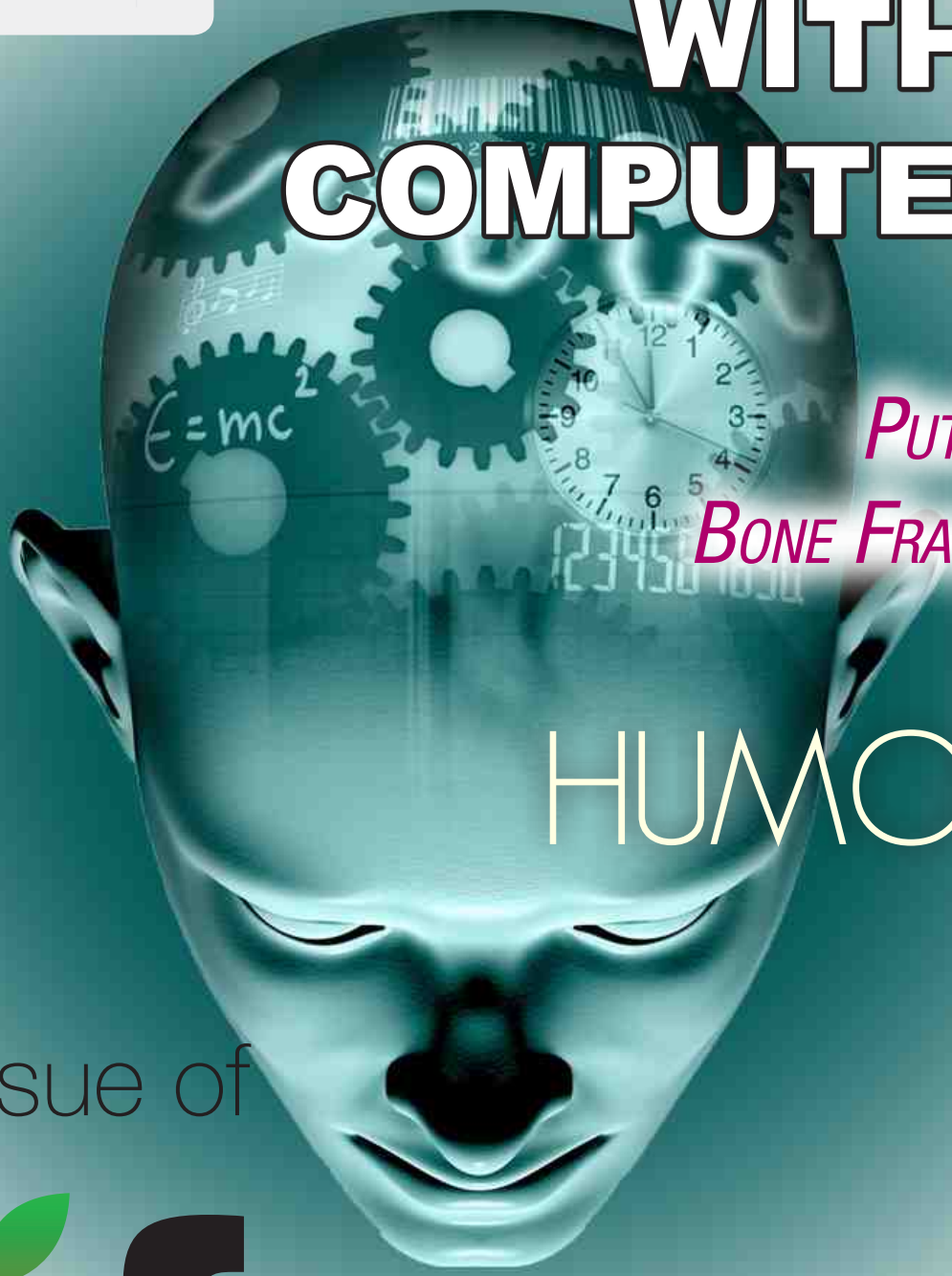
Inside this Issue of *Life.*

CAN WE MANIPULATE OUR BRAINS WITH A COMPUTER?



