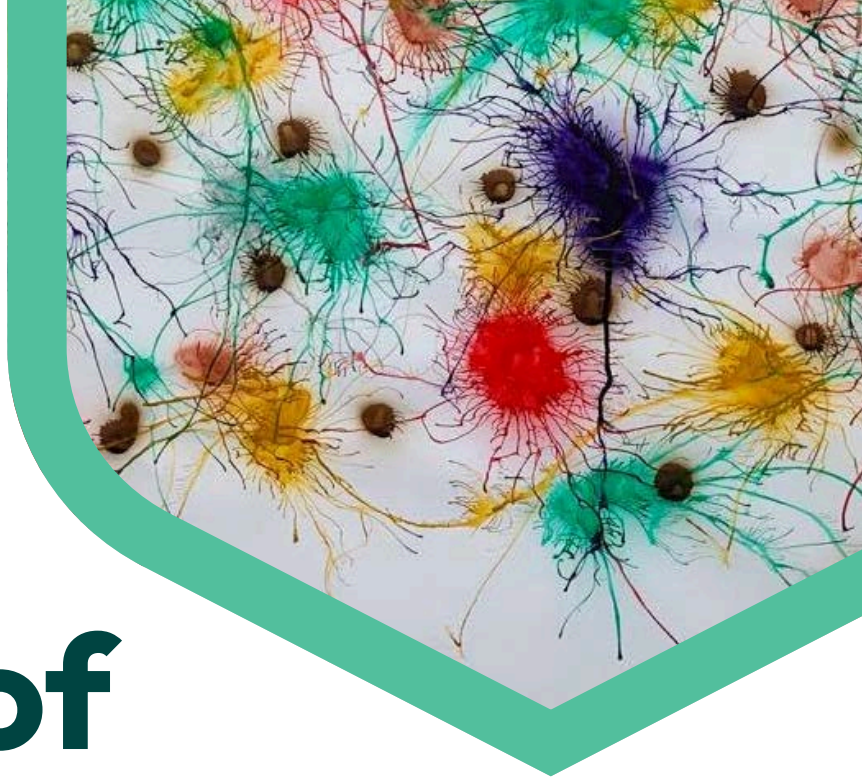


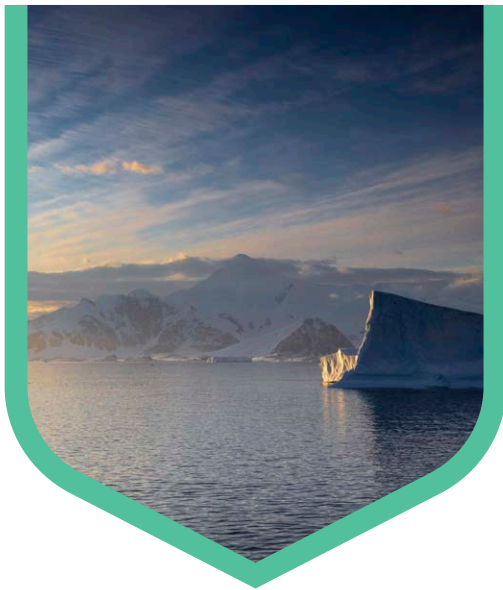


University
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Images of Research 2022



 @ExeterDoctoral #IoR2022

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‘Images of Research’ is an innovative way for Early Career Researcher staff to highlight the wide range of research that is taking place at the University of Exeter and an opportunity to look at research in a new and exciting way.

There are two main aims of the competition:

- To engage the public in academic research, particularly the breadth of research taking place at the University of Exeter.
- To provide an opportunity for researchers to communicate often complex research to non-specialists.

A Cracked Joke: Behind the Scenes of Research

Shokraneh Moghadam

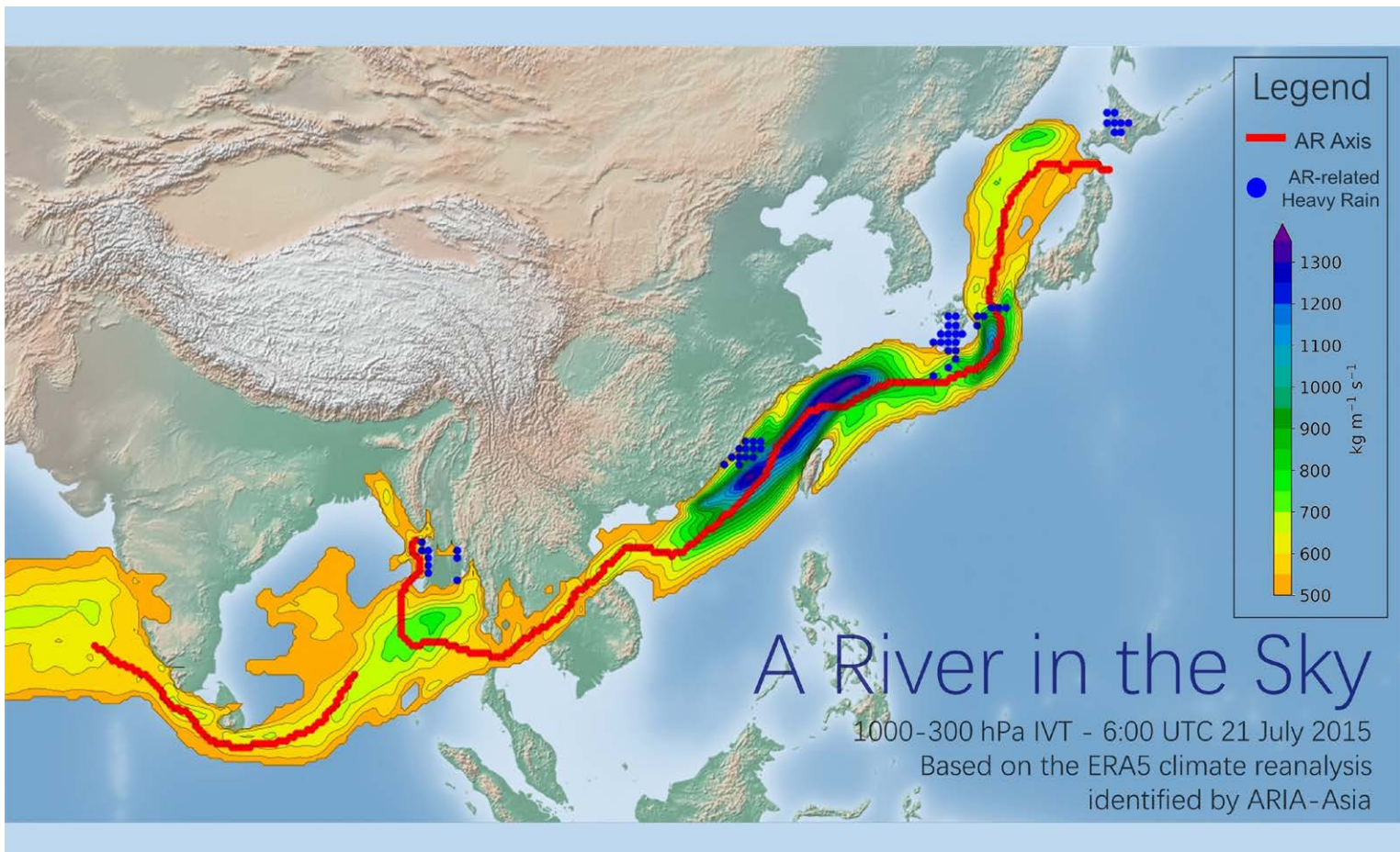


What does research look like behind closed doors? Apart from a whole lot of meetings, laughter plays a leading role in building good working relationships. As part of our research, we are developing and testing a group-based weight management programme (called PROGROUP). Currently, we are monitoring progress at each study site, which helps us plan for incoming data and site visits. With this in mind, we've set up a 'control centre' in one of our

offices. In this photo, one of our 'commanders' takes reign and details session dates for a study site. What you can't see in this photo is a cracked joke, by colleagues behind the camera. We thought it would make an interesting photo to show the 'behind the scenes' of research, but to also show that in every mundane task, shared laughter between colleagues can go a long way in improving our working relationships.

