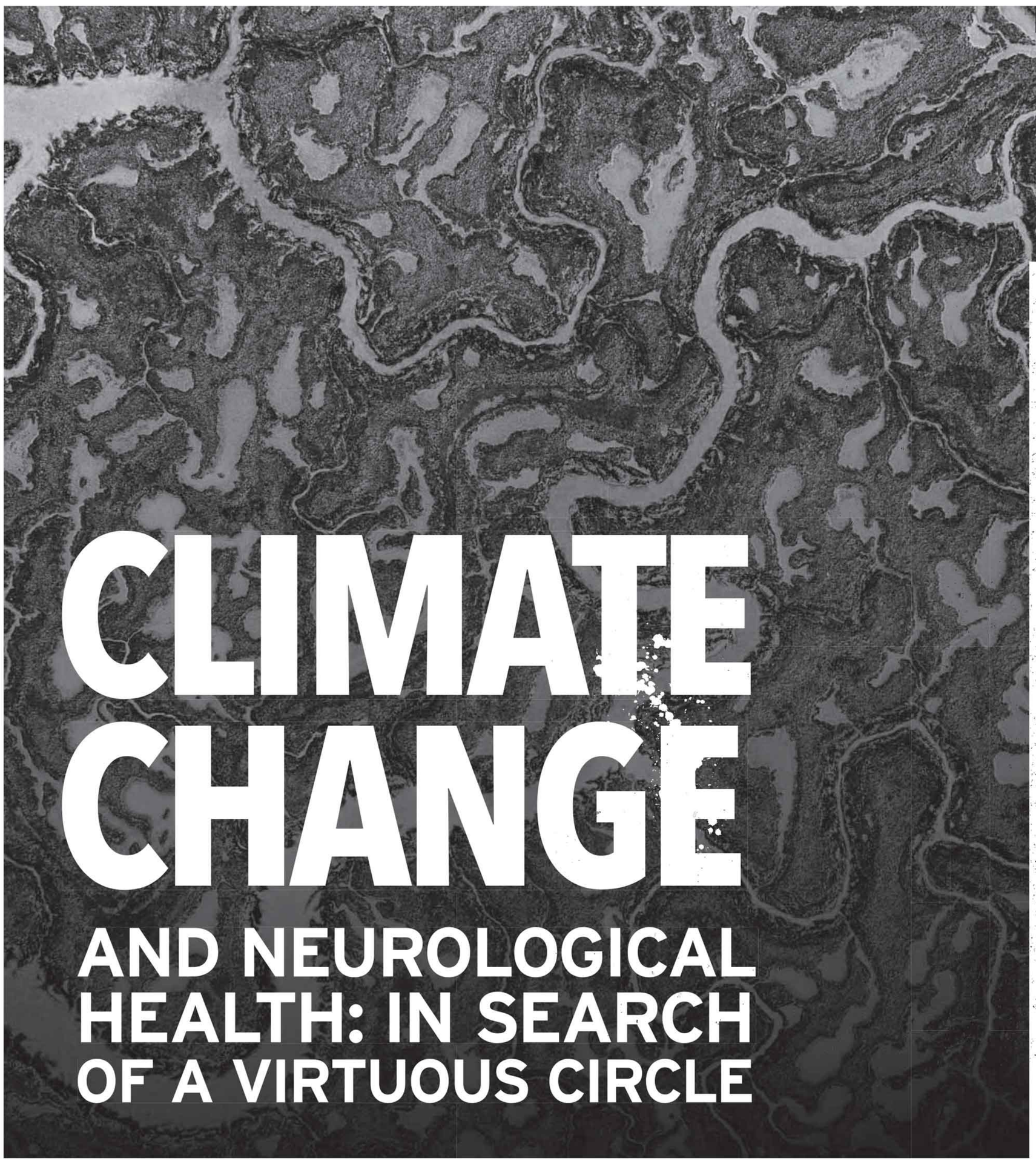


# CLIMATE CHANGE AND NEUROLOGICAL HEALTH: IN SEARCH OF A VIRTUOUS CIRCLE

**WHAT IMPACT WILL CLIMATE CHANGE HAVE ON NEUROLOGICAL HEALTH?**

***Galia Wilson, Chair, DSUK*** *Continued increase in temperatures mean the management of Dravet Syndrome will become harder in the summer months due to the risk of overheating, which could lead to an increase in seizures.*

***Ellie Lumbis*** *Climate change could have a high impact on people with epilepsy. increasing the chances of seizures due to the heat and possibly increase the rate of people being diagnosed with photosensitive epilepsy from the flickering of sunlight through the trees.*

***Scott Fulbright CoFounder Living Ink*** *There is not a region of this world that is immune to climate change. Inland areas have seen increased forest fires, temperature fluctuations and extreme drought. Coastal regions are experiencing massive storms and increasing water levels and temperatures. The increase in temperature is devastating coral ecosystems which will have major repercussions.*

***Theresa Dauncey Chief Executive National Brain Appeal*** *We don't know what the health impacts will be, but we urgently need to start finding out so that we have a chance to manage and mitigate to the largest extent.*

**WHAT IS YOUR MAIN MESSAGE TO THE WORLD LEADERS AT COP26?**

***Galia Wilson Chair DSUK*** *I acknowledge that climate change is complex, but I'd urge leaders to look beyond the obvious to understand that climate change has consequences on health and in particular neurological conditions. If action isn't taken soon then we may see these conditions and the management of them worsening.*

***Claire Pelham Chief Executive Epilepsy Society*** *Be brave and be bold!*

***Nicola Swanborough, Head of External Affairs Epilepsy Society*** *People with uncontrolled seizures cannot drive. This often affects their employment prospects and means travel abroad is rarely an option. Consequently, they have a lower carbon footprint than many, yet they will endure the impact of climate change generated by the rest of us. That does not seem fair.*

***Scott Fulbright CoFounder Living Ink*** *Communicating how climate change affects human health and living conditions is necessary to convince people this is real and needs addressing. Reducing fossil fuel usage is one of the top priorities. Developing not only plans but creating an accessible and accountable market for carbon.*

***Theresa Dauncey Chief Executive National Brain Appeal*** *What kind of world do you want to be a leader of? A thriving one or a dying one? Would you like there to be people around who will remember your contribution?*

The impact climate change has on neurological health may not be instantly obvious. Yet, as with other aspects of global warming, the interrelationship between the two – specifically, how global warming and the factors that drive it affect neurological disorders – is deep and complex.

Neurological disorders are conditions that affect the brain, spine and nerves, and the more than 600 that have so far been identified include epilepsy, stroke, multiple sclerosis, Parkinson's disease, Alzheimer's and other forms of dementia.

Nearly one in six of the world's population people suffer from neurological disorders, of which 6.8 million died as a result each year, the United Nations estimated back in 2007. As rates of those suffering named neurological conditions have risen steadily over the years since, the overall number today is likely considerably more.

Some 65 million people around the world have epilepsy – the most common neurological disease, for example. In the US, 3.4 million people were living with the condition in 2015, The Centers for Disease and Control and Prevention found – more people than ever before.

The reality is stark.

Although age-standardised incidence, mortality, and prevalence rates of many neurological disorders declined for many countries from 1990 to 2015, the absolute number of people affected by, dying, or remaining disabled from neurological disorders over the past 25 years has been increasing globally.

## CLIMATE CHANGE, POLLUTION, AND NEUROLOGICAL DISORDERS

The specific causes of neurological disorders vary and can include genetic disorders, congenital abnormalities, infections and injuries. Specifically relevant to climate change, however, is another important factor impacting on the lives of many: environmental health problems.

Many environmental health problems are caused by pollution, which is a major contributor to climate change.

Air pollution has been linked to Parkinson's, for example. Chronic exposure to noise pollution such as from traffic and trains, meanwhile, was recently linked to a possible increase in dementia. Water pollution that contaminates drinking water can have an adverse effect on brain function.

Often, agriculture is a major contributor to water pollution in the form of fertilisers, pesticides, and animal waste washed into rivers and streams. Over-exploitation of land – which along with growing consumer demand, drives farmers to use chemicals to get the most out of it – is a further contributor to climate change.

Prolonged exposure to heavy metals, air pollutants, pesticides, nanoparticles containing metals, and industrial chemicals were among common environmental risk factors for accelerating the deterioration of patients with Alzheimer's disease, according to the researchers behind one 2020 report.

For some conditions, another contributor is temperature extremes.

Some 62% of people with uncontrolled seizures experience an increase in their seizure activity during unusually hot weather, the UK's Epilepsy Society recently found. Likewise, a sharp dip in temperature has the same result, according to research in India.

Take a helicopter view, and the interconnections become clear. As climate changes, it is likely that the over-arching risks associated with a condition such as epilepsy – the risk of seizures, the impact of treatments, and the likely health outcome – will change, too.

Drill down further and the picture grows ever more complex.

## GLOBAL WARMING AND DISEASE SPREAD

Global warming leads to certain conditions that lead to the spread of vectors for infections (defined as "any living agent that carriers and transmits an infectious pathogen to another living organism") that make epilepsy worse.

Many climate change-related factors can alter the strength and potential of these living agents – impacting biting behaviour or infection capacity, for example. Higher temperatures can also make more common the vector-borne diseases that can cause epilepsy seizures in the condition's acute phase.

It's not just the direct impact of the greater temperature extremes caused by global warming that can adversely effect a person's likelihood to develop a neurological condition or suffer an existing neurological condition made worse, however.

