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MESSAGE FROM THE EDITOR

Ionic Magazine 12.12

Smart is the new sexy and Ionic knows that better than all. Once again a huge thank you to our contributors for another slick issue.

In this edition, read about breakthroughs in cancer treatments, pharmaceutical farming, retinal transplants amongst many others. And for those with a more futuristic fetish, we have a run down of advances in synthetic biology as well as augmented reality. We also continue Ionic's feature ion, with a look at Sulfur (sulfide and sulfate). As ever, alongside each article our fabulous artists tell it their way. Explore the same story through a different perspective. Like what you read or see, then check out our contributors personal websites, blogs and social networking sites.

On the subject of blogs: Ionic has jumped on the blog bandwagon. Previous and current Ionic entries are now also available on www.ionicmagazine.co.uk/blog so now not only can you subscribe to receive all future issues, but you can also like, tweet or leave comments on each and every article. What's more, stay tuned for the Editors blog in between issues.

Finally, for information on how to contribute to Issue 3, go to www.ionicmagazine.co.uk/getinvolved

Enough from me, enjoy the read.

Yalda Javadi Ph.D. **Editor**

CONTENTS

SULFUR - SMELLS OF HELL

Sulfur and its compounds have powerful uses for good and for evil

By Akshat Rathi - http://akshatrathi.com

In 1991 a volcanic eruption occurred on the island of Luzon, near the Philippines. In a short period of time Mount Pinatubo had injected into the atmosphere 10 billion tonnes of magma and 20 million tonnes of sulfur dioxide. In the months that followed, global temperature had fallen by 0.5 °C. The cooling occurred because of the formation of a thin layer of sulfuric acid that reflected the sun's radiation.*

Apart from its rare use in cooling the atmosphere, sulfuric acid, a compound of the abundant element sulfur, is used in many industrial applications. So much so that the amount of the acid produced in a country could be a good measure of that country's economic development. Sulfuric acid's historical name is the oil of vitriol and the usage of the word vitriolic stems from its strongly acidic nature. When added to water (H_2O) it forms sulfate ions in a heat-producing reaction. Such is its affinity to water that if added to sugar it removes hydrogen (H) and oxygen (O) from it leaving behind a tower of black carbon.

Sulfate ion is a doubly-negative ion that consists of a sulfur atom bonded to four oxygen atoms. Attached to some valuable elements, it is found in the form of minerals too. Gypsum, which is commonly used in plasters, is a sulfate salt of calcium. Another important ion of sulfur is the sulfide ion. Not unlike sulfates, sulfides are also found as minerals in sulfide metal ores.

But sulfide compounds are more commonly known for foul-smelling versions. Burning of sulfur results in the formation of hydrogen sulfide that smells like rotten eggs., which was once considered to be the "smell of hell". This odd connection was probably the result of a similar reaction occurring near a volcano which, in the middle ages, was considered to be a gateway to hell.

Hydrogen sulfide is not half as bad as its cousin, dimethyl sulfide, which has a disagreeable odour even at low concentrations. And yet, dimethyl sulfide when diluted further is very important to our culinary experience. It is part of the smell of cheeses and the aroma of truffles.

Sulfur compounds have an evil side too. In World War I the Germans used mustard gas, a sulfide compound, that caused horrible blisters. Unlike chlorine, it was colourless and the effects of it were felt only after a few hours. Worse still, it did not kill but only incapacitated the soldiers.

Then there is sulfur hexafluoride, an utterly unreactive gas, that is used on an industrial scales to provide an inert atmosphere for reactions that occur over 1000 °C, for example in the smelting of magnesium. But sulfur hexafluoride is a greenhouse gas that has 32,000 times the potential of carbon dioxide. Even small amounts of the gas are very harmful to the planet, yet it is used on industrial scales. It seems, then, that sulfur and its compounds affect many things from the depths of hell to the very edge of the atmosphere.

* Many consider that mimicking this eruption to cool the planet may be necessary. But a British project, Stratospheric Particle Injection for Climate Engineering aimed to test the feasibility of such an intervention was cancelled in May 2012 because of patent issues and the lack of regulation over actions that can affect many nations[1].

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By Carlos D. Toledo-Suárez

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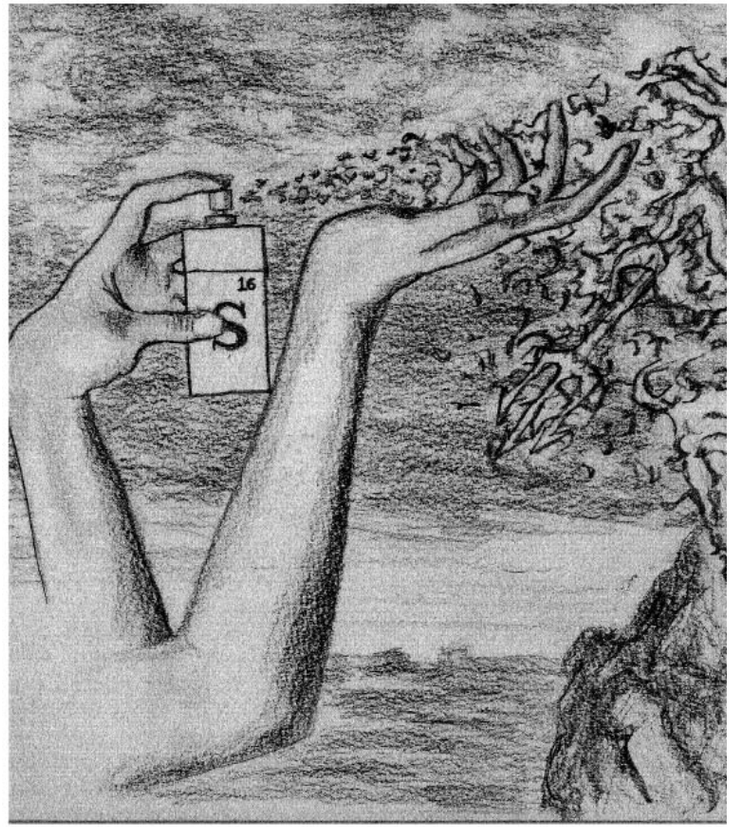

SYNTHETIC BIOLOGY – LIFE IS WHAT YOU MAKE IT, LITERALLY!

By Lux Fatimathas - www.facebook.com/l.fatimathas

"It's alive, IT'S ALIVE!" exclaimed Dr Frankenstein upon creating a living being from spare parts. This classic tale of horror takes root within the dark arts of science fiction. Though far from being science fact, this movie masterpiece is no longer entirely based on fiction either. Fast forward to the twenty-first century and the burgeoning field of synthetic biology combines the natural and the artificial to generate biological organisms that previously did not exist.