A River in the Sky

Ju Liang

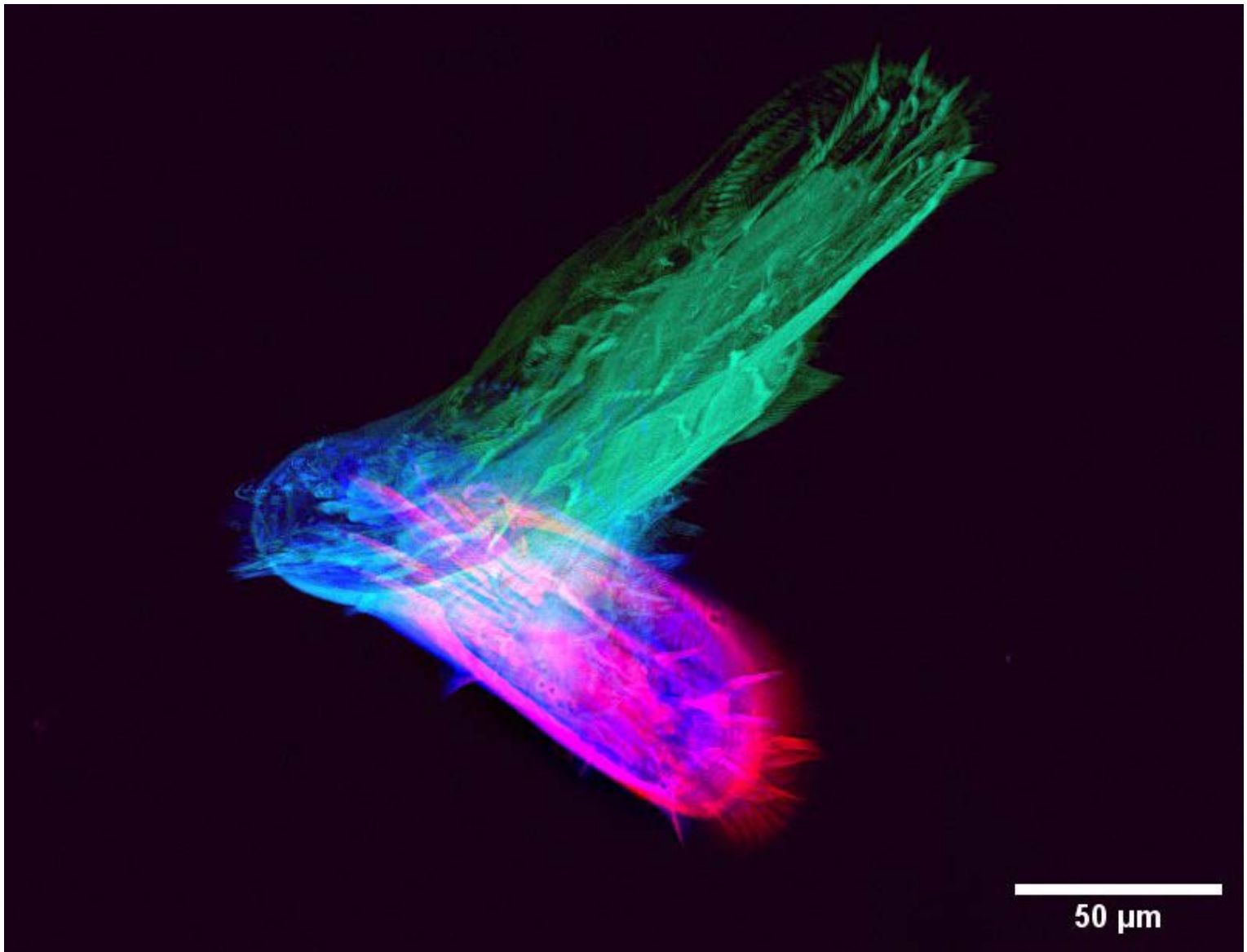


Atmospheric rivers are weather systems featuring intense and filamentary transport of water vapour in the atmosphere. Such weather phenomena are closely linked to extreme precipitation and devastating floods. Here, we perform a study to identify atmospheric rivers in high-resolution climate data and investigate their historical trends over the populated regions in East Asia. This image shows an identified atmospheric river with a length longer than 5000 km, elongating from South India to northern Japan, bringing heavy rains to Myanmar, southern China

and Japan on the same day. The shown features (shaded colours: river plume; red line: river axis) are identified by an objective identification software named ARIA-Asia (Atmospheric River Identification Algorithm - Asia). Objective identifications of atmospheric rivers help to understand the physical mechanism behind such weather systems and improve the resilience of local communities to extreme precipitation. The research article on this study is published in *Climate Dynamics* (<https://link.springer.com/article/10.1007/s00382-022-06339-5>).

A Walking Single Cell

Hannah Laeverenz-Schlogelhofer



How does a single cell perceive and move through the world? Movement is crucial in many aspects of life, like when escaping predators, foraging for food or orienting towards light. Even single cells can display such complex behaviours and respond to environmental cues. This image overlays frames colour-coded by time from a 1.6-second microscope video of a unicellular organism called Euplotes captured at 800 frames per second. We use microscopy and high-speed imaging to investigate how organisms

without a nervous system, like Euplotes, control their movements and interact with their environment. Euplotes are widespread in marine ecosystems and coordinate their 15 leg-like appendages to swim through the water and crawl along surfaces. Here we see how a Euplotes cell reorients itself by jerking backwards and then rotating. These turning sequences allow Euplotes to explore their microscopic world and are triggered by mechanical stimuli, which enables the cell to avoid obstacles.