The unintended consequences of humans' attempts to manage the climate – re-establishing wetlands, for example, to cite just one example – can also have a detrimental impact. Then there are the direct health impacts of global warming and the factors that drive it.

There is a "strong association" between exposure to particles known as PM2.5, which are formed as a result of burning fuel and chemical reactions that take place in the atmosphere, and neurological disorders, according to a study covering 26 countries or regions by researchers at Hong Kong Baptist University published in September.

Inhaling smoke from America's rising number of wildfires and the associated dangerous toxins is having a negative impact on people's health – mental health, especially – according to a study published the same month which analysed the impact of smoke from the fires which burned millions of acres of California alone this year.

The interrelationship between climate change and the spread of infectious disease is well-documented. Increasing temperatures are expanding the areas of the world where diseases such as malaria and dengue fever thrive, for example.

The WHO estimates that, if global temperatures rise by two to three degrees centigrade, the population at risk of malaria will increase by three to five per cent due to an increase in the range and intensity of transmission. About 8.4 billion people – almost 90% of the projected global population – could be exposed to malaria or dengue by 2080 if greenhouse gas emissions continue to surge, according to a study published this summer in The Lancet Planetary Health.

Meanwhile, attention is growing on the extent to which the root causes of climate change also increase the risk of pandemics.

Deforestation – a major cause of climate change, which occurs mostly for agricultural purposes – is the largest cause of habitat loss worldwide. Loss of habitat forces animals to migrate and potentially contact other animals or people and share germs.

Animals coming into contact with other animals normally wouldn't create an opportunity for pathogens to get into new hosts, despite advances in sanitation and hygiene made in recent years. Further, climate change-related urbanisation and migration will further complicate disease prevention and control.

When it comes to COVID-19, climate change is not as yet a proven cause.

With evidence of a mechanism by which climate change could have played a direct role in the emergence of SARS-CoV-2, the virus that caused the COVID-19 pandemic in a recent study published in the Journal of the Total Environment, however, it may well soon become acknowledged as one contributing factor.

In relation to neurological disorders, this is relevant for particular and notable reasons, the World Health Organization has found.

First, people with pre-existing mental, neurological or substance use disorders are more vulnerable to SARS-CoV-2 infection and may pose a higher risk of severe outcomes and even death . Second, COVID-19 itself can lead to neurological and mental complications, such as delirium, agitation and stroke.

COVID-19's impact on people in a number of cognitive-related areas including memory loss, 'brain fog', and dementia, is the subject of a new US academic research study now underway.

## PATIENTS, CARERS, AND GREENHOUSE GAS EMISSIONS

Further complexity in the relationship between climate change and neurological health comes in the form of the degree to which greenhouse gas emissions generated by the whole range of healthcare, for example travel to and from health appointments and healthcare settings, or to overseas health-related conferences and events – is a factor contributing to climate change.

However, evidence suggests that telemedicine, which has increased in use and prevalence for social distancing reasons during the pandemic, is helping to reduce the overall carbon footprint – and so, negative environmental impact – of healthcare, including care related to neurological disorders.

Growth of virtual medical consultations over the past six years has corresponded with a decrease in greenhouse gas emissions due to transportation, according to one study conducted in America's Pacific north-west.

## A VIRTUOUS CIRCLE

If all of this feels too bleak to bear, there is good reason to take heart. For there are also good aspects to the degree to which climate change interplays with mental health. When one improves so does the other, and vice versa.

Invest in neurological health and people will be better positioned to meet the climate change challenges that lie ahead. Effectively meet climate change challenges, meanwhile, and there will be positive gain for all.

# HEATWAVES AND THEIR EFFECTS ON THE BRAIN

There's no arguing that the planet isn't getting warmer. According to the WHO, heatwaves and hot weather are the most dangerous of natural hazards. Extreme temperature events are increasing in frequency, duration and magnitude. Between 2000 and 2016, the number of people exposed to heatwaves increased by around 125 million.

The American Psychological Association first coined the term 'eco-anxiety' in 2017, pointing to the impact of heat on our minds in relation to knowing its connection to climate change. But what happens to our thinking is one thing; something different could be happening to our actual brains.

**For some people with epilepsy, the effects of climate change interact with their bodies directly.** For example, the brain itself in people with Dravet syndrome – a form of epilepsy that starts in infancy and can have mild to severe effects – may be affected by changes in ambient temperature. Anecdotally, heatwaves can be dangerous for people with Dravet syndrome and some experience more frequent seizures.

Even those who don't have epilepsy will start to feel the effects of heatwaves on the brain. Cognitive function may slow, making it harder to make decisions, work or learn. A recent study by the Harvard T.H. Chan School of Public Health suggested that a heatwave can make your thinking 13% slower.

Along with being hot, the Harvard research states that heatwaves present other dangers to the brain from lack of sleep to dehydration, both of which can be dangerous in themselves and lead to further incidents. When we're sweating in the heat, that water needs to be replaced frequently, and in countries without access to clean water supplies the risks of dehydration are severe.

Heat stress can also be a dangerous condition. Lav Varshney, a neuroscientist at the University of Illinois Urbana-Champaign, has pointed out that at high temperatures, the blood brain barrier can break down. This causes unwanted proteins to build up in the brain, causing inflammation and interrupting normal function.

Research to a survey conducted by the Epilepsy Society, where almost 1000 people responded, found that over half of respondents saw a change in their seizure activity during very hot weather. This included an increase in frequency, severity or extra seizures when they had felt their epilepsy was generally under control.

Epilepsy is a global neurological disease, but numerically overall it does affect more people in low to middle income countries. People living in poverty with no, or difficult, access to medication are more likely to suffer with epilepsy or its consequences. These regions of the world are also more likely to feel the impact of climate change and extraordinary heatwaves.

The planet's average surface temperature has risen around 1.18C since the late 19th century. According to the Met Office, climate change has made the previous record-breaking 2018 UK summer heatwave thirty times more likely and, by 2050, heatwaves like this could happen every other year.

**On a global scale, the increasing temperature of the planet is having an effect on our brains – not just on what we think, but also how our brains function.** This is not a future speculation but a current impact, and if we don't do something to change the situation, then many people with epilepsy will be facing an even more challenging future.


## THREE WAYS TO PROTECT THE PLANET AND YOUR OWN NEUROLOGICAL HEALTH

Climate change and pollution are adversely impacting our neurological health. *What can we do?*

If climate change, and the fear you can do little to tackle it, makes you stressed and anxious, you are not alone. In a global survey of young people led by Bath University and published last month, two thirds of respondents said climate change left them feeling sad, afraid, or anxious, and three quarters said they thought the future was frightening.

The mental health consequences of events linked to a changing global climate – from mild stress and distress, through high-risk coping behaviour such as increased alcohol use and, occasionally, mental disorders such as depression, anxiety, and post-traumatic stress – have now been acknowledged in a report by the American Psychiatric Association.

Further, distress associated with environmental change close to your home now even has its own word: 'solastalgia' (from the words 'solace' and 'nostalgia'), according to the Lancet Commission on Health and Climate Change. Solastalgia is connected to another term: 'dis-ease' – defined as concern, caused by a hostile environment, that a person is powerless to do anything about.

But while awareness of climate anxiety may be growing, so too is an understanding of the positive benefits people can gain from a sense of control.

People who feel in control of their lives and who find purpose and meaning in life are less likely to have anxiety disorders – even when going through the toughest times, according to one recent study. This has positive implications within the context of climate change.

In short, you may feel less anxiety about global warming if you do more to help reduce it. And, if you follow these suggestions, you could stand to reap other health benefits, too.

**1. WALK MORE**

Much evidence points to being more active – if possible, taking part in regular, heart-pumping exercise – as the number one thing you can do to improve brain health, according to Johns Hopkins neurologist Barry Gordon MD, PhD. He says there are benefits to be gained no matter at what age you start. If you can, walk more and drive less – which, of course, will be good for the environment, too.

To avoid breathing in air pollution from cars on the road, try looking at alternative traffic-free routes. If you have to drive, consider car sharing.

**2. EAT BETTER**

Diet plays a large role in brain health. It is also a contributing factor in global warming. Greenhouse gas emissions and other, different types of pollution are generated at each step in the food and drinks industry's global supply chain.

According to the Mayo Clinic, eating less meat and moving towards a more plant-based diet will help both the planet and your health.

According to some estimates, animal agriculture is the UK's largest producer of air pollutants – accounting for over 50%. A Mediterranean diet emphasises plant-based foods, wholegrains, fish and healthy fats such as olive oil, while incorporating much less red meat and salt.

Vote with your wallet by supporting brand owners and retailers with transparent environmental and sustainability strategies.