Synthetic biologists study living organisms to uncover how life works and how we can harness it to our benefit. In the first instance, scientists are attempting to recreate biology using manmade parts, providing us with a deeper understanding of what it minimally takes to generate life. In the second instance, scientists have rebooted existing biology after building in new specs to transform living organisms into biological machines with practical applications.

Whichever the approach, it all begins with DNA – the genetic code to life. For decades we have been artificially manufacturing the building blocks of DNA represented by the letters A, T, C and G. We have cloned genes into and out of different organisms, in a process called genetic engineering. Biomedical engineer Jim Collins famously referred to synthetic biology as "genetic engineering on steroids". Manufacturing a single gene is quite different from creating an entire genome of thousands, millions or even billions of As, Ts, Cs and Gs strung together without a single typo.

Biologist Craig Venter met this challenge in 2008 by being the first to manufacture the whole genome of a bacterium[1]. Two years later Venter went one step further by manufacturing the genome of one bacterium and implanting it into the shell of another, whose own DNA had been removed[2]. The manmade DNA was distinguished from the natural DNA by encoding a few lines of verse from English poet James Joyce: "To live, to err, to fall, to triumph, to recreate life out of life" [3].

This new bacterium, spurred to life by a manmade genome, was controversially hailed as the world's first synthetic life form and nicknamed Synthia. Some religious groups declared Venter was trying to play God. However man is a long way from creating life from scratch. Although the instruction manual for Synthia was produced in a lab, Nature made the body it commanded.

Inverting this scenario has also resulted in a new creature - the eight-armed, artificial jellyfish - made by implanting rat heart cells containing Nature's own DNA into a silicone body suit[4]. In this feat of reverse engineering, heart cells grew into a silicone body by following paths marked out by scientists using special proteins. This hybrid organism was released into liquid and with the help of some electrical shocks, began to swim in patterns similar to its natural counterpart, the ocean-dwelling jellyfish.

The development of curious new creatures is touted as the next phase in medical and industrial development, with spider-goats and micro-organic drug factories making the headlines. Before the image of a half-goat-half-spider-like beast is conjured up in your mind, rest assured that the spider-goat

By TroutPoutt

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looks just like every other goat. The difference is genetic, as slotted amongst a stretch of DNA normally responsible for milk production; scientists have placed a spider gene encoding dragline silk[5].

Ever seen a spider fall? You'll find it catches itself by shooting out a substance as strong as steel called dragline silk. Medical research has already shown it to hold potential for use as stitches, artificial tendons and scaffolds for growing ligaments[6] and skin grafts[7]. Harvesting copious amounts of dragline silk from thousands of tiny spiders is an impossibly difficult task. The spider-goat however just requires milking. The milk is then processed to extract the silk, providing a potential source for mass production of Nature's very own Kevlar.

Mass production is also the goal of micro-organic drug factories. Yeast has long been used to leaven our bread and brew our beers, but its benefits stretch far beyond filling our bellies. Biochemical engineer Jay Keasling constructed a unique genetic circuit combining genes from bacteria, plants and yeast. This novel piece of genetic technology, when inserted into yeast, allows them to produce a chemical called artemisinic acid – a vital precursor to the anti-malarial drug artemisinin[8].

Artemisinin is normally extracted from the plant sweet wormwood, with yields that vary with the weather. It is cheaper however to extract its precursor from these genetically rebooted yeast factories. This yeast-manufactured drug is set to hit the market this year, with hopes of making anti-malarial treatments more affordable in countries that desperately need it.

Affordability is also at the forefront of Keasling's next biological reboot. If yeast can make drugs, how about bacteria that make jet fuel? With the cost of flights soaring as the world's oil supplies dry up, micro-organic fuel factories would be a timely salvation. Keasling's experiments have shown the bacterium, E.coli, commonly known to cause stomach upsets, can be genetically hijacked to produce a variety of fuels[9]. Inserting an extra set of genes poached from other bacteria equipped E.coli to churn out chemicals that can be processed into petrol, diesel and jet fuel.

In a far-flung future where jet planes are fuelled by a stomach bug, a laptop made from bacteria would not seem out of place. Early efforts in organic electronics have produced a primitive 96-pixel screen made from electrically sensitive yeast[10] and hard drives made from E.coli chromosomes[11]. The list of products that may sprout from synthetic biology is growing, but are we ready for it?

Strict regulations are in place to ensure that manipulated bacteria are rendered harmless to the human body, that hybrid organisms are kept safely within a lab, and that new drugs or chemicals produced are rigorously tested. It is nonetheless difficult to predict the consequences of such major modifications to biology. With this in mind, synthetic biologists cautiously venture on, and Frankenstein's creation will stay put in the fiction aisle of your local library.

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VASCULAR DISRUPTING AGENTS IN ONCOLOGY – A NEW 'BREAKDOWN' IN CANCER TREATMENT

By Rugina Ali - www.facebook.com/rugina

Vascular Disrupting Agents (VDAs) are a novel class of drugs that target the blood supply of a tumor. Normal tissues of the body maintain their blood supply by an orderly and efficient vascular network. These networks are organized with mature, evenly distributed, vessels to allow adequate circulation of oxygen and other nutrients to all cells. Conversely, the vasculature, supply of vessels to a specific region, of solid tumors is fundamentally different. Tumor angiogenesis, the process of developing new blood vessels, which is required for tumor growth and metastatic spread, involves several processes, including growth, reproduction and movement of cells that line the interior surface of blood vessels, known as vascular endothelial cells[1]. This leads to the formation of a functioning vessel with an opening. Without angiogenesis, tumor growth is restricted to about 1mm from the blood vessel due to lack of oxygen and nutrients1. For further growth, they must develop a blood supply network, which differs from that found in normal tissue in that it is primitive in nature structure, and functionally abnormal.

Due to the importance of vasculature for the development and growth of tumors, it has received a great deal of interest as a possible therapeutic target, which has lead to the evolution of a novel class of drugs known as Vascular Disrupting Agents (VDAs). VDAs exploit known differences between blood vessels of tumors and normal tissues, which allows them to selectively block or rapidly destroy pre-existing vessels of tumors. Ultimately shutting down the tumor's blood supply, thereby depriving them of the oxygen and nutrients they need to survive. VDAs can be divided into two categories: (1) biologics, such as antibodies and peptides that deliver toxins, effectors that promote the coagulation of blood (procoagulant) and agents which encourage programmed cell death (proapoptotic) to the tumor endothelium, and (2) small-molecule agents which exploit known differences between tumor and normal blood vessels to induce selective vascular dysfunction. Minutes after VDA exposure, affected tumor blood vessels begin to show signs of damage leading to a marked reduction in blood flow and ultimately tumor cell death and secondary cell death as a result of prolonged lack of oxygen.