Beaver Reintroduction in Great Britain

Alan Puttock

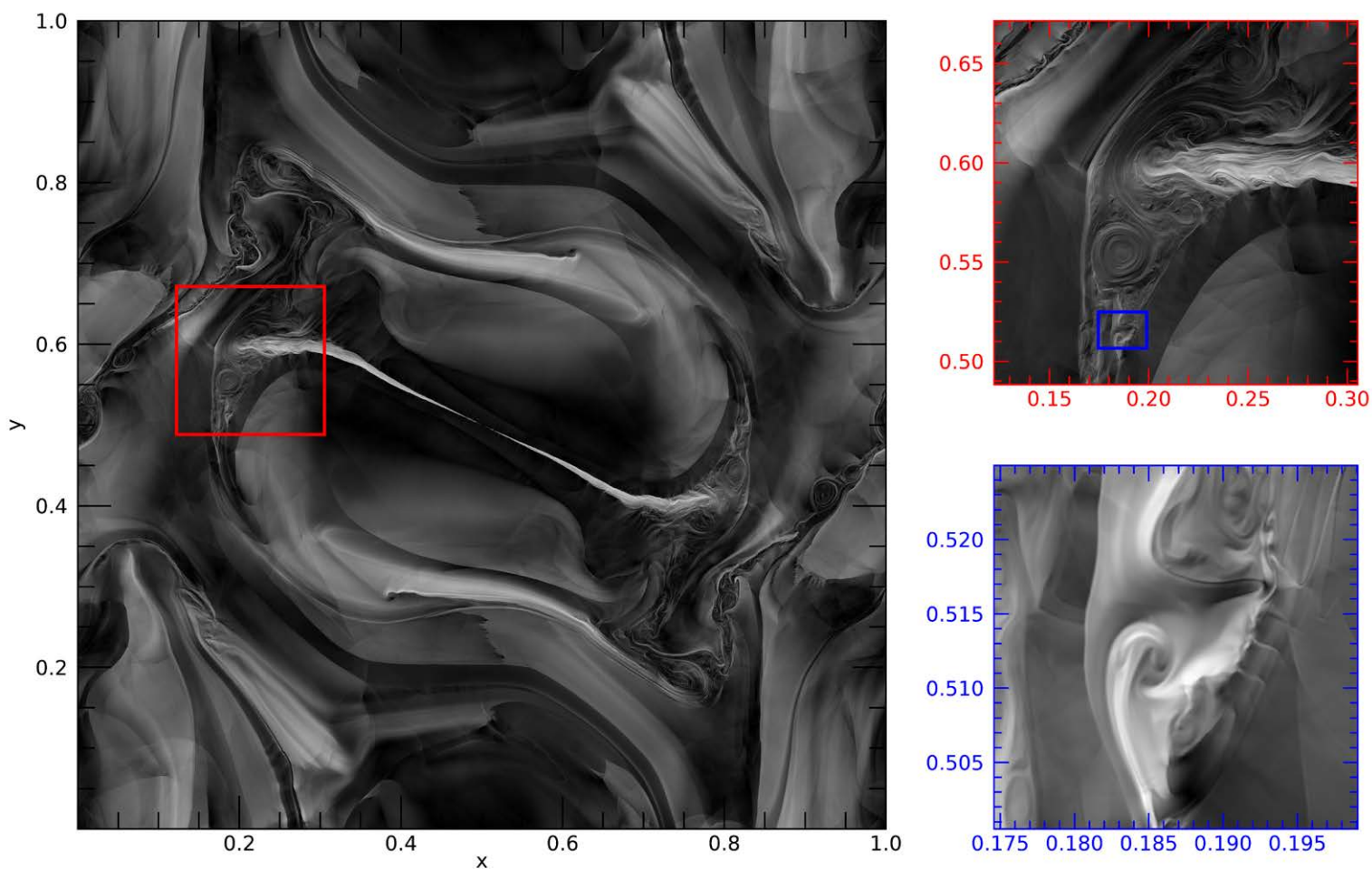


Eurasian beavers (*Castor fiber*) were once widespread and are now being reintroduced to an environment that has been intensely populated and modified by humans. As ecosystem engineers, beavers can dramatically modify ecosystems, notably this includes the creation of dams and complex wetlands. These wetlands bring a host of benefits for biodiversity and society. Our research has shown that beavers increase water storage and slow the flow downstream, meaning both reduced flood risk

and increased water availability during drought periods. This aerial image from one of our study sites, not only demonstrates the extensive wetland habitats beavers can create, but also serves as a visualisation of the conflicts and benefits of living with beaver. The community downstream will benefit from flow attenuation and reduced flood risk, biodiversity will increase, but some farmland has been lost. Understanding these dynamics is critical to renewing our coexistence with this species.

Bringing Order to Chaos

Ben Snow



'Big whirls have little whirls that feed on their velocity, and little whirls have lesser whirls and so on to viscosity.' Lewis Fry Richardson. Turbulence is a universal feature of nature, demonstrated by chaotic flow structures. The figure shows ever-smaller features that exist in the same simulation, from the large scale structures (left figure), to intermediate scales (top right), to small scales (bottom right). I study the flow of energy from large to small scales in turbulent plasma and how this energy is dissipated. The simulation shown is rife with shock waves, that can be seen as sharp structures in the figure, that are very efficient at dissipating energy. I work on classifying the types of shocks that can occur, how they redistribute energy, and what this means for turbulent astrophysical systems.

Compassion on Campus

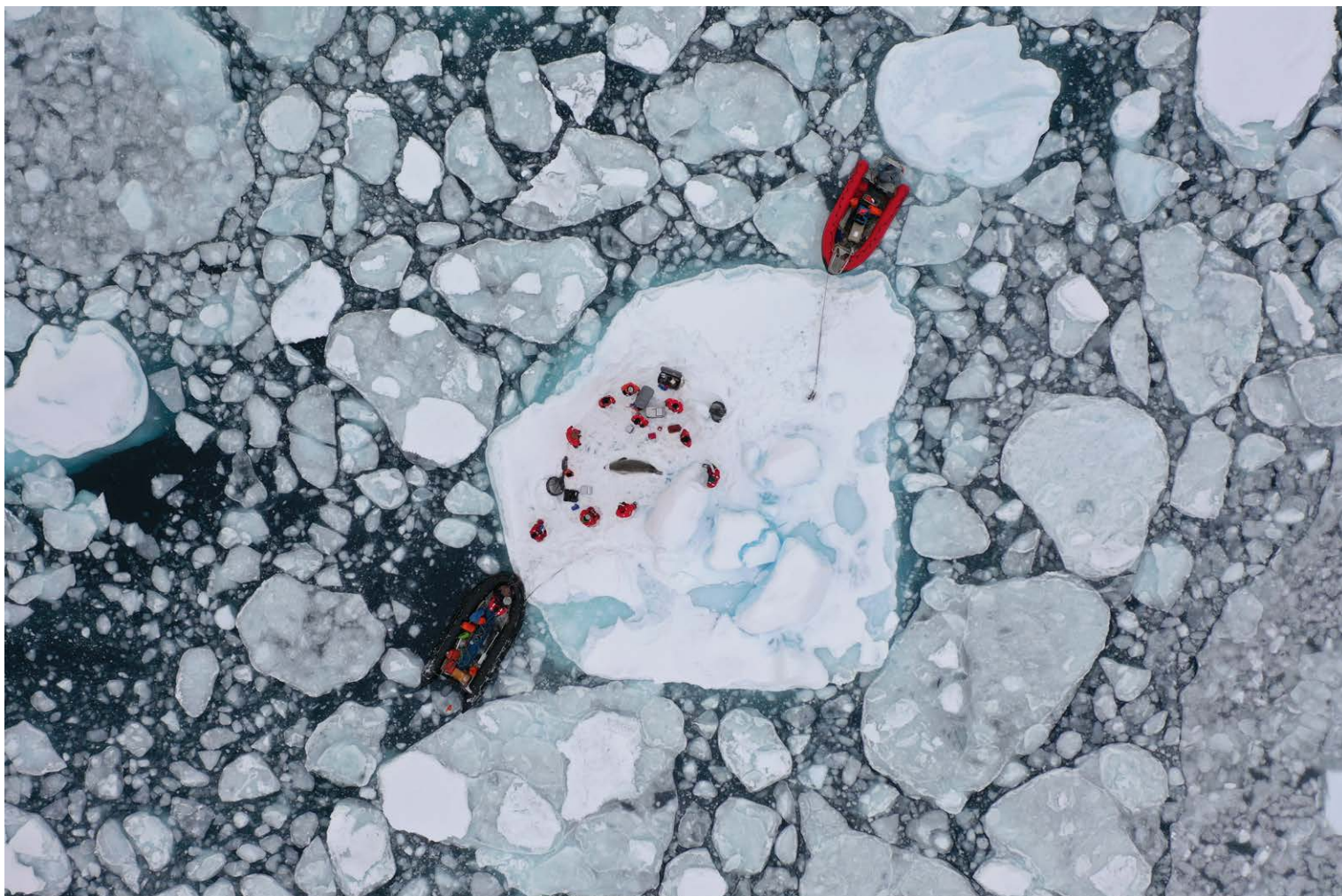
Polly Card



These images are of Exeter students working in collaboration with researchers on a transdisciplinary mental health project called Nurture U. The project explores ideas to improve wellbeing at university to help make university culture more compassionate. Students draw on their experiences to find new ways to promote wellbeing and learn about mental health. The project is funded by the Medical Research Council and is happening at the Universities of Exeter, Oxford, King's College London, Newcastle, Southampton and Cardiff.

Crabeater Seals from the Sky

Luis Huckstadt



Scientists are using satellite tracking, whole-organism biology, remote sensing and drones to understand how climate change is impacting crabeater seals in Antarctica. We study seals as they haul out on ice floes to assess their health status and body condition, collect samples to study their ecology and physiology, and take photos with a drone to later being able to easily measure wild seals remotely without having to handle them. Because crabeater seals are highly specialised predators of Antarctic krill, a keystone species of Antarctic trophic webs, they can serve as sentinels of the status of Antarctic marine ecosystems.