**3. BREATHE EASY**

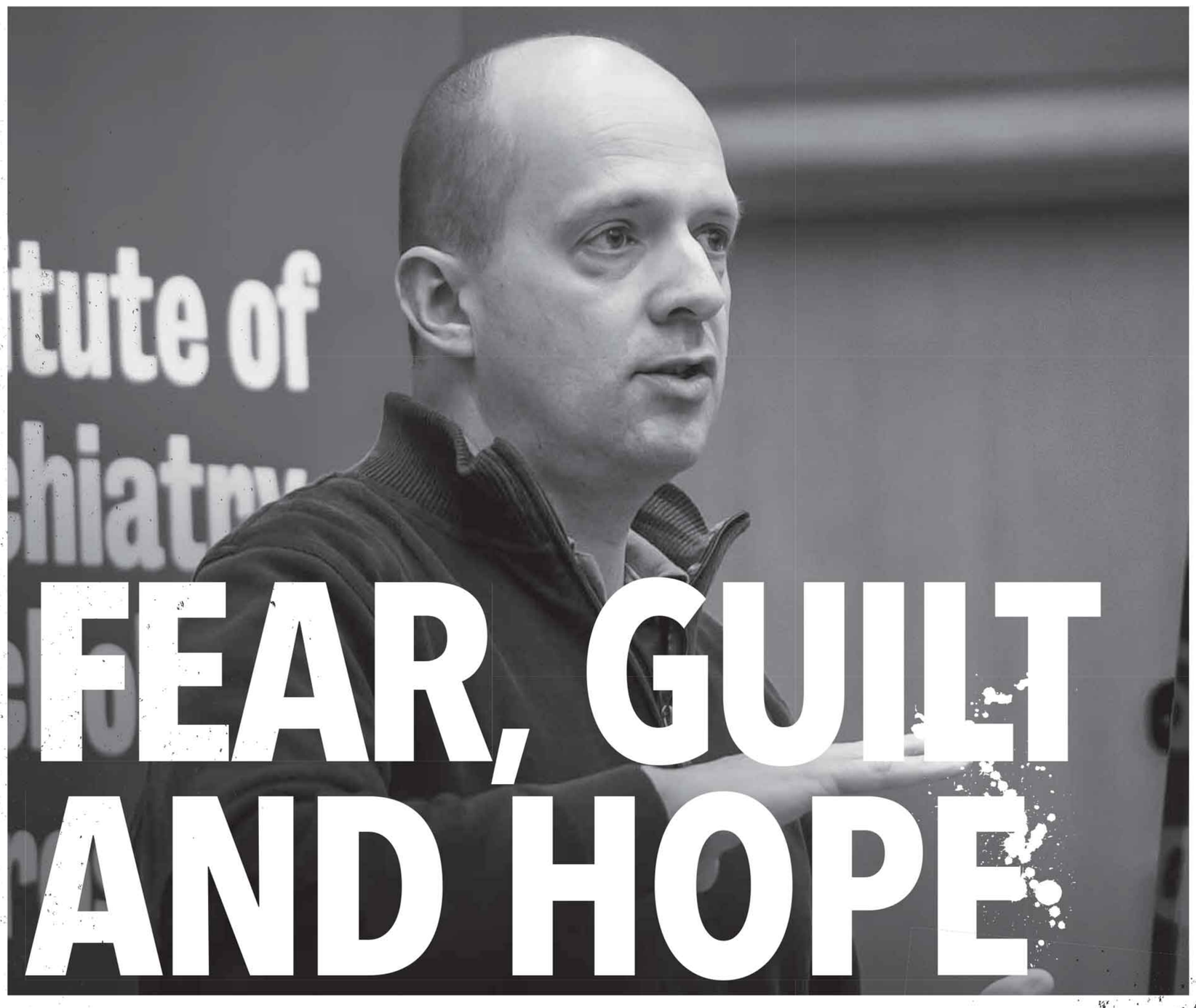
Air pollution has been closely linked to several neurological disorders by multiple studies. Discussions at the World Congress of Neurology suggested a connection between the development of late-onset sporadic Parkinson's disease and Alzheimer's disease and environmental toxins.

Improve your air quality at home by keeping rooms well-aired, using allergy-friendly, 'gentle' products, and solid or liquid cleaning products instead of sprays which can be breathed in. The British Lung Foundation also recommends that people dry laundry outside where possible, and that homes are kept heated to 19C or above in winter months to avoid condensation.

By checking your home's Energy Performance Certificate, you can see where there may be room for improvement. For example, installing better insulation or using more efficient appliances can help. The walking and cycling charity, Sustrans, also recommends switching energy suppliers to companies who use renewable energy sources.

It also says that if you live in an urban area, consider planting trees or installing a rooftop garden – both of which can help improve the air quality of your neighbourhood in the long-term. These can also help to reduce ambient temperatures – which can be higher in built-up areas due to the proliferation of concrete.

The idea of changing world climate can seem overwhelming, but it need not be this way. Little steps can make a big difference, particularly when many people make changes to their lifestyle and choices. And making better decisions about the air that we breathe and the future of the planet could bring down the levels of anxiety – just by knowing we are doing our best.



# FEAR, GUILT AND HOPE

## ARE NOT THE WAY TO CREATE ACTION ON CLIMATE CHANGE

There's no doubt that there is some polarisation around climate change in terms of beliefs and action, but actions can be used to change entrenched beliefs and in turn be put to good use.

Usually, the focus is that changes in beliefs result in changed behaviours. In a reversal of this theory, Kris De Meyer, Director of the UCL Climate Action Unit, puts actions first as a trigger to change beliefs.

De Meyer says "In the case of successful health behaviour change, it's all related to the individual. However, for climate change, we are asking someone to change their behaviour to benefit others rather than the individual and so the usual incentives are not aligned in the same way."

There has been some successful research that indirectly links to climate change. Take marketing for vegan foods. In 2017, Better Buying Lab commissioned research on social media to understand responses to the words 'vegan' or 'plant-based'. 'Vegan' was more than twice as likely to be used in negative contexts as 'plant-based'. This had an impact on the way vegan food can be successfully marketed and a possible follow-on result for climate action. But direct nudges at the level of the individual are few.

Kris De Meyer says that part of the problem is the complexity of the issue. Many people have goodwill toward saving the planet. But if you have family on the other side of the world and can only get there by plane, a clash of values easily arises.

In other cases, it's just a matter of not knowing what you need to do or if you have the skills to do it. "If you find yourself in a busy A&E department and you have the right medical training, you will know what to do, triage, find specialists or treatments." De Meyer explains. "If you are a layperson, you will be a headless chicken. Doctors and nurses have agency in that example – they know how to act. When it comes to climate change, we are all laypeople. Very few of us have agency to make change."

Lack of agency - or feeling as though you have no options to do as you would like to – is not uncommon. "Imagine you are a pension fund manager," says De Meyer. "Your kids have climate anxiety, and you are very concerned yourself, but as a pension fund manager you have a duty to maximise return on investment and minimise risk for the people whose money you manage. You feel there is no way you can add climate change to your professional role. Maybe in a few years, we will have figured out how to bring climate change into fiduciary duty but at the moment, not many people are able to work it out."

Similarly, many business leadership coaches feel they cannot broach the topic of climate change with the company executives they coach until their clients ask for it themselves, for fear of losing business. De Meyer has worked with others in commerce and finance as well as people in political power. In a series of sessions with MPs and peers in the UK, many participants felt they were unable to commit to climate action while their constituents wanted them to focus on different areas. In the case of peers, there were business sectors like food or shipping that they felt were too complex to influence change.

"The only reliable way for people to change is when they persuade themselves," says De Meyer. "When I work with people, I help to create the conditions for them to act and then learn from their own actions. Actions drive beliefs - if you start to act, your understanding of the problem, possible actions and your own agency change. Before you know it, you are in a virtuous circle of acting within the space that you have."

This effect is not directed at people who are entirely sceptical about climate change. De Meyer feels that this is a small group and even though they are often thought of as the block to action, it's actually people with good intentions on climate action who need the most help.

"The question I am asked most often is 'What can I do?', and not just from individuals," says De Meyer. "I've heard millionaires ask this question. I've heard politicians ask, and people in finance and oil industries who say, unless our shareholders instruct us on climate change, we cannot do more. This sounds like abdication of responsibility but it's more to do with lack of agency - they don't see how they can make something work within their limitations."

### FEAR, GUILT AND HOPE DON'T CHANGE THOSE MINDS

There's a conventional wisdom that either fear, guilt or hope will drive action on climate change. According to De Meyer, these do often not work. "Emotions are a sign that people are paying attention and that the issue is getting through to them, " he says. "But when you are spending mental energy on those issues, there's no guarantee that you will act on those in the way that advertisers or campaigners want you to."

There's an added problem in the current fragmentation around what amounts to meaningful climate action that makes it harder for brands to do right by individuals who are ready to fight over their views on the best courses of action. "People are willing to fight over whether vegan food should take priority over Duchy Originals in the supermarket," says De Meyer. "The Insulate UK campaigners have also really divided people over their actions on the M25. There is a schism between what people think is the right or only way to act on climate change and these fault lines have multiplied in recent years. In response to threatening information, people will come up with different answers and convince themselves that this is the right thing to do, even if that is doing nothing."

### NOT SEXY OR FAST ENOUGH

It's frequently said that climate change is a marathon not a sprint, but this doesn't change repeated urgent calls for action and a risk that this urgency gets mixed up with the speed of results. De Meyer says that people are right to raise their voices and ask for more action, but he points out that the human mind is not great at understanding exponential problems, or exponential solutions. "We have not noticed that in the past few years, we have joined an increasing curve of activity," he says. "This hasn't been reflected yet in a large drop in emissions, but in reality, that result might not appear for five to ten years."

De Meyer points out that real climate action such as legislation and policy started to appear in the 1990s and that work was deeply unsexy. Policies around solar tariffs and renewables appeared in places like Germany – twenty years ago - but it has not been until now that the affordability of this technological change has meant cheaper and cleaner electricity.