One limitation following VDA treatment is that a residual rim remains around the tumor boundary that most likely derives nutritional support from surrounding normal tissue vasculature and is therefore less susceptible to VDAs[2]. Considering these cells can act as a source of tumor regrowth, VDAs are thought to be most efficient when combined with other treatments. Significant improvements were found in antitumor activity when VDAs were given within a few hours after administration of conventional chemotherapy/radiotherapy in a variety of tumor models[3]. When VDAs were administered prior to conventional compounds, no improvement was seen and may be explained by impairment of tumor vasculature leading to lack of delivery of subsequent chemotherapeutic agents. VDAs are currently being tested in human trials, which are showing promising results in the treatment of advanced non-small cell lung cancer (NSCLC) and an aggressive, treatment resistant, thyroid cancer known as anaplastic thyroid carcinoma[3] (ATC).

By Jon Heras

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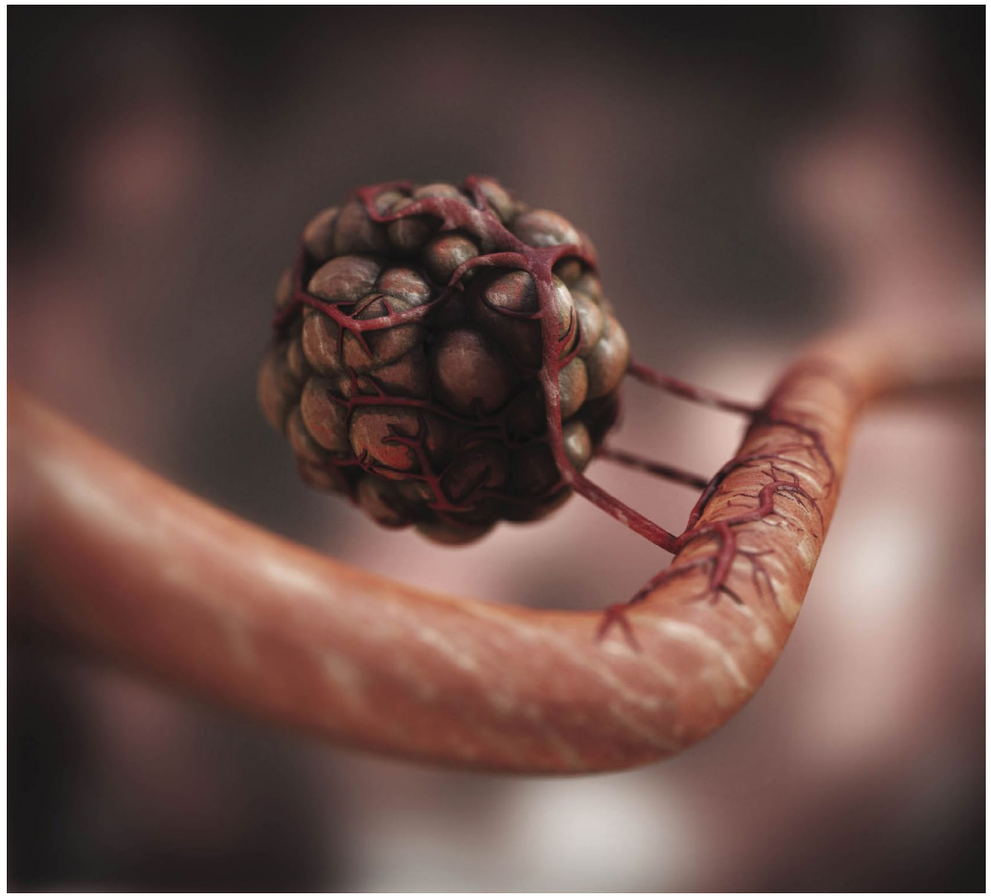

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OF MICE AND MEN: MAPPING THE MOUSE GENOME

By Karen Brakspear

The humble mouse shares a surprisingly high degree of its DNA sequence with humans, so it is little wonder that we have turned to these small creatures to help uncover some of the mysteries encoded within our own genome. While the ground-breaking task of sequencing the entire human genome was completed more than 10 years ago, understanding how the jumble of approximately 3 billion As, Ts, Cs and Gs (the bases that encode our whole genetic makeup) contains the information required to make us human is an ongoing task and an undeniable challenge. One startling discovery was that the vast proportion of our genome is not gene-encoding and appears to have no function whatsoever, leading to it being referred to as 'junk' DNA. However some of these stretches of DNA have been highly conserved through evolution and it is becoming increasingly apparent that not all non-coding DNA is necessarily 'junk'.

Bing Ren and colleagues at the Ludwig Institute for Cancer Research and the University of California, San Diego have revealed how they have mapped some of these non-coding sequences in the mouse genome and assigned functions to them[1]. Where and when certain genes are turned on or off is regulated by a variety of factors, including specific regions of non-coding DNA sequence that are located close to the gene. These sequences are called 'cis-regulatory elements' and proteins bind to these sequences to regulate gene expression. The team in San Diego used a method called ChIP-Seq, which is a high-throughput and sensitive method to sequence the DNA regions bound to certain target proteins, in 19 different tissues and cell types from the mouse. They used target proteins that are involved in promoting, enhancing or repressing gene expression to identify nearly 300,000 cis-regulatory elements, constituting 11% of the whole genome. Interestingly, they found that enhancers for particular genes were often organised in clusters with the promoters for those genes, and that these clusters were probably physically separated from other such clusters within the genome.

Various mouse tissues and cells were used in this study including brain, liver, heart and embryonic stem cells and this has meant that the findings have begun to shed some light on how genes are regulated in a tissue- and developmental- specific manner. For example, enhancers that were important in the growth and development of neurons were active in the embryonic mouse brain, whereas enhancers associated with genes for transmission of nerve impulses were more dominant in the adult brain.

The data from this study may help us to understand the non-coding sequences within our own genome given that the regulatory regions identified made up roughly 70% of the non-coding DNA sequences common between mouse and human. Furthermore, many human diseases, including cancer, are associated with misregulated gene expression and so techniques such as this can begin to illuminate how this occurs and even begin to identify potential therapeutic targets.