Flat-headed Mayfly

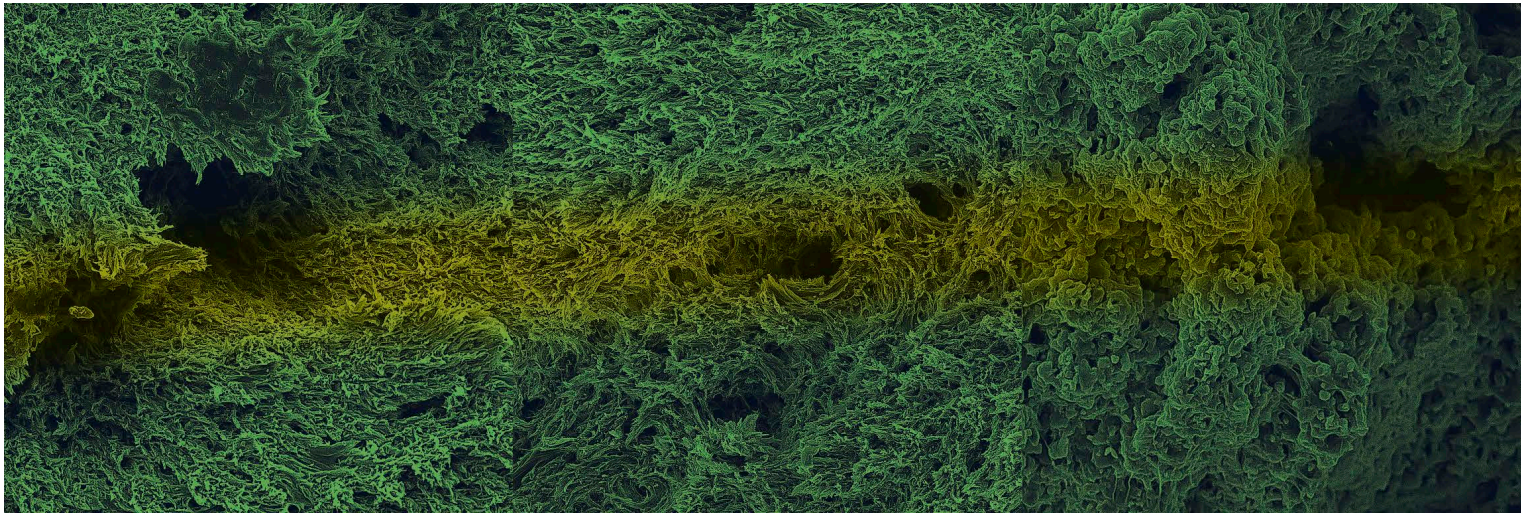
Kate Baker



This Natural Environment Research Council funded project investigated patterns of habitat use by benthic macroinvertebrates (such as dragonflies, stoneflies, and mayflies) in the tropical streams of Ulu Temburong National Park in northern Borneo. Understanding the spatial structure of macroinvertebrates and their habitats within streams and rivers is important to inform management and restoration decisions. Kate's favourite macroinvertebrate was the flat-headed mayfly, Heptageniidae, which has a flattened head and body enabling them to live on the tops of the rocks even in fast flowing water. When on fieldwork Kate enjoyed taking photos and videos of life underwater in the streams and rivers of Ulu Temburong.

From a Little Spark May Burst a Flame

Milad Latifi



“Break” is what we all know in word, where we could imagine this word’s definition by remembering a scene from our memories. The question is had you ever see how it really looks like? The flames that consume living things in their eternity or a blood that boils due to the extreme heat. This image gives us a microscopic view of the shattering of a PVC hourglass sample after tensile testing in a University of Exeter lab. It is seen how a 10×10 mm part of the sample breaks, turning blossoms into ash like a dragon’s breath. The research has improved our understanding of what a break is, as well as how to recognise pipe breakage modes by navigating this strange world of stretchable and flame-like patterns. Pipes which bring us the symbol of purity and life, water.

Hornet in Hand

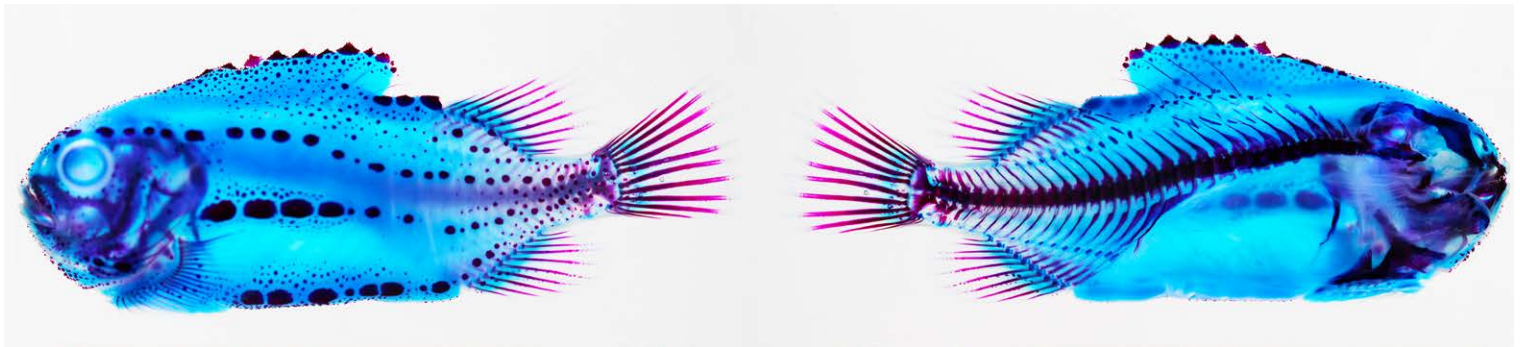
Thomas O'Shea-Wheller



The invasive hornet *Vespa velutina nigrithorax* is rapidly spreading across continental Europe and Asia. These insects predate upon native pollinators and managed honey bees, raising concerns for agricultural production and ecosystem health. Thus far, DEFRA has managed to stop the hornets from establishing in the UK, by coordinating a national response to locate and destroy any queens that arrive from Europe. My research aims to develop technologies for detecting the hornets remotely, and assessing their impact on native pollinator populations. This photo was by my colleague Dr Peter Kennedy during fieldwork in Spain, and shows that despite their fearsome reputation, I have developed something of a fondness for these often-misunderstood insects.

Inside and Out

Jonathan Ball



Whole body Lumpsucker fish (*Cyclopterus lumpus*) suspended in glycerol, stained for both cartilage and bone. Lumpsucker fish are used for generating a relatively inexpensive caviar substitute and as cleaner fish in salmon farms. Spending their initial few months in tidal pools after hatching, the fish migrate to open water as they mature. The absence of a swimbladder and presence of pelvic suction cup was used to hypothesise that these were a

bottom dwelling species, but they can be found in the open sea especially during migration for breeding. The fixed tissue is stained using Alcen Blue (cartilage) and Alizarin Red (bone). Dark red/purple shows the location of external bony nodules, fins, the pelvic suction disc, spine and the cranial bones. Dark blue cartilage connections are visible in the fin bones. Alcen blue also lightly stains the remaining soft tissues.

Investigation of Woody Debris Movement in Menstrie catchment

Martina Egedusevic



This picture has been taken during my research at the Menstrie catchment, that as related to woody debris movement across this catchment. On this picture, I did installation of water level sensors on the bottom of the river bed. This included use of the sledge hammer. It was good fun.

Let's Make Tech-YES-Logical Relationship!