He goes on to point to a quiet but interesting announcement that took its time to arrive. "Last month's announcement by China that it will not fund foreign coal investment anymore, was the result of years of painstaking diplomatic discussions". China, South Korea and Japan were all funding coal power plants in different parts of the world. Years of quiet behind-the-scenes negotiation saw South Korea and Japan pledge change, and finally led China to make its announcement too. But we cannot see all of that work, it happens slowly and not necessarily publicly, so it's easy to think things are not happening."

Those are a couple of powerful changes that arrived slowly, but they are not great examples for people to change their own narratives to action.

"The biggest source of agency in everyone comes from learning about changes committed by others," says De Meyer. "When it comes to climate, it's hard because there is not enough agency or stories to share that we can learn from. But once we do hear of someone who has brought climate policies into their own work or put climate change in their decision-making for big institutions, we will very quickly find that framework in which all of us find their place and their role to act on climate change."

## TROPICAL DISEASE COULD RE-EMERGE IN TEMPERATE CLIMES INCLUDING UK

Malaria is a disease we'd be forgiven for thinking only affects far-flung lands – and something we only really consider if we're heading off on holidays to certain tropical countries.

You'd be surprised to hear however that the potentially fatal disease used to be endemic in the UK – and experts fear that global warming could see malaria returning to our shores once more.

Between the 16th and 19th century, malaria was a leading cause of death in marshy areas of Britain, like the East Anglian Fens and the last indigenous case in England was declared as recently as the 1950s.

Scientists are warning that if climate change continues unabated, malaria could once again take hold around river estuaries and low-lying wetlands across the UK, transmitted by a species of mosquito commonly found in Britain, called *Anopheles atroparvus*.

Temperature rises and the higher risk of flooding caused by climate change make the UK even more attractive for mosquitoes and could have a twofold effect – it could cause British mosquitoes to breed more frequently and if it arrived in the country, it would also speed up the maturation of the malaria parasite.

As well as the Fens, historically the areas most affected by malaria included the Thames Estuary and South-East Kent, Holderness in East Yorkshire, the Somerset Levels and other areas bordering the Severn Estuary and around the Firth of Forth.

Researchers have calculated that if global warming continues at its current rate, some of these same areas could once again become breeding centres for malaria, for up to four months each year by the end of this century.

People become infected when bitten by a mosquito carrying a parasite that causes malaria, which then gets into our bloodstream. Even mild cases can cause high fevers, chills, flu-like symptoms, fatigue, headache, weight loss, nausea, vomiting, diarrhoea, stomach pain, joint pain, severe anaemia and muscle aches.

More serious life-threatening cases can cause brain (cerebral) malaria which can lead to bleeding on the brain, brain swelling, brain damage, seizures and coma. Many survivors are left with life-long epilepsy, a serious neurological condition, with children more likely to be affected than adults.

Even now, WHO recorded 229 million malaria infections and 409,000 malaria deaths in 2019 worldwide, mainly of children under the age of five.

Death rates have plateaued over the last few years because mosquitoes are becoming increasingly resistant to insecticides, so climate change is even more of a concern. WHO has labelled malaria as one of the most climate-sensitive diseases and forecasts at least another 60,000 deaths by 2050.

It is already creeping back into Europe. In 2018, Italy, which was declared malaria-free in 1970, had a number of cases in people who had not travelled abroad.

And experts say some places in the UK could become warm and wet enough with climate change to sustain a potential malaria outbreak.

Plus, disruptive climate change is already here – 2019 saw the highest temperatures ever recorded in Britain for both winter and summer: 21.6C on the 26th of February in London and 38.7C in Cambridge on the 25th of July.

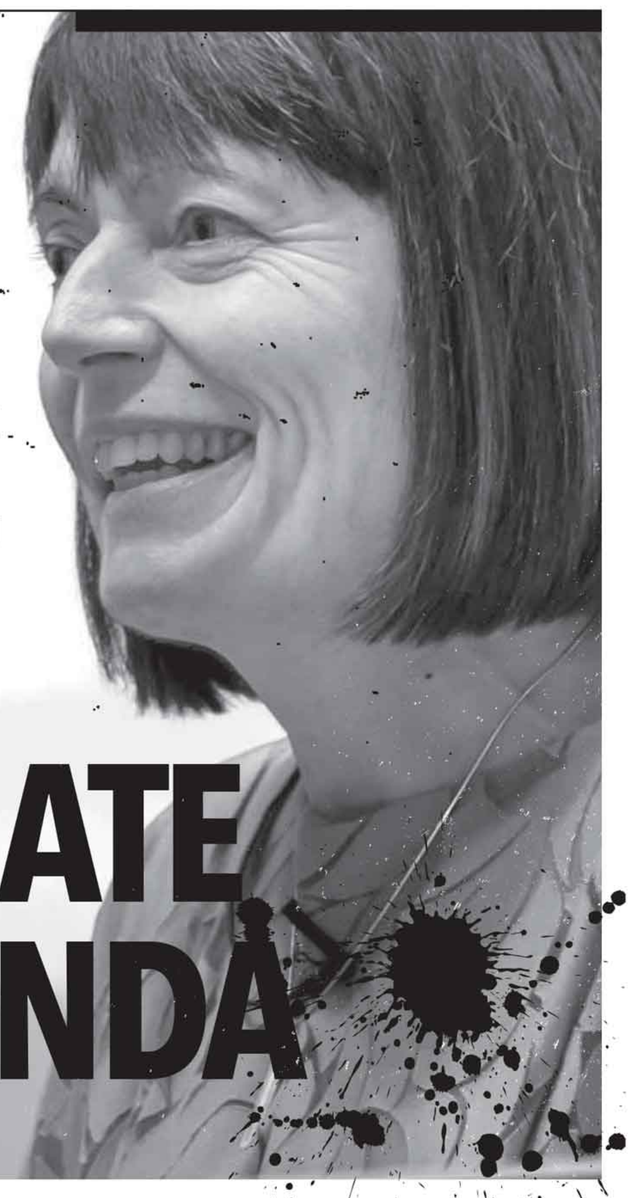
In 2020, it was the wettest February on record and the year 2020 was the third warmest, fifth wettest and eighth sunniest on record.

So far this year, July saw the hottest day ever recorded in Northern Ireland, and Scotland had its fourth hottest summer ever. Meanwhile, London, East Sussex and Hampshire received 140%–150% of average summer rainfall and the Isle of Wight exceeded 200%.

Experts say that in the space of 30 years, the UK has become 0.9C warmer and 6% wetter.

It's clear that urgent action needs to be taken to combat climate change and with it, the chance of malaria, or other mosquito-borne neurological conditions returning to our shores, and as a consequence, the risk of more people having seizures or being left with life-long epilepsy.

# HEALTHCARE NEEDS TO BE ON THE CLIMATE CHANGE AGENDA



When we think about the phrase 'climate change', more often than not images of rising sea levels and imperilled polar bears come to mind, and in some cases the conversation switches to an appealing idea of warmer weather. These stereotypes not only cause fatigue in our thinking but they miss the point that climate change is already having an impact on our health. The problem is we're seeing a chain of events that is making the issue seem somewhat opaque.

Epilepsy is one of the health conditions likely to be exacerbated by climate change. There's not a great deal of awareness about this, and there are a number of reasons for that.

First of all, there is a stigma around epilepsy that leads people to hide their condition. Clare Pelham, chief executive of the Epilepsy Society, further described the stigma: "I have met well-known people with epilepsy who have made me promise not to say anything. In a time when we are being more open about things like mental health – we are not doing so well with epilepsy. People seem to have a sense of shame about their condition, when we would all benefit from knowing much more about it. Because of this stigma, only 0.3% of research funding in England goes to research on epilepsy."

Epilepsy affects 1 in 100 people, making it one of the most common neurological conditions – hardly a minor issue. It's likely that you know someone among your circle of friends or in your family that has the condition. On a global scale, this means around 70 million people have epilepsy, and of those that we know about, 80% live in low- to middle-income countries.

How is this connected with climate change? The majority of people with epilepsy live in countries that are hardest hit by the effects of climate change, from drought to flooding and heat waves. These are the people who are most at risk.

An added issue around increasing awareness of the condition is that epilepsy is not a single condition or disease; it's an umbrella term for a whole range of conditions, all of which have the occurrence of seizures in common. Researchers working in the field often refer to the epilepsies – plural. We may not have identified them all, and the better we become at identification the more we see that broad categories are made up of smaller different groups of epilepsy.

The Chalfont Centre for Epilepsy is the number one epilepsy research centre in the world. One of the pieces of cutting-edge research there is genomic sequencing. It has set up a way of comparing information about diagnosis through genomic sequencing all around the world. This means we can find a type of epilepsy which affects perhaps only six people, that we know of, around the world. In summary, 'epilepsy' is a huge umbrella term that can cover a large variety of neurological conditions.

Sometimes epilepsy is something people are born with, in other cases it can occur spontaneously in a lifetime with no information as to why. Hormonal change can be a trigger in puberty for some, and it can start or stop at the menopause for women. In some cases, it can mirror the menstrual cycle, or occur as a result of pregnancy. People who suffer head injuries, like boxers or jockeys, can also end up with epilepsy, and it can happen as the result of a brain tumour or surgery. But one of the lesser-known ways is that it can be acquired is through infection.

This is not common in Western Europe or America. Infection can be spread through various vectors. You can develop epilepsy in a country where malaria is endemic, for example – that's along with other possibilities. When conditions arise where the malarial mosquito can flourish – and we are seeing more of this due to climate change – then there's a chance that more cases of epilepsy will arise.