1. Shen Y et al. Nature 488 (7409) 116-20 (2012)

By Megan Lighfoot
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BRAIN-SCAN ME THAT MELODY

By Helga Groll - www.naturalartiste.blogspot.co.uk

In a society where talent shows dominate our TV programmes and we secretly cannot wait for our weekly X factor fix, it is surprising how little we actually know about the science of music. While we're swinging that leg over the dance floor and belting out to our favourite tune on the karaoke machine, neuroscience is probably the last thing that pops into our minds. But in fact, even humming a melody involves a range of complex cognitive processes, ranging from processing the music and sensory motoric functions such as dancing or balancing to memory storage and retrieval.

Once belittled as "auditory cheesecake", the neuroscience of music is a relatively young field that aims at understanding cognitive brain functions and processing, in particular speech, and is gaining increasing attention by scientists[1]. And as such, we are now beginning to understand how music is processed in the brain, and whether it is similar to language processing.

It was once thought that the left-brain hemisphere is responsible for language processing, while the right hemisphere is responsible for music processing. Nowadays it is known that listening and engaging to music is processed bilaterally throughout the brain, involving the cortex, sub-cortex and cerebellum mainly in the right but also in the left hemisphere. Brain areas processing speech and music do not completely overlap but some common grounds can be found, for example in the syntax[2]. However, lateralities exist in some cases, that is certain information is only processed on either left or right side of the brain[1]. Melodic attributes can also be found in the way we talk, which is with different pitches. High flat pitches are associated with fear; while falling pitches are comforting and large bell shaped pitches are associated joy or surprise. It was even shown that with composers, the rhythm of the native language is reflected in their instrumental music[3, 4].

Music also changes brain structure and function and it was found that brains of musicians differ in morphology and function to the brains of non-musicians[5]. Music enhances brain activity, and those who learned to play an instrument at a very young age show a lot more changes in the brain than the ones learned as a teenager or in later years[6]. Moreover, links between musical discrimination and cognitive abilities have been found, for example children with dyslexia have impaired melodic and rhythmic tasks abilities[7]. A change of brain morphology was shown not to only occur in musicians' brains, but also in people suffering from amusia[8]; a deficit in music processing in which people cannot discriminated between pitches less than a semi tone apart, although it is nowadays seen as a rather selective impairment of perception, concerning either rhythm, or melody, or both, or in more simple terms "tone-deafness".

Many people see emotion as the essence and purpose of music. And although the role of emotion in music processing is still widely debated[9], it was shown that music can indeed trigger emotional responses such as shivers, thrills and changes in heart rate[10]. When listening to music, the same brain areas are activated in a similar manner to other emotional stimuli[1], and dopamine, a chemical that triggers the brain's sense of reward, is released[11]. Oddly, sad music can make people happy. It tricks the brain to release prolactin, a bonding hormone released during breast feeding or sex, which induces a positive mood change[12].

By Thomas Weaver

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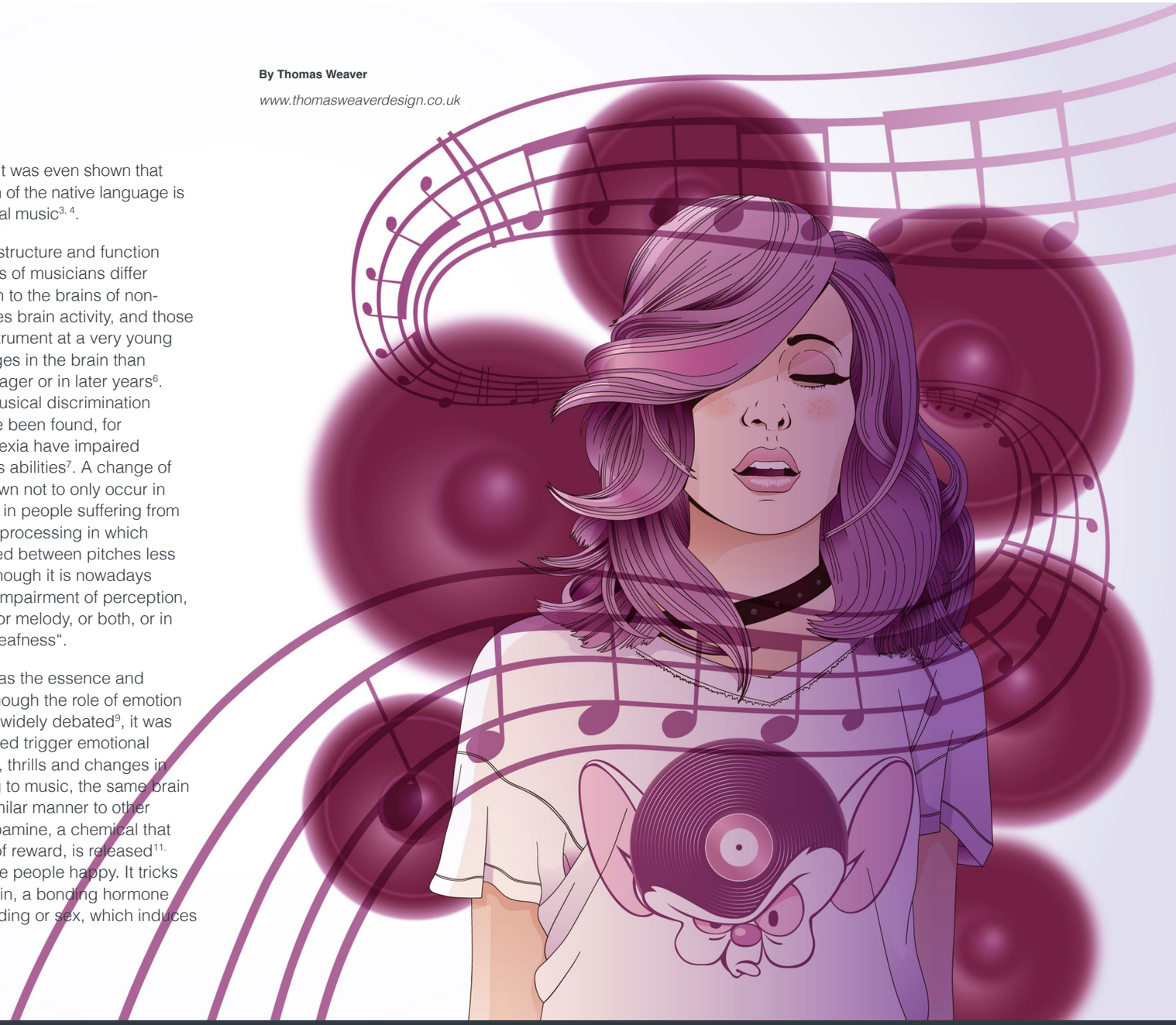

Undoubtedly, music has a great significance in our lives and as John Miles put it in his ode to music “Music was my first love and it will be my last, music of the future and music of the past”, no one can imagine a world and life without music.