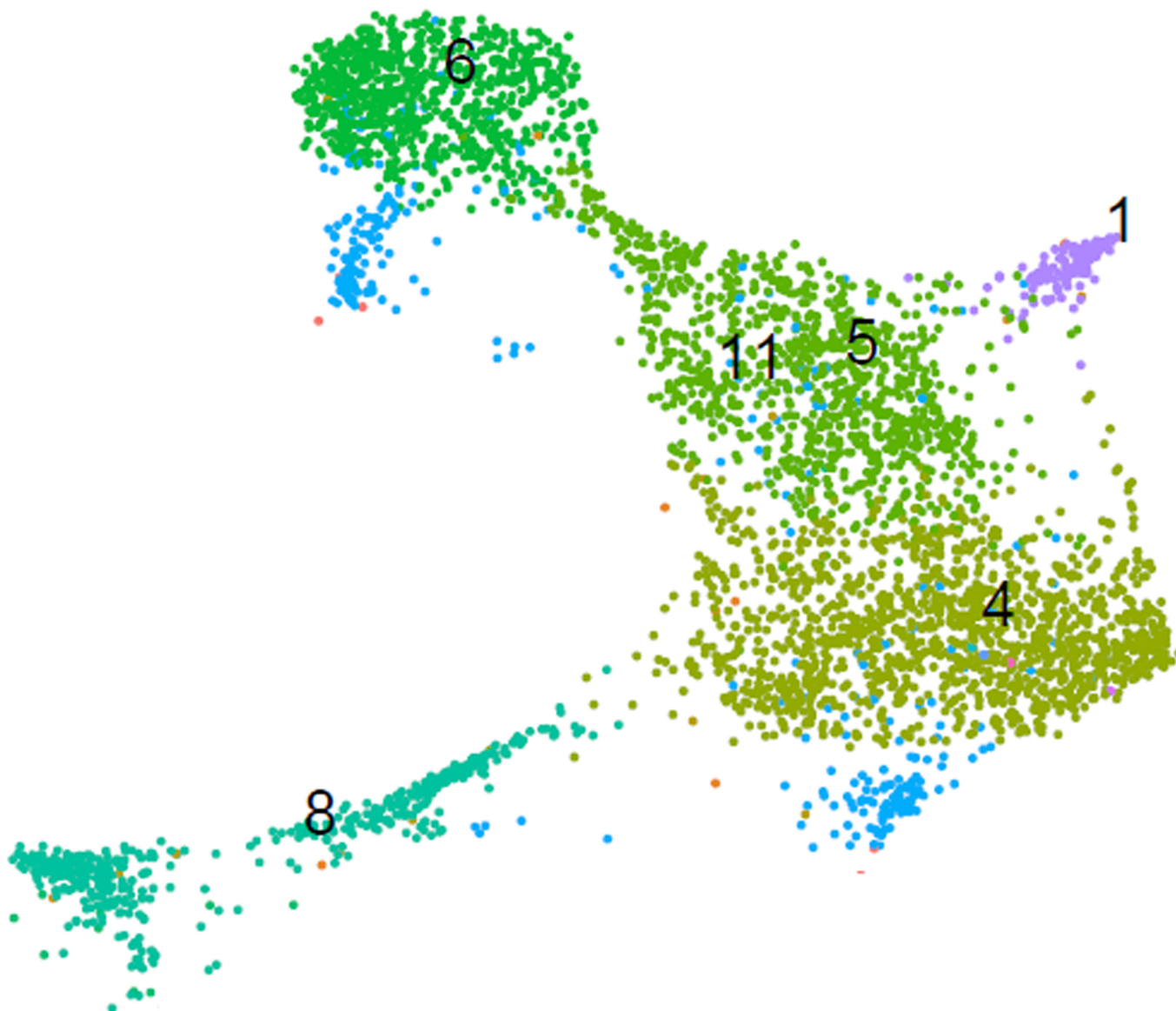
Anurag Roy

The Internet of Things (IoT) provides everyday objects and environments with “intelligence” and data connectivity to improve the quality of life and the efficiency of a wide range of human activities. Solar energy is one of the leading sectors where IOT develops massively. We are generating more power from the Sun (renewable) that can work in daylight to run your smartphones, tabs, etc., saving power, battery life, and less charging. However, IOT often feels unmissed that each individual is responsible for their own experiences and outcomes and can negatively impact relationships. Easily accessible energy, technology use and technoference add significantly less personal time spent, less satisfaction and less connection. No! Instead of Tech-NO-logy, we prefer to say tech-YES-logy and ensure sustainable development with a stronger relationship and better wellbeing.



Lung Mesenchymal Cells as a Flying Duck

Xinpeng Dun

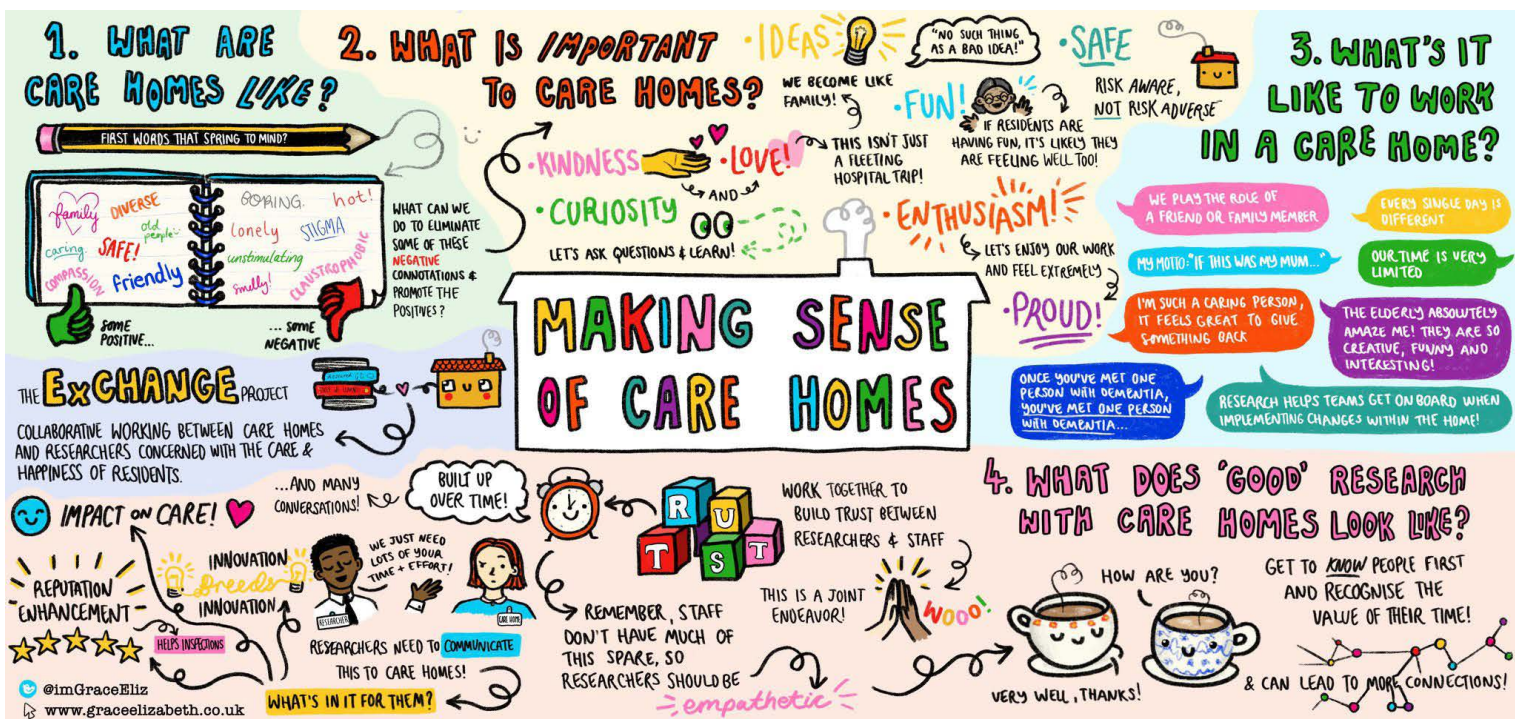


Single-cell RNA sequencing technology has become the state-of-the-art approach for unravelling the heterogeneity and complexity of RNA transcripts within individual cells. Following RNA sequencing, data analysis could reveal the composition of different cell types and their functions within highly organized tissues and organs. We are analysing single cell RNA sequencing datasets from healthy and fibrotic human lungs aimed a better understanding the

function of individual cells, and more importantly, to identify the origin of pathological cells leading to lung fibrosis. Our analysis to the cell clusters of mesenchymal cell population in human lung not only discovered a novel mesenchymal cell type that recruits immune cells to the diseased lung but also created an image as a flying duck, which I would like to share with university wide research communities taking the opportunity of 2022 Images of Research Competition.