When not enough is done to combat climate change, it is vulnerable people who will be affected first. "It's like getting very drunk, waking up with a hangover and wondering why," says Pelham. "Doing damage to the climate means we are hurting people. Although public education is getting better, we are also damaging the health of our world population at the same time. This adds injury to injury."

### GET HEALTH ON THE CLIMATE CHANGE AGENDA

COP26 is bringing together leaders from around the world, and while there are many different points of change to be discussed, there's a surprising lack of events relating to healthcare on the agenda. Environmental protection is a wide and thorny topic, but this glaring omission needs to be addressed. It can be something where leaders can hear the voices of those affected.

"I was a senior civil servant in a previous life," says Pelham. "In general, I find that most politicians want to do the right thing. Many of our politicians took pay cuts to pursue a life of public service, and many of them work extraordinary hours. Most of them want to work to make the world a better place.

"When you look back at the Victorians as pioneers of public health: they built sewers and achieved clean water and vaccinations. Amazing work, but all of that would have been of no use without being championed by the politicians and leaders of that time. Vaccination for smallpox wasn't invented in a cupboard and given by Jenner only to his friends, it was championed by George III. It was politicians and leaders who championed public health from their sense of public service.

"Fast forward a few hundred years to the cabinet and the risk is that, instead of being able to say I made smallpox disappear from my country, you end up saying I allowed climate change to happen, and as a result the health of people got worse. This is fiddling while Rome burns. You're only doing small things when you could be doing very big things with a long-lasting legacy."

Pelham sees the opportunity for leaders to make their mark and leave a positive legacy from their time in power. "Managers get things done right, and leaders get the right things done. Leadership comprises looking at the big stuff and sorting it out. If you don't, it would be one thing to not know it was happening but there is a danger of something much worse. It would not be ignorance as an excuse, but wilful negligence, and that is not acceptable."

### COMMUNICATION FOR BETTER HEALTH

"Which of us has not googled a minor health concern and become unduly anxious?" wondered Pelham. "This is why I continue with the Epilepsy Society Help Line. An app, social media post or YouTube video might suit some people for a professional download of information, but for many people what they want is someone to talk to, especially as becoming more anxious can set more seizures into motion.

"Some have offered me well-meaning advice to close our phone lines," says Pelham. "But if anything, I want to expand the service. Not everyone has supportive friends and family if they are open about their condition. There is something to be said about a listening ear, you cannot hear that someone is crying in a text-based chat. If we could fund this on Sundays this would be enormously helpful for so many people – not everyone can find privacy or time at work during the week, and it's services like this that can really help people with different conditions cope.

"The Epilepsy Society Help Line has heard from more people with anxiety due to the pandemic. The problem for people with epilepsy is that anxiety can trigger a seizure, and this can have a much wider negative impact on lives – you can lose your driver's licence which threatens security of daily movement and even work.

"People are worried about the effect of COVID-19 on epilepsy drugs, vaccination concerns and also supply of medication. We don't have all the answers, but we are able to be clear about the situation, and share the expert view as well as being a shoulder to cry on. Converse to what we might expect, when bad things happen on a large, out of your control, scale, you worry less about the small stuff, and there was some of this as an effect of the pandemic. But, as people return to more normal life patterns, the old anxieties emerge."

In order to shift health and epilepsy up the agenda, and to develop a wider understanding around health and climate change, Pelham has some ideas as a campaigner.

In Britain we have two of the most venerable institutions in the world in the NHS and the BBC," she says. "My ask to the BBC would be for it to commission a programme with David Attenborough covering the impact of climate change on the human animal.

"My ask of Sajid Javid would be that the NHS take a global leadership position on climate change and health, in the way it took a lead on the position of free medical care post World War II," says Pelham, who believes that the UK taking a lead in bringing together nation states to address the worldwide public health consequences of climate change would be a fitting legacy for Glasgow COP26.

"As news emerges from the gathering of world leaders at COP26 this year," she continues, 'there might not be a headline about epilepsy on the six o'clock news. Not all leaders will know much about the condition or climate change's impact on epilepsy – but if one person reading this is informed to find out more, and to get to know the issues better, and can tell another, it might just start a conversation that will place health squarely on the COP agenda next year, and help us all consider a warming planet in terms of its impact on our daily lives."

# SCOTLAND PLEDGES NET ZERO EMISSIONS

Climate change is the topic of the 2021 United Nations Climate Change Conference (COP26) this year of course, but as the meeting of world leaders takes place in Glasgow, it's worth taking a look at the local impact of global warming right here on our doorsteps.

On a global scale we know that the world's climate is changing – oceans are warmer, snow and ice are vanishing, and sea-levels have risen while concentrations of greenhouse gases increase in the atmosphere. In Scotland, these changes are a direct threat to our environment, our health and, of course, our future.

Scotland's beautiful natural assets are at risk as climate change affects coastal habitats, natural carbon stores and soils. These not only increase risk levels for marine and wildlife, but also for agriculture and business.

Climate change can have a devastating impact on ecosystems across the country when it comes to biodiversity. Changes in the timing of spring events like leaf unfolding, bird migration and egg-laying have been observed, and some species populations may change as they have had to adapt. Heavier rainfall events will cause difficulties for river species like salmon and disrupt spawning grounds. Droughts can affect the survival rate of young mammals, birds and plants and, as seasons shift, flowers may not open at times when their pollinators are active.

As ecosystems change, new conditions emerge that may allow existing pests and disease to spread, acting as a threat to the health of native plants and animals.

Infrastructure in Scotland is also exposed. Flooding is a long-term risk but, somewhat ironically, drought and severe weather may also be significant.

Climate change may see Scotland's rivers and lochs run dry, posing a threat to crops and renewable energy sources according to the University of Dundee. Freshwater resources are already under pressure which can negatively impact ecosystems around the country. Although a warmer climate may make it easier to grow different crops in Scotland, it can also spread pests that might limit this potential.

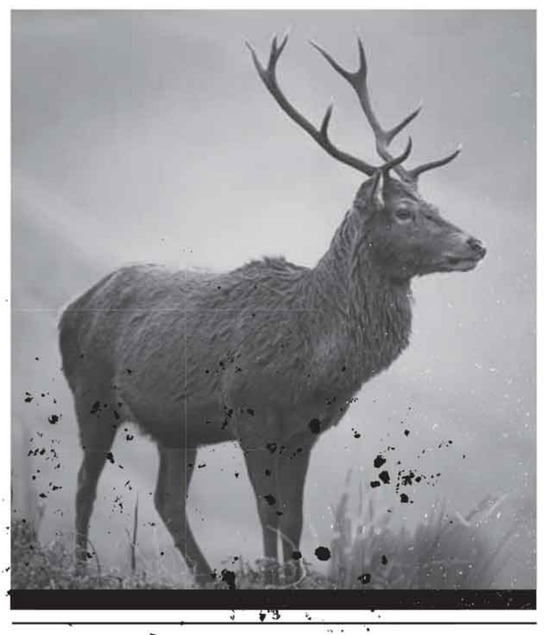
When it comes to our health, the warmer weather in Scotland may go some way to increase active outdoor lifestyles and reduce winter mortality. But heatwaves are no joke for the elderly and people with neurological conditions such as Dravet's syndrome, which can lead to tragic outcomes.

In July this year, flash flooding took many by surprise. Over half of the month's usual rainfall fell in one hour in Edinburgh. This happened in the same year as the fourth hottest summer in Scotland since records began. As a result of this freakish weather, Scotland is experiencing moderate water scarcity at the moment, and businesses from hydropower facilities to whisky distilleries could be disrupted.

Scotland's manufacturing, agriculture, services and wider industries are going to be affected if the rate of global warming does not change. Higher temperatures will see a drop in productivity, flooding can disrupt supply chains and crops, businesses on the coast may also be threatened by rising sea levels and by coastal erosion. With global warming in its current state, businesses across Scotland would be wise to consider environmental threats and changes in their financial outcomes and risk assessments.

The Scottish government has plans to transition to net zero emissions for Scotland by 2045. It says that, this way, Scotland's contribution to climate change will end definitively within one generation. To meet this deadline there are a number of actions on the table, including reducing greenhouse gas emissions, supporting decarbonisation of the public sector, encouraging low carbon living for everyone, working to establish a Scottish nitrogen balance sheet to track effective use and working with communities to find the best solutions.*

The government also says it will lead international action on climate change. This is vital and especially important while the COP26 gathering takes place.



*To be in a real position of power, Scotland needs to lead by example*

# CLIMATE CHANGE IN MIND

## HOPING FOR CLIMATE CHANGE ACTION AT COP26



"My son couldn't control his body temperature; he got very red, and then if he was in water and cooled down too quickly, it would also set off a seizure – and one seizure can mean weeks in hospital."

When he was three years old, Galia Wilson's son Arlo was diagnosed with Dravet syndrome, a rare and severely disabling type of epilepsy. Seeking support from other parents in the same position, she contacted DSUK (Dravet Syndrome UK) and a couple of years later she became chair of the charity.

This month, Galia, in her capacity as chair of DSUK, is speaking at the Epilepsy and Climate Change Conference, where she will highlight the impact of global warming on the lives of people living with Dravet syndrome and the families who care for them.

Despite the devastating consequences that climate change has already unleashed on the world, it can still be a fairly abstract concept for some people and the prospect of warmer summers are a guilty upside of a catastrophic change.