The field of neuroscience of music has only recently started to flourish and due to the advancement of brain scanning methods, research in processing music will provide us with a better understanding about cognitive abilities, from auditory to motor processing and speech. It will also bring us more insight about developmental disabilities such as autism. And it may answer the maybe the most intriguing question, why have we evolved music and a musical brain? Although scientists argue that music has no purpose in an evolutionary context and had no adaptive value for our survival, it certainly has an uncannily important value for our wellbeing and society, now as much as in the past, as well as in the future.

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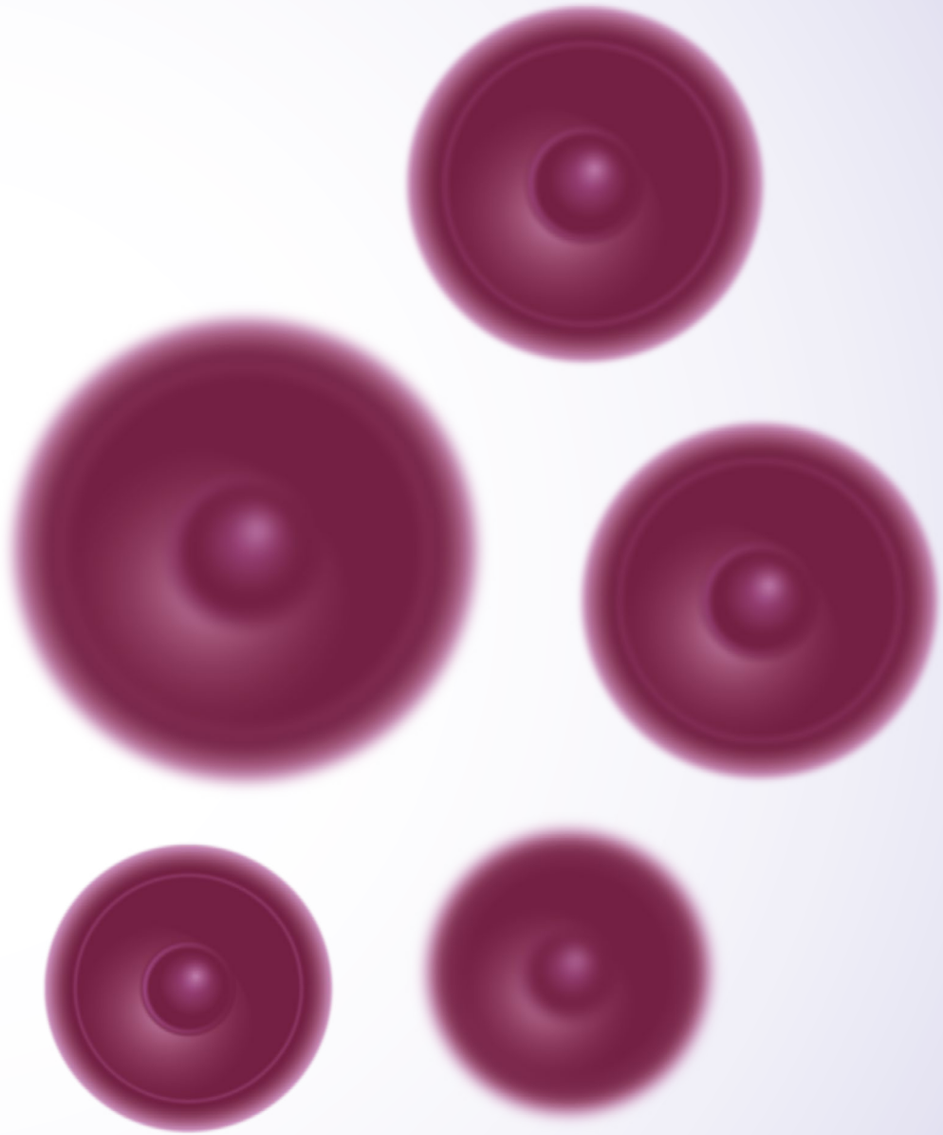

A NEW ERA FOR PHARMING

By Laura Dixon - http://www.lauradixon.me.uk/

Scientists in London are using plants as factories for the production of novel, pharmaceutically useful molecules. Plants harness energy from sunlight and convert it into sugars, a process essential to our life on Earth. These sugars, and the many other molecules plants make; we eat or feed to livestock. Plants also naturally produce a number of medicinal molecules, such as aspirin. Therefore, we have long been aware that plants are capable of producing complex and useful molecules in large quantities and we have exploited this, predominately through farming.

Work in a number of laboratory's, including Professor Julian Ma's at St. Georges Hospital in London utilises the power of plants to make molecules[1]. But these are molecules not naturally produced by plants. Plants can be engineered to express proteins from other species which are then called recombinant proteins, and they include proteins such as human antibodies which are required for vaccination. In particular, Professor Ma's group use plants to produce an antibody against HIV, the virus that leads to AIDS. Just as we farm plants for molecules to eat they can now farm plants for specific pharmaceutical molecules, this technique has been termed "pharming".

Plants offer a number of advantages over other systems used to produce recombinant proteins. Traditionally bacteria and yeast cells have been used but these both require very sterile conditions for growth, which are expensive to maintain, and the quantities are limited. Also mammalian cell lines have been used, but again growth conditions have to be closely regulated and contamination can cause the loss of a huge quantity of cells and as such the final product. Plants on the other hand, are grown in greenhouses and the end product is of extremely high quality – better than any of the other systems. The development of this technology offers huge potential, the efficient and reliable production of recombinant proteins, which can then be used to treat and prevent diseases. The work in Professor Ma's group focuses on diseases most prevalent in developing countries including HIV, tuberculosis and rabies. So far they have developed and refined the expression of antibodies in plants[2]. They also work on the characterisation of the pharmacological candidates for testing in human trials.

As the technology developed in Professor Ma's laboratory uses genetic modification they have been careful to use plants that will not enter the food chain. The ideal plant produces a large amount of seeds, which are packed with protein, in the case of Professor Ma's plants recombinant proteins such as antibodies against HIV. Currently they are using tobacco plants as a lot is known about farming them, which can be utilised for biological pharming. Whilst this technology is still in its trial stages, data so far has shown it has huge potential in the production of large quantities of high quality recombinant proteins. Pharming may indeed be the way forward.