Making Sense of Care Homes

Chloe Place



Stigma, prejudice and ageism dominate public perceptions of care homes: "ending up in a care home" is a widely expressed fear. Yet care homes are the home or workplace of well over a million people in the UK and many more regularly visit or spend time in them. The ExCHANGE (University of Exeter and Care Homes Knowledge) Collaboration is a group of care home owners, relatives of residents, and researchers concerned about the health

and happiness of those working, visiting, and living in care homes. We are exploring how research in and with care homes enhances people's everyday lives. This colourful sketchnote is one of the innovative methods ExCHANGE is using to show what care homes are really like, to celebrate them as exciting and rewarding places to live and work, and to demonstrate how research can add value to the lives of everyone in them.

Optics and Photonics: the building blocks of modern-day technologies

Yessenia Jauregui-Sánchez



Optics and Photonics address and solve the challenges of the modern world and improve the quality of our lives. Optics-based technology is everywhere, just look around you, at your mobile devices. Most screens are made up of millions of pixels that work together to create a colour image. In the bright regions, the pixels light up with different intensities, while in the dark regions they go out. To see

this effect, simply add drops of water to a phone display. The drops will show you the red, green, and blue colors of the pixel grid in the same way that the rainbow appears when sunlight reflects off raindrops. An iPhone 8 Plus was used in this shot. In Prof. Bertolotti's group, we exploit the properties of light transport in complex and disordered media to develop non-invasive imaging systems.

Pandemic Play

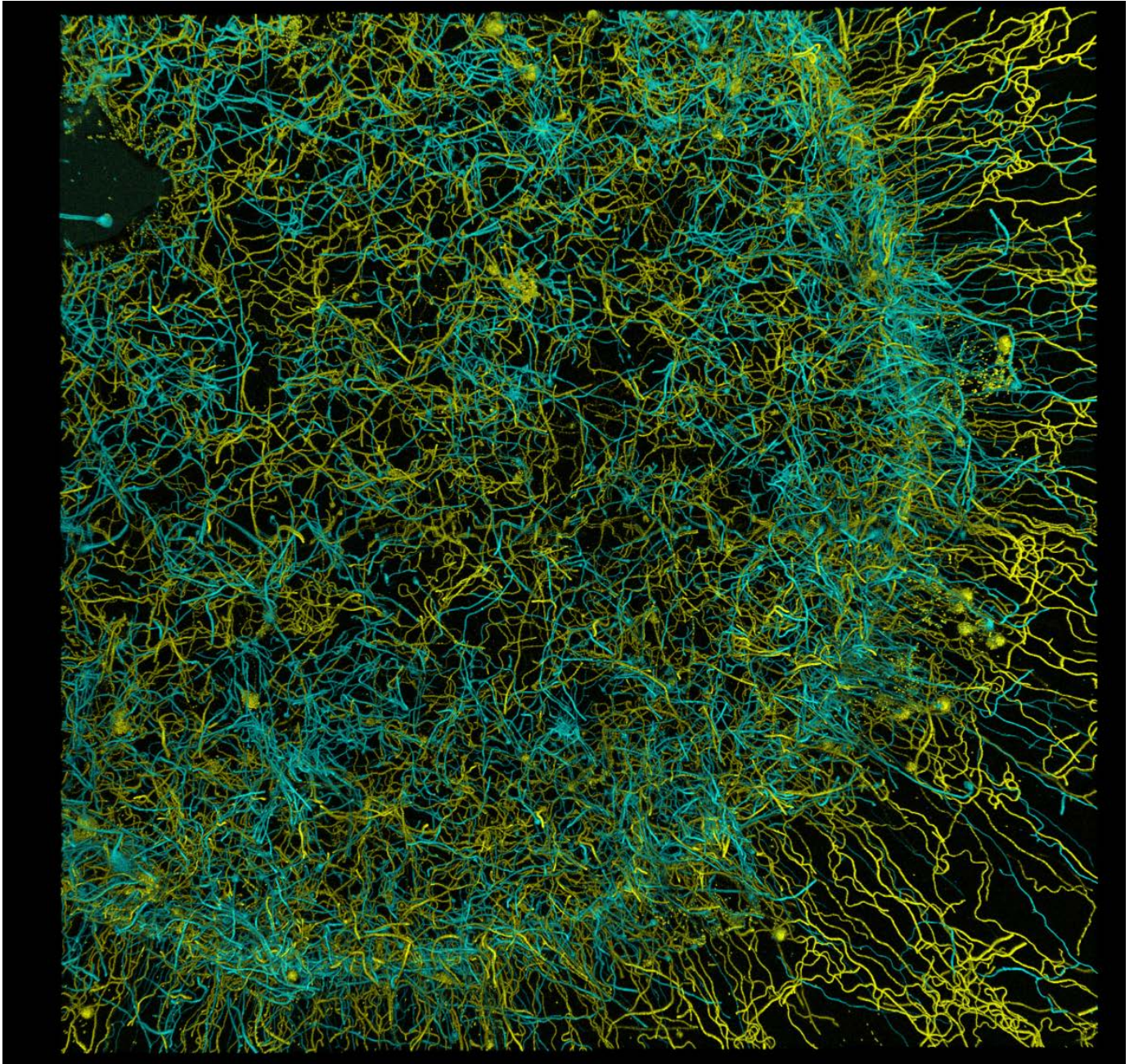
Rachel Nesbit

Play is fundamental to childhood and is protected in The United Nations Convention on the Rights of the Child. During the pandemic we worked with the Museum of English Rural Life to create an archive of play during the pandemic to capture children's experience for future generations. In this image, a girl, aged 6 created her own masks for her dolls as real-life masks were "too big". This powerful image shows how children use play to understand and make sense of the world around them. Our research examines the importance of play for children's mental health. In the recovery from the pandemic, we have advocated for children to be given time, space, and freedom to reconnect with their peers. Working with Save the Children and Play England we launched the #SummerOfPlay campaign – gaining the support of over 150 organisations including the LEGO foundation, NSPCC, and Children's Rights Alliance for England.