However, for Galia, Arlo and the many other families around the world affected by Dravet syndrome, hot weather is dangerous and trying to keep cool is a constant challenge. Heat and sudden temperature changes can bring on a seizure, particularly in younger children whose bodies are less able to regulate their temperatures.

Galia explains: 'Most parents just have to think about finding shade, but when it's hot a lot of our families won't take their children out, because the moment they step outside they could have a seizure. The heat is really hard to manage. Our forums are full of people talking about how to deal with the heat: many have to install air conditioning or wear cooling vests and special neckties to try and keep their core temperature low.

"My son couldn't control his body temperature; he got very red and then if he was in water and cooled down too quickly, it would also set off a seizure – and one seizure can mean weeks in hospital. Now that he is 14, his body mass means his seizures have abated slightly, so it's got easier, but it can be hard to manage and we still have to use fans at night."

Galia used to work as the director of a large team in healthcare PR and was planning to return to work after Arlo was born. He had his first seizure at ten weeks old and it became clear that she would need to take some extra time off, but on a visit to her company to negotiate her return, Arlo had a seizure in the office and Galia knew that she would have to stop work to focus on him.

As well as caring for Arlo and having another child, Galia spends a lot of time connecting families, providing them with emotional, practical and financial support, raising awareness, keeping up with medical experts, supporting research and fundraising in her role as chair of DSUK. She also keeps up regular communication with Dravet syndrome organisations in Europe and the US to build international co-operation and learning.

At the global Epilepsy and Climate Change Conference, Galia's talk will be on heatwaves and Dravet syndrome.

'In some climates, you can't go out for months because of the heat,' she says. 'As summers become warmer the problem is only getting worse and it can be hard to keep a child with Dravet syndrome indoors. I want to highlight what it means practically for our families and to get it taken seriously.

> *"It's not just about the weather getting warmer, these are real life day-to-day health issues. In some ways my motive is selfish, because we want to protect our children as much as possible and global warming is an additional burden we could do without."*

Galia will be monitoring COP26 very closely, hoping that the world leaders can together make some real progress on tackling the climate emergency. She says: 'I hope it brings meaningful change, not just more waffle. I'm not an expert, I'm a consumer, but a consumer whose life is affected by climate and the world is heating up at an alarming speed.'

As always, she will be sharing her learnings with the other families who are part of the DSUK community that is so important to her. Despite having many of the symptoms, Arlo was not diagnosed with Dravet syndrome until he was three and a half, so his first years were a lonely time for Galia. Her son's seizures were lasting well over an hour, she was making regular trips to A&E and lived with the constant fear that she would lose him – all of which was made even more difficult to handle because of the lack of a support network.

As soon as she got a diagnosis, she immediately contacted DSUK and within three weeks she was at the annual Centre Parcs trip, meeting other families whose children share the condition.

For Galia, the diagnosis came as a relief, although for many families it can be a particularly challenging time, as they struggle to come to terms with such an extreme condition. For all of them though, being connected to other families through DSUK is a source of strength. Also, the closed Facebook forum is a particularly important space, a safe place reserved for parents and carers, where they connect to talk about the wider challenges of living with a child who has Dravet syndrome, as well as sharing more practical information.

There are around 350 members of the Facebook forum, and nearly 600 families registered with DSUK in total. Usually, about 50-70 new families join every year, but Galia says there has been a 'massive decline' in new members during the pandemic, which could be due to reduced testing and diagnosis, or to less exposure to the viruses that usually trigger the first seizure.

When she takes to the platform at the first global Epilepsy and Climate Change Conference, Galia will be doing more than just talking about the impact of global warming and sharing the knowledge, skills and experiences she has accumulated – she will also be furthering her important work in raising awareness of Dravet syndrome and building the Dravet syndrome community that has made such a difference to her own life.

*https://www.dravet.org.uk/*

# EPILEPTIC WARRIOR CALLS FOR AWARENESS ADVERTISING CAMPAIGN

Seventeen-year-old Ellie Lumbis is a force to be reckoned with. A feisty young woman with a passion for literature, she's currently studying a fiction writing course online at her home in the Hertfordshire village of Walkern where she lives with her mum, dad and older sister. She dreams of being an author or publisher – and she also happens to have epilepsy.

A self-described 'proud epileptic warrior', Ellie has fought hard to get to the point where she can embrace her neurological disorder. However, life with epilepsy certainly hasn't been easy for her, as is the case for many of the 600,000 people in the UK who have epilepsy – that's about one in every 100 of us.

Ellie was diagnosed with epilepsy aged seven. She elaborates: "I had a seizure at my primary school. We were all lining up for PE and I just fell on the floor. I woke up in hospital and I was like, where am I? What's going on? Then I started having seizures quite a lot after that."

Being diagnosed with epilepsy was bewildering and frightening for young Ellie.

She explains: "It made me feel I was very different from other people. I thought, are people not going to like me anymore? Are my friends not going to want to be friends with me anymore? What's going to happen to me in the future?"

Luckily, her friends and family remained supportive.

However, life got tougher for Ellie when she began secondary school and the bullying started.

Ellie takes up the story. "Suddenly, a lot of my fellow pupils started being very harsh about my epilepsy. They called me names. They thought my seizures were hilarious and they mocked me and joked about me. It was awful.

"I was bullied every day and it caused me so much anxiety that it started triggering my seizures. I had to speak to my teachers every day and they spoke to the pupils doing it, but that was it, so the bullying continued. It got so bad that once, a few boys chased me around a park calling me Epileptic Ellie and my mother had to get the police involved."

However, Ellie's situation improved when she started at college – though with some trepidation.

Ellie explains: "I was worried I wasn't going to make friends, that people were going to be like they were at secondary school. But they weren't and they listened to me."

Ellie was breezing along, landing top marks in English and with her days of being bullied behind her, she remained seizure-free for two years.

That was until two months ago when the rug was pulled from under her feet, and she had two debilitating seizures without warning. "After a seizure, I don't really know what's going on and I can't get my words out. I have a headache, I feel sick and go to sleep for three or four hours. Those after-effects usually go on for the rest of the day. The next morning, I'm usually okay, though I might still have a bit of a headache," Ellie explains.

Ellie was left devastated. She'd been looking forward to learning to drive and that had been taken away from her. Her mood sank and her anxiety returned.

Ellie says: "It left me feeling so sad, because I'd felt I'd progressed so far. My doctor had even spoken to me about coming off one of my medications because I was doing so well.

"But when the seizures came back, unfortunately that couldn't happen and I couldn't start to drive. I also left college because I couldn't deal with the pressure of feeling so sad and anxious. It made me shut myself out from the world – which I did before, due to the bullying. It sucked away my freedom."

The effect was also profound on her family. "It's really upsetting for them,' Ellie says. "Every time I have a seizure, my mum just bursts into tears and my dad gets so upset."

However, Ellie decided to take control and put a positive spin on her situation. She explains: "When I had those two seizures, I reflected back on everything I've been through when I was bullied about my epilepsy. Was it because those people weren't aware of it? Or did they just have cold hearts? Either way, I felt I needed to find a way to create more awareness around epilepsy."

That's now Ellie's mission, with help from the Epilepsy Society.

She began working with the Epilepsy Society last year, getting involved with #ZachsLaw campaign. The campaign is inspired by ten-year-old Zach Eagling, who has cerebral palsy and epilepsy, who was targeted by internet trolls during a marathon fund-raising walk last summer. His mother was sent flashing and strobing images on social media aimed at causing a seizure in her son.

Ellie joined Zach and others from the Epilepsy Society at an online conference, where they spoke to MPs calling for a change in the law to make the intentional sending of flashing images to a person with epilepsy a criminal offence.

Ellie says: 'The reason people don't understand epilepsy and why people get bullied for having it is because you rarely see it talked about. You don't see adverts about it or see it on TV.'

She has a point – there is a similar number of people in the UK living with autism and there are four times more people with epilepsy than those living with Parkinson's. Yet, unlike epilepsy, both conditions are talked about more in wider society.

Some people are often wilfully ignorant and even dismissive about the condition. Ellie recalls a newspaper story a few weeks ago about a woman who had a seizure on a train and the guard refused to help her, because she was delaying the train.

"There's not enough awareness, understanding or visibility when it comes to epilepsy," Ellie says, "That's why I want to put my voice out there to the world and why others should put their voices out there."

Through the Epilepsy Society, Ellie has also made lots of friends with the condition. She adds: "It's good to actually have people around me now, who suffer from the same thing – so I don't feel different."

She also said the support of the Epilepsy Society had been a lifeline: "They've given me advice, they got me involved with the conference call with the MPs, I took part in the epilepsy awareness Purple Day (26th of March, every year) and they listen to me. It makes me feel good."

Ellie hopes to start fundraising for them for a campaign to raise awareness around epilepsy. She explains: "I'd love to be able to raise money to put an advert out there on TV or on posters to have it everywhere. Then hopefully bullying around epilepsy can stop."

Ellie also paid tribute to her family. "They're just so supportive of me and I'm so grateful. Without them and the Epilepsy Society, I wouldn't be standing here right now."

As for fellow folk with epilepsy, Ellie shares some fighting talk, saying: "More people with epilepsy should speak out because not enough voices from us are heard compared with people with other disabilities. That's why I'm sharing my story.