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By Vanna Barber
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OUT OF THE DARKNESS

By Kirsty Oswald - twitter.com/kirstyoswald

In May this year, researchers announced that they had implanted two blind British patients with retinal prostheses, giving them vision for the first time in decades[1]. What is this new technology and how has science fiction come so close to fact?

Scientists have attempted to restore sight to the blind for centuries. However, it was only in the 1990s that the technology really began to take shape[2,3]. Now, there are at least 15 research groups around the world working on retinal prostheses[4].

Two conditions - retinitis pigmentosa and age-related macular degeneration - account for most blindness in the western world[3]. They both affect the retina – the part at the back of the eye that absorbs light.

The retina makes an excellent target for a prosthetic implant because when just the outer layers are damaged, the nerves that process and carry the signals from the eye to the brain are still there and still work[5].

The job of the implant is to recreate the pulses that light usually generates in the retina[2,3] sending electrical impulses shooting down the optic nerve and into the visual cortex. And the result – vision. Just as Chris James experienced[1].

“As soon as I had this flash in my eye, this confirmed that my optic nerves are functioning properly, which is a really promising sign,” Chris said. “It was like someone taking a photo with a flashbulb, a pulsating light, I recognised it instantly.”

This description may sound disappointing after headlines like “Blind man can see again” but the technology is still in early, yet promising, days.

What’s more, researchers have found that the longer patients wear the device for, the better their vision becomes. They can start to make out shapes and outlines as the brain adapts to make sense of this new information[1].

“There are grounds to be cautiously optimistic and there is every reason to believe we are on the path to achieve this goal,” says researcher, Lofti Merabet of Harvard University[5].

The particular project that the British patients are involved in is by German company Retinal Implant AG and uses just one of several potential ways to target the retina.

Other devices in development differ in several features for example, where the implant sits (on the retina or within it); how much equipment sits outside the body (most need an external power supply, some need glasses); and what number of electrodes stimulates the retina (this dictates the resolution)[5].

But what will it take for this technology to go from science’s vision to patients’ vision?

Firstly, studies will be needed to make sure that the prostheses are safe in the long-term and don’t do further damage to the retina. From a technical point of view, many of the devices in development have a limited number of electrodes. Increasing the number will give patients better resolution and more useful vision. Researchers will also need to learn more about how blindness and, equally, restoring sight change the brain[5].

This research has a long way to go, but for now there is light where before there was only darkness.

By Jac Scott

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THE MULTIPLE REALITIES OF AUGMENTED REALITY

By Anna Chatzimichali - twitter.com/basicideas

Augmented Reality is an emerging technology, merging 3D visuals into the real world. New gaming platforms can bring popular games like Tetris on your carpet or your kitchen table. Maybe you already tried the Layar App on your cell phone or stumbled upon an advertisement using Augmented Reality, like the viral marketing campaign last year that created angels appearing in the middle of the London Victoria train station. The truth is that this technology definitely captures peoples' attention. Just like anything new and flashy.

But is there anything else there beyond marketing gimmicks or gaming?

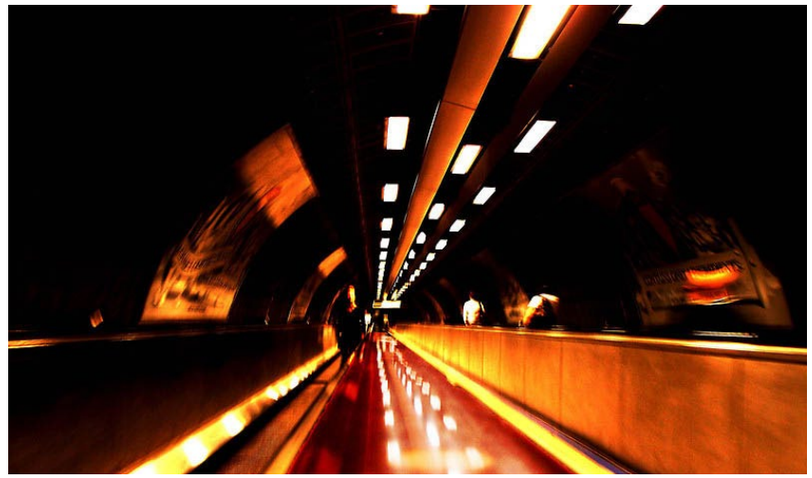
We perceive the world directly through our senses; through Augmented Reality the world is augmented with virtual information that is not there, but only experienced through vision. And in some case by smell too. Tokyo University developed an Augmented Reality headset combined with a smell spray device. That way you can have the same Augmented Reality cookie (or Meta-cookie as it is called), changing flavours and colours in every bite using the different smell[1]. In practice this technology reinforces dietary programs, especially for hospitalised patients by making bland food appear tastier, as the creator declared[2].

A more cultural promise of this technology is the application on heritage sites. Here Augmented Reality can be used to reconstruct historical cultural heritage monuments that can be visited and experienced by visitors[3]. Imagine for example visiting the ruins of an ancient temple, while having a full visual experience of its primary glory and learn more for ancient architecture.

And if you got tired of wandering around, why not stay in and "edutain" (educate and entertain) yourself with an Augmented Reality book. The first pop-up Augmented Reality book was introduced last year for the iPad titled "Whose afraid of bugs' [4]. In this book you discover virtual bugs that can interact with you, which according to recent psychotherapy studies can also serve as a treatment of phobias such as arachnophobia (fear of insects)[5] by helping you overcome your fear in a safe environment.

Of course, what the future holds is not limited in portable screens or head mounted devices, not even in electronic glasses. Researchers are working to the development of electronic contact lenses, offering the ability to superimpose a transparent high-resolution display over the field of natural vision of the eye[6]. Earlier this year, Google released a video about an exploratory project named Project Glass[7] challenging us to imagine a world with such technology that can help us to explore and share by bringing us information directly from every aspect of life.

But before you get over excited about Augmented Reality you need to consider that a lot of these ideas came into existence during the early 90's, and those that drive current and near-future developments are already about twenty years old. So please be patient, there is plenty of time to decide is which reality you want to live in!