Planet Killer-Fungi

Darren Thomson

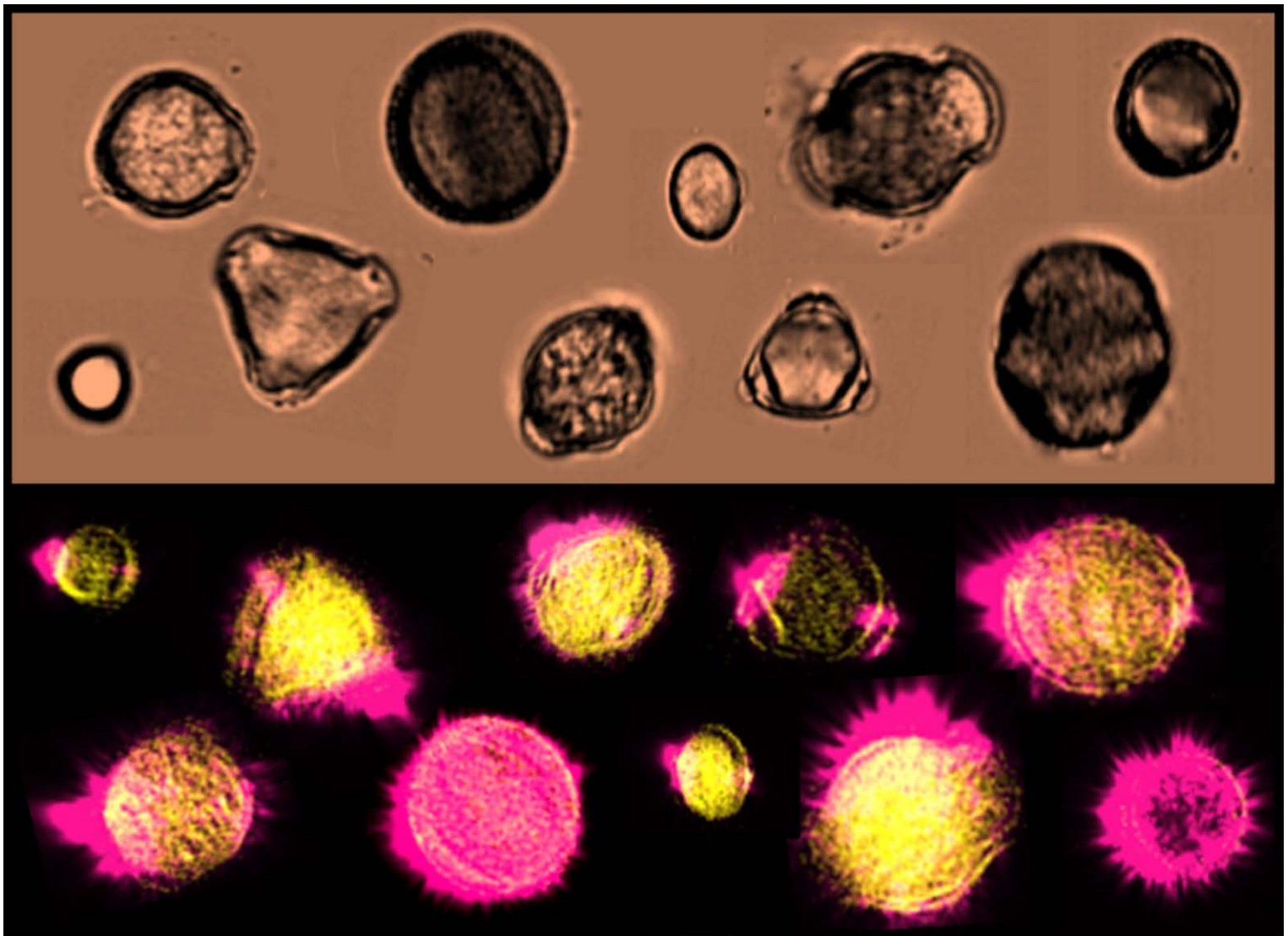


This image represents fungal pathogens forming a microcolony (~1mm wide). This wordly, but deadly form can develop from a few tiny spores into a 'fungal ball' in respiratory patients suffering from Aspergillus mould infections of the lung. It not only physically blocks the

airways but can overdrive inflammation to the patient's detriment. The formation of these planetary structures are studied here in Exeter using fluorescence imaging technologies.

Pollen Power

Ann Power



Pollen extracted from wildflower honey made in Topsham, Exeter. Brightfield, autofluorescence (yellow) and light scattering (pink) images of pollen grains captured by imaging flow cytometry have been used to train a deep learning network for automatic pollen classification. Traditionally, pollen experts painstakingly identify pollen using light microscopy, which is time intensive and sometimes it is impossible to distinguish between different species. However, our network, developed with experts

at Swansea University, can rapidly identify pollen at high accuracy and eliminate human bias. Unlike previous deep learning networks that are solely tested on 'lab based' training images, our exploratory tool can predict pollen types, even if they are not included in training data. This is key for classifying pollen in 'real world' environmental samples, such as honey. Bees store pollen as a protein source for their young. It can inform us about food quality, biodiversity, bee behaviour and pollination.

Red kite Feeding at Bwlch Nant yr Arian

Virginia Thomas



My research explores conservation feeding as part of a larger project which investigates why people feed animals and the intended and unintended consequences of this. This photograph, taken at Bwlch Nant yr Arian near Aberystwyth, Wales, shows me taking part in the daily feeding of red kites. Red kites were almost extinct in Britain with only a single breeding female left in Wales. Following a reinforcement programme which started in 1989 their

numbers have risen and the population is now estimated to be 4,600 pairs, with hundreds of kites living near Bwlch Nant yr Arian and other strongholds. While red kites no longer need feeding to support their survival the incredible spectacle of hundreds of kites gathering to feed creates a tourist attraction and the opportunity to engage publics with species conservation as well as habitat and biodiversity protection more broadly.

Reef Rehab

Ines Lange



Coral reefs around the world are suffering from the effects of climate change, pollution and destructive fishing practices. Reef restoration can be an effective tool to improve coral reef health at a local level, but only if done well and with the involvement of local communities. I am currently visiting the incredibly successful Mars Assisted Reef Restoration Site (MARRS) in Indonesia to investigate if restored reefs can provide similar levels of functions compared to nearby healthy reefs. Diving here feels like being on a different planet (maybe not Mars but...), with thickets of corals densely covering the seafloor, where formerly only rubble fields existed. You need to look very closely to even see the steel frame that builds the basis for this new world. The project, carried out by a fantastic Indonesian team and based on scientific evidence and monitoring, suggests that not all hope for reefs is lost.



Sperm Whale in the Deep Azure Waters of the Indian Ocean

Kirsten Thompson



There are many regions of the open ocean that have sparse survey coverage and for some species, such as sperm whales, there are few data on their distribution and habitat preferences. This lack of data hinders our ability to designate marine protected areas and manage the multiple threats from human activities. To address this knowledge gap, passive acoustic surveys are key in generating data on cetaceans in remote regions. These surveys yield large amounts of data, the analysis of which is time consuming

and can account for a substantial proportion of the survey budget. Semi-automatic processes enable the bulk of processing to be conducted automatically while allowing analyst time to be reserved for validating and correcting detections and classifications. Our research has recently provided a streamlined method for analysing acoustic datasets so that such large-scale surveys can be more affordable, and therefore, more accessible in future.