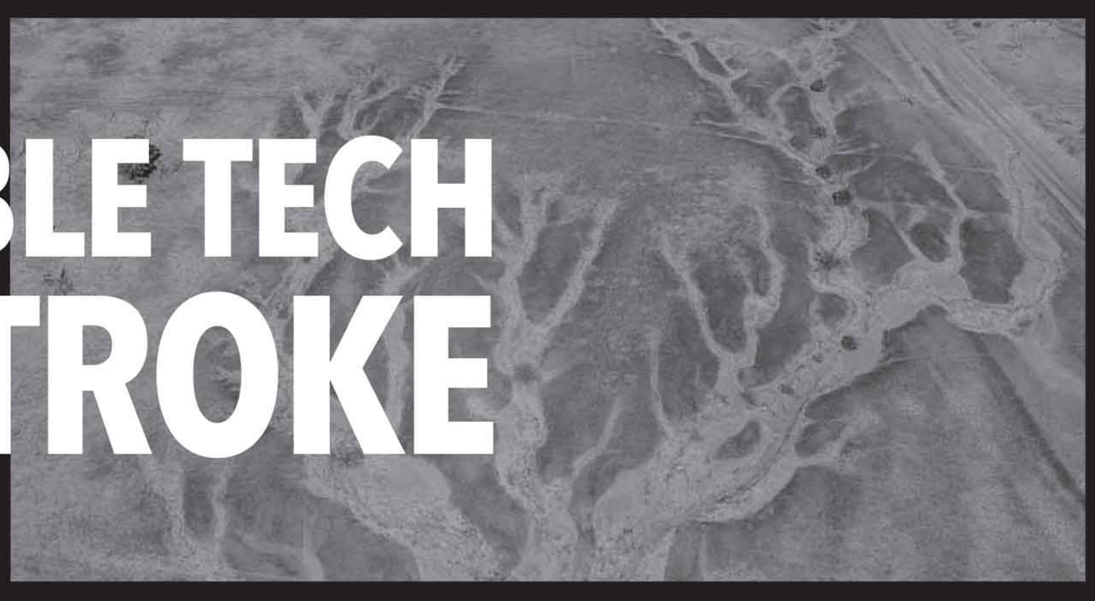
"Also, don't give up on your dreams and remember, you are not defined by your illness. Put yourself first and don't listen to the bullies."

*"I'm now proud to be an epileptic warrior. Calling myself a warrior shows that I'm strong and I don't care what other people think anymore."*

*- Ellie Lumbis*

To donate to the Epilepsy Society, go to **https://epilepsysociety.org.uk/get-involved/donate**

# WEARABLE TECH FOR STROKE



Stroke is the leading global neurological cause of death and disability. According to the World Health Organisation, stroke was the second most common cause of death globally in 2019 and it is the single biggest cause of adult disability. The global prevalence and burden of stroke is increasing, particularly in low- and middle-income countries. Because of this, the prevention of stroke is an important future target for global health.

Climate change produces temperature variations which can affect human physiology with a potentially important impact on the occurrence of cardiovascular diseases including stroke.

David Werring FRCP PhD FESO, Professor of Clinical Neurology at the UCL Queen Square Institute of Neurology says that it's not just global heating that could be having a detrimental impact, "The potential mechanisms for climate effects on stroke are likely to be different for cold or hot temperature exposure," he says. "In cold weather there is an increase in blood pressure with peripheral blood vessel narrowing and increased blood viscosity amongst other factors.

"By contrast, in high temperatures, increased sweating and skin blood flow can produce dehydration, increased blood cell concentration and elevated cholesterol levels. The elderly may be particularly susceptible to the effects of temperature changes because of impaired body heat regulation and added complications like diabetes or medications including blood pressure drug treatments. It is also possible that older people do not sense temperature changes as effectively as younger people, making them more vulnerable to the effects of climate change."

Global heating produces hotter summers with more frequent heatwaves. While some people in the UK may feel they are enjoying better weather, this also means colder winters, both of which could have an impact on stroke incidence. Werring explains, "Most published studies support an increase in overall stroke risk with increasing ambient temperature, but the effect may differ according to the type of stroke; 'ischaemic' stroke is due to blockage of an artery, while brain haemorrhage (bleeding into the brain) is due to blood vessel rupture, so these stroke types may be affected differently by the environmental temperature."

**THE NEED FOR MORE DATA**

The picture of climate change in relation to stroke is not black and white. The data on ambient temperature and ischaemic stroke indicate that both high and low ambient temperatures, or temperature changes, might be risk factors.

In a thorough review, including 21 studies with a total of nearly half a million patients: two studies found a link between large increases in average temperature and ischaemic stroke, a finding also supported by a Korean study which found higher ischaemic stroke risk with higher temperatures. By contrast, a different study, in Boston, USA, found that ischaemic stroke peaked in the 10 to 24 hours after a drop in apparent temperature. So both extremes of temperature might be bad for stroke risk.

For intracerebral haemorrhage, some studies found a link with reduced temperature, particularly with increasing age. Interestingly, one study in Taiwan, a country where central heating is not generally used unless the temperature falls below 10C, reported an association between intracerebral haemorrhage and a mean temperature below 17C.

Ambient temperature might also affect survival after stroke. One study in China found that both cold and hot weather were significantly associated with an increase in years of life lost from stroke, with a stronger effect from low temperature.

"You can see even from the most relevant studies so far that whilst we do not know yet which end of the scale of climate change is having the greater impact," says Werring, "it makes sense that a changing ambient temperature for the planet will have an impact on our health."

Air pollution is also emerging as an important risk factor for stroke, which is aggravated by climate change. According to the United States Environmental Protection Agency, 'climate change can impact air quality and, conversely, air quality can impact climate change'.

"Pollution may be linked with stroke because gaseous pollutants and small particles react in the blood systemic circulation to produce reactive chemicals, which can damage the lining of blood vessels and inflame the lungs," says Werring.

According to a report by Verhoeven JI et al. in Lancet Planetary Health 2021, it is now estimated that air pollution is responsible for 14% of all stroke-related deaths worldwide and air pollution-related stroke is highest in low- and middle-income countries because of their fast-growing economies, industrialisation and urbanisation.

As for temperature, the effects of air pollution also differ according to stroke subtypes. Werring explains, "There is an increased risk of ischaemic stroke (the most common type of stroke where a blood clot blocks the flow of blood and oxygen to the brain), after short- and long-term exposure to air pollution, an effect which is strongest in low- and middle-income countries. Air pollution levels have decreased particularly markedly during the global lockdown which could provide a unique opportunity to investigate how air quality affects stroke incidence."

More data are urgently needed on how temperature change impacts stroke incidence. Werring says that finding out more about the impact of climate change on human health could help us to diagnose, treat and possibly predict any negative impacts on our brains and blood vessels.

"It is vital that we better understand the impact of climate change on different stroke subtypes," he says. "If we could gather more information via gadgets like wearable tech, we could learn a lot more about exposure and minimise impact. Rather than just measuring steps per day, a better understanding of pollution levels, as well as ambient temperatures, could give us a much clearer picture. This takes funding of course, but if climate change is having a negative effect on global health right now, then world leaders need to review their plans and make sure that their focus includes health as well as other areas of our changing environments."

**IS THERE ENOUGH RESOURCES BEING PUT INTO RESEARCHING THE EFFECTS OF CLIMATE CHANGE ON NEUROLOGICAL HEALTH?**

***Ellie Lumbis*** *I don't believe enough resources are given into researching effects on neurological conditions. I feel they're missing out on that little detail (talking to us) that will make them dig deeper into their research.*

***Scott Fulbright CoFounder Living Ink*** *The repercussions of climate change have very broad and unknown consequences. Ticks in the north-east USA carry Lyme disease, which causes devastating neurological issues. According to the US EPA, climate change has contributed to an expanded geographic range of where ticks are found, increasing the cases of tick-borne diseases.*

***Clare Pelham Chief Executive Epilepsy Society*** *Only 0.3% of government funding for research goes to epilepsy. Imagine the difficulty of securing funding for research into the impact of climate change on neurological conditions. It is important to be positive though and the UK Government's commitment to invest 2.4% of GDP in research is heartening.*

***Theresa Dauncey Chief Executive National Brain Appeal*** *Very limited resources are currently being invested into neurological health in every area. It should be a priority - if climate change has a major impact on how well our brains might function, we may not have the capacity to make the right decisions to turn things around.*

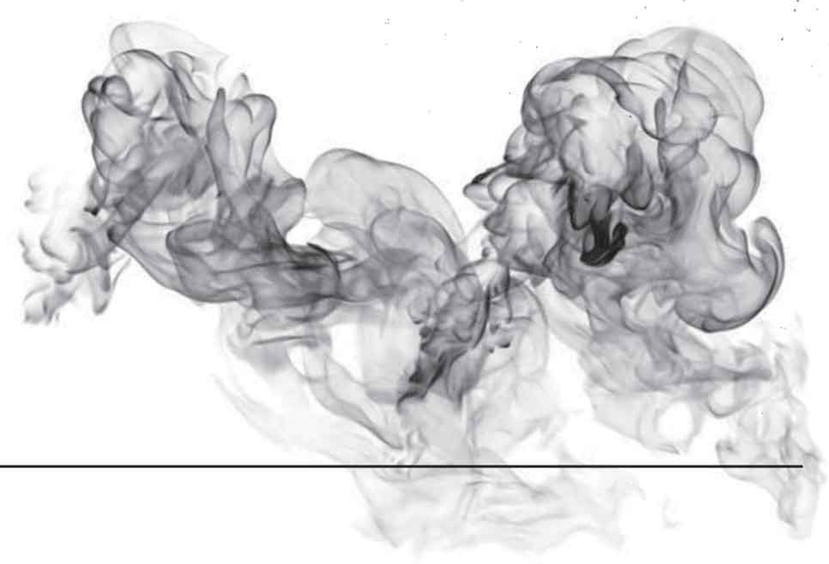
**ARE GOVERNMENTS WORLDWIDE DOING ENOUGH TO TACKLE CLIMATE CHANGE?**

***Clare Pelham Chief Executive Epilepsy Society*** *People and our governments have been slow to respond to the real challenges of climate change. There is much talk and pledges, but not enough real, game-changing action. It is significant and humbling that it is the younger generation who are holding us to account.*

***Scott Fulbright CoFounder Living Ink*** *There is a lot of rhetoric and goals being set, but there needs to be much more action related to reaching goals including mandates and incentives to increase the adoption of carbon reducing technologies.*

***Theresa Dauncey Chief Executive National Brain Appeal*** *Governments around the world are doing a lot of talking about tackling climate change. Now it's time to walk the talk.*

# LIVING INK



You won't have spotted it when you picked up this paper today, but you're holding Living Ink. The ink that has been used to print this insert comes from spirulina algae waste. It doesn't sound glamorous and it's not really – but sustainability is not always glamorous.