By Daryl Rhys Jones

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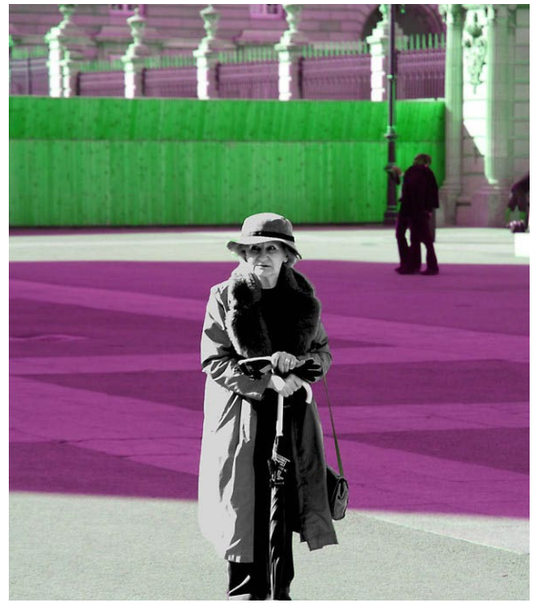

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ULTRA-VIOLET VISION: MORE THAN MEETS THE EYE!

By Katie Tomlinson - www.biofizz.wordpress.com

Somewhere over the rainbow, just past our visible spectrum lies the hidden world of ultra violet light. UV light has very short wavelengths between 10nm – 400 nm. A massive range of insects, birds, fish, reptiles, plants and animals have evolved to use UV light to find meals, attract mates and communicate safely out of sight from predators (and us!). But now, kitted out with UV goggles and high definition cameras, we're getting a closer look at the action.

Insects like the Sara Longwing butterfly are able to see wavelengths of light as short as 310nm. This 'sixth sense' allows pollinating insects to spot hidden UV markings on flowers. Take the aptly named plant Black-eyed Susan, which has UV absorbing pigments called flavonoids in the centre of its flowers. Although invisible to us, insects find these UV pigments totally irresistible. They act like dark bull's eye targets, guiding towards delicious nectar food. And of course, plants also get something out of this meal deal: pollination!

Rafflesia plants are slightly more sinister and use UV markings to coax insects into their gaping mouth-like flowers. Once the insects land, the flower's slippery surface causes the insects to fall and drown in the plant's digestive juices. And equally deceptively, some crab spiders use UV decorations to trick honeybees into their deadly webs.

Scorpions are slightly more conspicuous … they glow in the dark! Scorpions naturally like hideaway from nighttime predators by keeping in the shade. Even the faint glow of the moon and stars could give their game away. Spookily, scorpions' bodies are coated in a pigment, which converts UV light into a bright cyan-green florescence. Researchers now think this glow is picked up by the scorpion's own sensitive eyes, raising the alarm and allowing the scorpion to run for shade before they become bird food.

In the underwater world of the coral reef, fish are also raving about UV. The Ambon damselfish uses UV patterns to recognise the faces of invading fish, which compete for food and mates. Their bigger predator, the coral trout lacks UV vision, keeping the damselfish's golden camouflage hidden from view. But other fish find UV markings sexier and like the northern swordtail fish, who use them to attract the ladies.

Back on land, birds find UV pretty fit too. The robin's red breast and the blue tit's crest appear as bright UV beacons to females and definitely earn a few extra man points. Common Kestrals even use UV vision to pick up the trails of their prey, which feed on berries rich in UV pigments.

Finally, most large mammals (including us) have sensitive retinas, which are protected by UV proof corneas and lenses. But bizarrely, last year scientist Glen Jeffery and his team at UCL made a pretty 'cool' discovery: Reindeer can see UV! Reindeer feed off lichen and are hunted by wolves, which both absorb UV light, appearing dark and easily visible against the snowy white background.

Current research like this is shedding new light on a hidden UV world and with so much action going on right under our noses, there's definitely more than meets the eye!

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http://jeb.biologists.org/content/214/12/2014

By Caroline Grainger

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THE OVERSPILL OF DOMESTIC VIOLENCE

By Alison Gregory - twitter.com/AlisonGregory73

Domestic violence is experienced by 1 in 4 British women in their lifetime[1], and has profound physical and mental health consequences. Many women who experience abuse in relationships will discuss their situation with adult relatives or friends[2], and this social support has the potential to buffer against effects on health, and protect against future abuse[3-5]. There has, however, been a notable lack of consideration given to the consequences for the health and wellbeing of this supportive network – we simply don't know what the toll on the friends and family members is.

For this reason, a systematic literature review was carried out to capture and synthesise what little research exists on this topic. Since inclusivity was crucial, few restriction criteria were built-in and attempts made to find unpublished material. Following screening and lengthy analysis five key themes emerged.

The majority of impacts mentioned in the articles, perhaps unsurprisingly, were effects on psychological wellbeing that were both acute – where a particular incident had happened and the family member or friend experienced shock, trauma and fear as a result – and chronic – such as longer term feelings of anger, depression, guilt, powerlessness, frustration, worry and loss.

Counter-intuitively, almost half of the articles also described the beneficial impacts on psychological wellbeing of finding oneself in this position, including: increased self-esteem, self-revelation, acknowledgement of inner strength and validation of progress. Looking deeper, many of the situations where constructive effects were mentioned, involved friends or family members who were themselves survivors, who had gone on to provide support, and had experienced being able to offer assistance as an indication of the growth they'd made in their own lives.

Physical health implications for family and friends were rarely mentioned in the research found, except in 3 specific contexts: for family members post-femicide (when the abuse has resulted in the death of the woman) where they subsequently took on childcare roles, for family members or work colleagues who had witnessed abusive episodes, and for members of the support network where exhaustion was tied in with a sense of frustration in the long-term support of a survivor who remained in an abusive relationship.

The idea that perpetration would impact directly on those surrounding the survivor did not come as a surprise, however the extent of the perpetration described in several cases did. The portrayed abuse against friends, family and co-workers not only included physical violence, threats and harassment from the main perpetrator, but also in some cases from the perpetrator's network.

It is debateable whether the practical implications for friends and family members, such as providing childcare, finance and accommodation, fall under the remit of 'health and wellbeing', however information reported by the studies interweaves these disruptions of daily life with the negative health and wellbeing outcomes, and in some cases seems to suggest causal effects.

Clearly there are strong indications that friends, family members and co-workers are impacted both directly and vicariously by domestic violence, and consequently services need to be developed to support these people.