Stakeholders hold our research together

Rebecca Whear

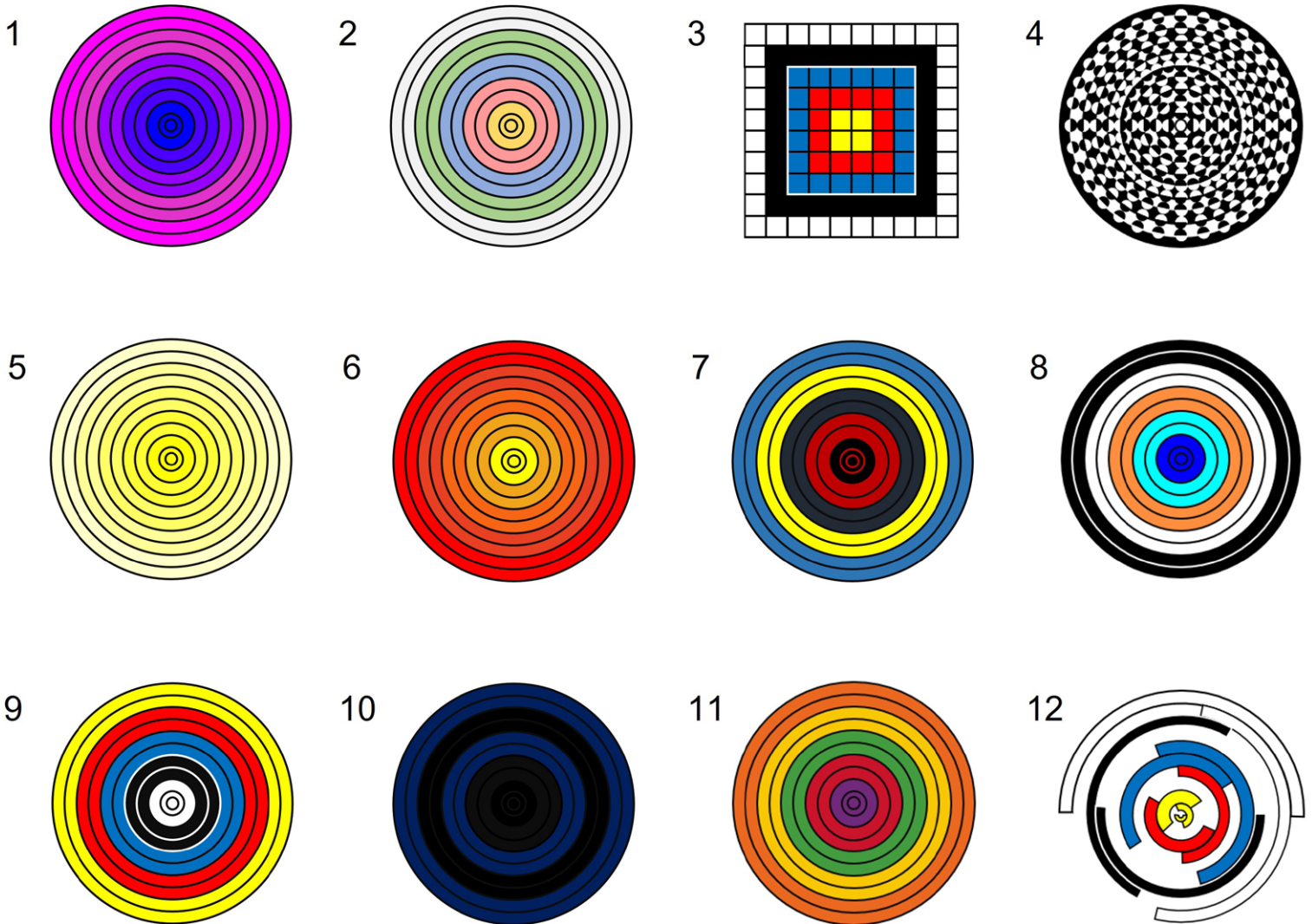


Stakeholders are essential to research because they help identify topics that are important to them. Our research project (iGEN), which mapped the evidence on intergenerational interventions, involved a diverse range of stakeholders including: people living with long term conditions and health challenges; academic colleagues from Exeter, UCL, Hertfordshire, and Sheffield; the Centre for Ageing Better; Cochrane Campbell Global Ageing Partnership; Age UK Cornwall; UNICEF; representatives from local councils, public health, adult social care,

children's services and charities, and other interested partners. Our stakeholders helped us develop the research protocol, structure the evidence map, produce the report, share findings, and inform the next relevant research steps. The evidence map will help researchers, policy makers and intergenerational workers to influence the use and development of future intergenerational interventions. This photograph was taken by one of our stakeholders when we joined together for the Only Connect conference at Falmouth University in July.

Symbolic Instructions in Archery Targets

Elliott Rooke

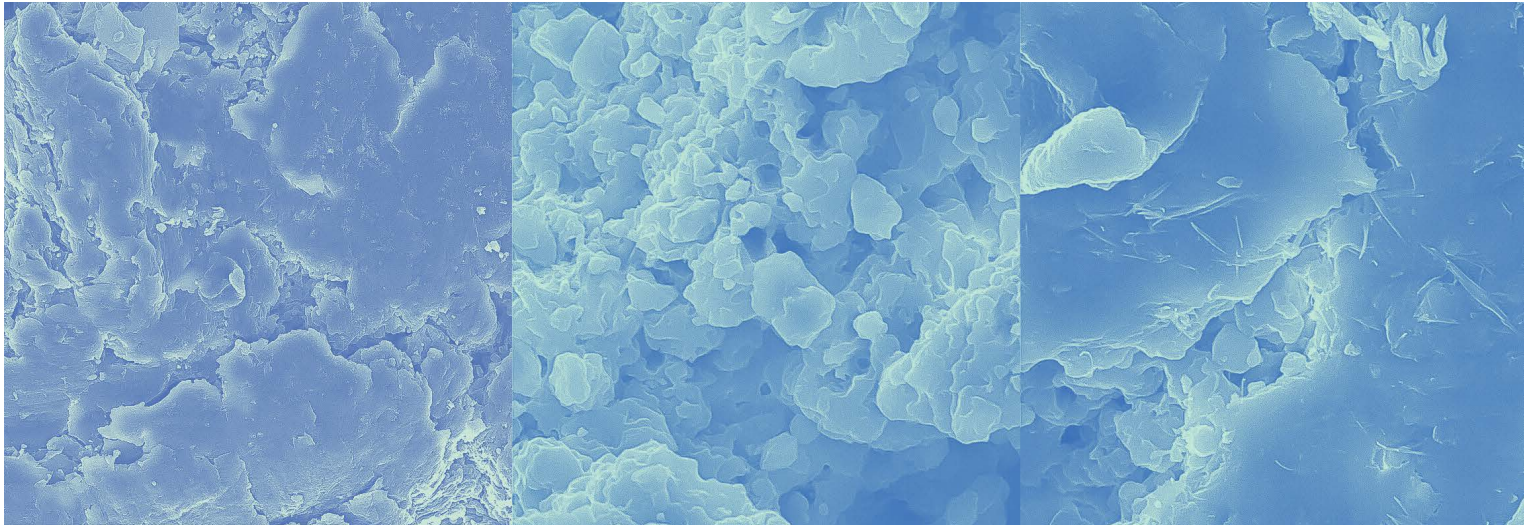


Images, colours, and symbols have a communicative power; they can convey complex ideas and instructions, calling for us to behave in specific ways. One of the best examples of this is the archery target. Using nested concentric rings and bold colours, the target draws the archer's eye – and aim – to its centre. This instruction is communicated by the design itself, leading to archery targets becoming symbols of accuracy, precision, and focused attention. However, for

archers this instruction can be disruptive. Some describe the experience as being akin to someone watching and judging their shooting. This can lead to a kind of performance anxiety – known as being 'gold shy' – where archers struggle to aim. To overcome this, archers practice against blank targets, but these designs were created to test whether other colour, shape, and pattern combinations could alleviate this anxiety or prompt other responses.

The Song of Ice and Fire

Milad Latifi



“When the great winter begins, absolute darkness rises on the winds, and whatever dwells within will destroy the world of living. When this terrible winter comes, all of the world must stand against it...” It looks like an apocalyptic dream but is a scientific forecast about the aged pipeline systems. Particularly in this country, when the life of Victorian water pipelines comes to an end, supplying enough and pure water for the urban and rural areas will be a nightmare. The ice-like flakes in the picture displays a 5,000 times magnified picture of the failed pipes, explains how it becomes brittle and fragile. This study enhances our knowledge about these vital and essential assets. “... and scientist and engineers must unite the society against the asset deterioration.”

The Virtual Shepherd

Mazyar Ghiabi



A shepherd in the 70 Peaks Valley of central Iran checks his smartphone while on a donkey. He is the Admin of a chat group with male, female and fake followers from all across Iran; and he welcomes every new entry in the chat with the traditional greetings and courtesy typical of off-line interactions. His virtual occupation though clashes with his everyday existence as a shepherd. Spending several hours a day online has transformed his daily routines.

Rather than the age-old route, he takes his flock where wireless 3G connection is stronger. He spends night hours being online, feeling tired in the mornings. While studying drug 'addiction' I followed his everyday life and observed how his attachment to technology was disruptive and transformative of his existence and that of the community, a small village 60Km away from the next main town.



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