Living Ink is working to change the way we print things, from newspapers like the one in your hands to textiles, even ski boots. It predominantly makes black ink – which you might think is limiting, but look around you now and see how many items of clothing and other products such as phone covers, headphones and shoe soles are black. That's a lot of black ink.

The black ink we've historically used to print most things is made from the petroleum-based carbon black. Living Ink is working to replace petroleum-based products such as carbon black ink. While the firm can produce different colours, it's the overwhelming need for a black ink replacement that has caused Living Ink to focus on this one, ubiquitous shade.

**HOW IT WORKS**

Algae is grown at a large scale. It grows very quickly in the presence of sunlight, water and carbon dioxide. The crude pigment is purified by Living Ink and is then milled and formed into a consistency with similar characteristics to carbon black. The final product is very black and doesn't fade when exposed to UV light. This makes it suitable for use in a wide range of versatile products.

Printing anything at all might not seem like the most sustainable option. But to make sure you are able to read about the work of EpiCC, and how climate change is having an impact on those with epilepsy and other neurological conditions, we decided to get a traditional paper insert into your hands so you can read it – in black and white.

Living Ink was co-founded by Scott Fulbright who, along with Steve Albers, took bioengineering out of the lab with a research focus into practical applications and the aim of having a positive impact in the world. To create ink, the firm collects algae waste products and processes them to create a rich dark pigment, useful for a variety of products.

From an optimistic startup, Living Ink has grown and now has a large production facility in Denver, Colorado. It is working with international brands, algae farms and printing facilities where the ink pigment can easily be used with existing printing facilities.

While the pandemic has hit many industries hard, it appears to have also provided time for business leaders to consider where their resources come from, and the impact they may have. Fulbright says that it was during pandemic lockdowns that a new wave of enquiries came in directly from designers, brands and textile industry bases such as Sri Lanka, Vietnam and China.

Living Ink is currently producing 500 kilograms of algae-based ink per day. The facilities used to create the ink are easily scalable, and can adapt to suit many different industry sectors.

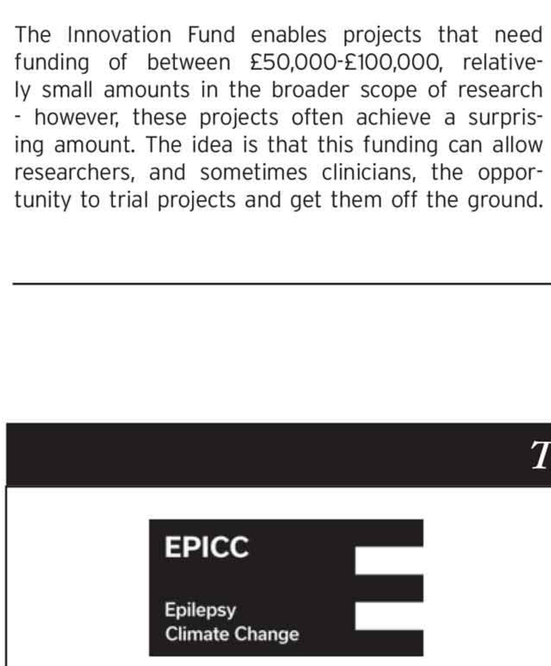
As brands and businesses have boardroom discussions about sustainability, it's not just packaging and plastics that are a top-line priority. The environmental impact of petroleum-based carbon black inks is also an important consideration. This shift towards awareness of entire product makeup is vital for companies that are keen to meet consumer demands.

Consumers are becoming hyperaware of the condition of the environment. Headlines around the COP26 meeting are proof that the state of the planet today, and in the future, is an important theme with an urgent need for change. It is this awareness that is changing industries as the public come to understand the layers of impact industry has on climate change. The more information that consumers can access about the products and services we use today and the impact they have, the more consumers are driving, and calling for, radical change.

The paper used to carry this ink was made by Mohawk Renewal. This company is driven by a desire to redefine fibre sourcing by using legacy materials like hemp, straw and cotton rag in new and sustainable ways. They want paper making to be a responsible industry. We might have shifted to digital tools in the past decade, but there's still plenty of paper being made, sold and used. Look up from this paper again and you can probably think of many other paper-related items near you now.

You might not be able to reverse climate change entirely by next week, but it's vital that there is a change for this planet, for the health of its citizens and for the future of all of us. There are small steps – like printing this newspaper with ink made from algae – that don't seem like a whole solution. But when 4.5 billion kilograms of ink are produced worldwide for printing on so many products – just imagine if this one step turned into a change, and all of that ink was sustainably produced.

*It's up to all of us* to take the initial small step to see change on a grand scale.



# TIME IS OF THE ESSENCE

"We found this project particularly exciting because it was the first time we had seen climate change work that specifically focused on neurological conditions," says Theresa Dauncey, Chief Executive of The National Brain Appeal. "Essentially, as humans, we are our brains and if we find that climate change is affecting how we perform, then this is really crucial. We saw that this could start a wider conversation and expand towards other conditions in the future.

The other aspect we liked about the project is that it includes research that could have an impact quite quickly, rather than taking years to be of practical use. For example, researching the impact of temperatures, that could lead to more seizures in epilepsy; or in terms of medication, if storage has an impact. We can then share this with the community and make some real and positive changes. We see it as very important that charities like us support these initiatives because it attracts the attention of other funds, bigger ones that can not only increase the work in neurology but maybe also in different health areas."

By providing smaller amounts of funding, the charity gives researchers the freedom to take risks and test theories. "Not everything will work, but even if things fail, we learn something or this can be used to spur on different areas of inquiry," explains Dauncey. The National Brain Appeal spends around three million pounds per year on neurological projects with the aim of getting work off the ground that will attract larger funding amounts from elsewhere - a bit like a starter fund for gathering knowledge. "The charity currently has fifty active projects. Each one explores a good idea with potential to provide benefits to people with neurological conditions. We provide a starter push to get projects off the ground," says Dauncey.

The National Brain Appeal is currently exploring how the public thinks about their brains and the possibility of living with a neurological condition. At the moment, understanding appears to be limited, especially in comparison with psychological campaigns or the health of the rest of the human body. "There is very low awareness of the prevalence of neurological conditions" explains Dauncey. "Sadly at least one in six people in the UK are affected. I think people often shy away from the brain and see issues as too intimidating and difficult to understand."

Dauncey also says it is a very common misconception that work on neurological issues is the same as work on mental health. "There is some link", she says, "and you can suffer mental health issues in relation to having a neurological disorder but the physical brain issues don't seem to create the same awareness as psychological ones at the moment."

**RESEARCH NOT FASHION**

The internet is filled with fitness hacks and even brain health advice from drinking water to eating specific spices or foods, but it's ill advised to start following these trends if they haven't been proved. "We focus on research into solving known problems with the brain and nervous system," says Dauncey. "Until there is proof that there are actions that can improve our health in a neurological sense, we steer away from giving out general health advice. Do a brain teaser every day if you enjoy them but it's not fair to tell people that certain activities are going to protect them from possible future neurological events."

Dauncey and her team at The National Brain Appeal have a similarly practical approach to spotting useful areas of research for funding, "It's about finding tangible solutions and actions," she says. "My first job was with Friends of the Earth and even back then I learned that if people cannot make changes easily then they won't change. When we fund research, we want the results to help decision makers to facilitate action and find ways for people to make smart choices easily," says Dauncey.

"It's about speed for me," she continues. "I want leaders to move more quickly. Every day that we procrastinate on climate change we are wasting time and risking the possibility of turning things around. Every month that passes makes it harder to achieve the things we need to. Leaders need to imagine they are living in 2050 now and think about what they would want to see in the future world that they can influence immediately.

When I was working for Friends of the Earth I was thinking of my children and grandchildren. But the research that EpiCC is doing is affecting people today, it's not about the next generations, we're already being affected and we need solutions now."

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EPICC Epilepsy Climate Change | epilepsy society | Climate Action Unit | UCL Queen Square Institute of Neurology

NHS University College London Hospitals NHS Foundation Trust | The National Brain Appeal Funding advances in neurology and neurosurgery | ucb Pharma | DRAVET Syndrome UK Hope for families with life-limiting epilepsy