By Nima Javadi
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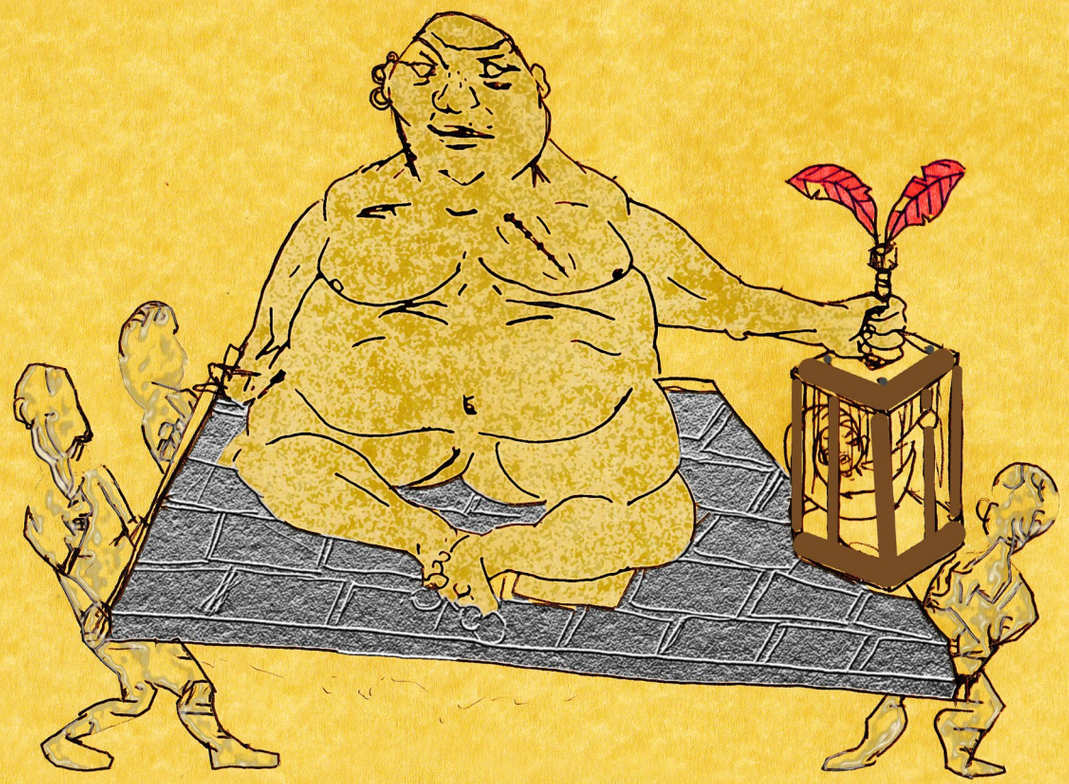

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MAD COW DISEASE- A TICKING TIME-BOMB?

By Daryl Rhys Jones - twitter.com/darylrhysjones

If you Google “mad cow disease” you will find a plethora of crazy cartoonish cows and terrible tongue-in-cheek humour. However mad cow disease, or bovine spongiform encephalopathy (BSE) is no joking matter, especially considering that the majority of Ionic Magazine readers (yes, you) might have been exposed to the infectious agent. BSE belongs to a group of fatal neurodegenerative disorders called prion diseases, made infamous following the outbreak of BSE and its subsequent transmission to humans as variant Creutzveldt-Jakob disease (vCJD) in the 1990s. This type of prion disease presents clinically with dementia, hallucinations, and finally blindness with the inability to speak or move. These devastating symptoms are largely due to the death of neurons and the typical sponge-like vacuoles that appear in the brains of those affected. And, as mentioned earlier, death is certain.

Although the UK has suffered the highest number of vCJD deaths, the effect was global with cases arising as far as USA, Canada and Japan. At the height of the BSE epidemic in 1992, 900,000 contaminated carcasses are believed to have passed through the food chain that year alone[1]. So ask yourself ‘how many burgers can a single infected cow produce, and how many McDonald’s did I eat in 1992’?

In 2011, 59 Britons were notified of being “at risk” of contracting CJD after undergoing surgery with the same surgical instruments that were previously used on two patients later found to be carrying the genetic form of CJD[2]. Indeed there is a need to drastically improve disinfection techniques, as infectious prions cannot be destroyed easily.

To date, just 176 UK individuals have died of vCJD; clearly there is a large discrepancy between predicted exposure and clinical disease. But why? In fact prion diseases have a remarkably long incubation period. Kuru, a prion disease that arose among the Fore People of Papua New Guinea, due to the consumption of deceased relatives, has variable incubation periods, which often exceed 50 years. Individuals silently incubating vCJD pose a risk to the general public through blood donations for example. Professor John Collinge, one of the world’s leading experts in prion diseases, is famed for suggesting that 1 in 1000 Britons is currently incubating vCJD. If this estimate stands firm the future of Britain’s people is bleak; a second wave could kill as many as 60,000 of us. Fortunately such estimates rarely stand the test of time. But what’s being done, just in case mad cow disease is a ticking time-bomb?

Currently immunotherapy is the forerunner of prion therapeutics. In 2003, prion-attacking antibodies were shown to cure mice with peripheral prion infection. However, if the infection was allowed to reach the brain before treatment was started, the mice were not cured[3]. This is because the antibodies could not cross the blood-brain barrier and were prevented from entering the brain due to their large size. However in 2010 a new and much smaller prion-attacking antibody was extracted from the blood of camels and successfully entered the brain[4]. Only time will tell if these antibodies may be effective in curing prion disease both peripherally and centrally. Until then, ***Keep Calm and Carry On....*** waiting.

“HEY DAISY, DID YOU HEAR ABOUT MAD COW DISEASE?

YEA, GOOD THING I’M A HELICOPTER!”

By Victoria Last

www.facebook.com/VictoriaLastArt

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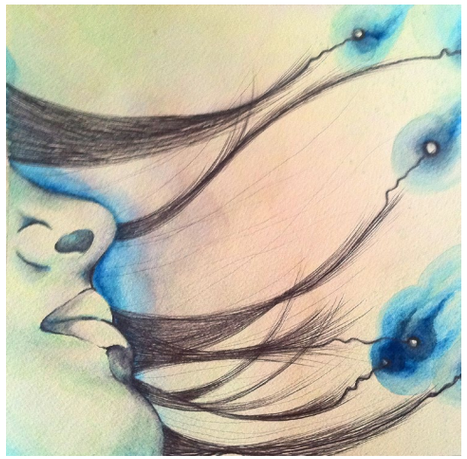

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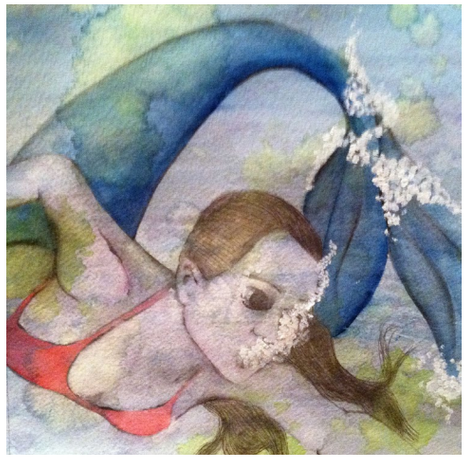

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