Putty for Bone Fractures

HUMOUR

14th Issue of

Life.

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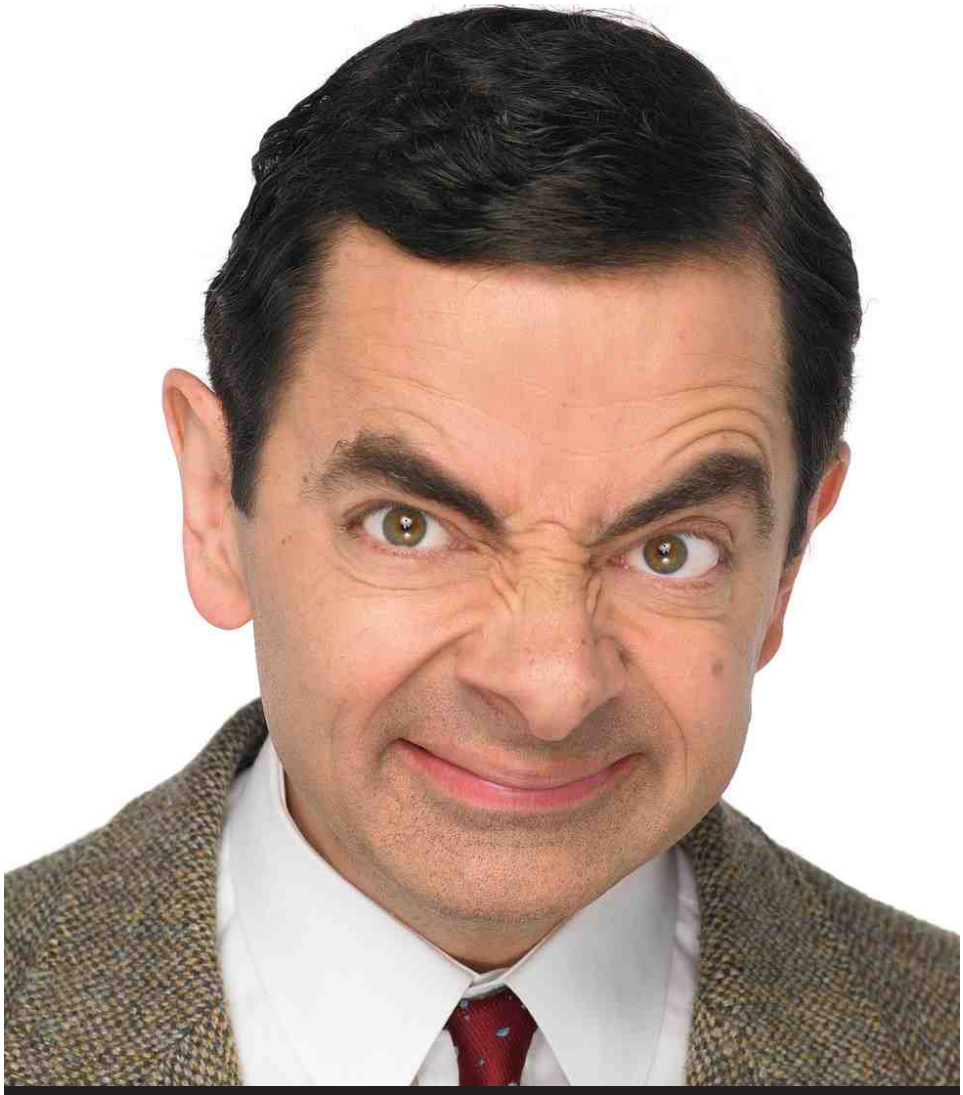
The Sutton Grammar School Biology Magazine

HUMOUR WHAT IS IT AND WHERE DOES IT COME FROM?



Rowan Atkinson, a prominent figure in English comedy

Humour is a very common part of our society. A large proportion of all TV programmes, radio programmes and films are comedic, and much of everyday conversation is spent sharing jokes and anecdotes with others. But what actually is humour?

Try to define humour and the only definition you are likely to come up with is "when something is funny". It sounds very simple but is the only definition that anyone, including the dictionary, can think of. Something is either humorous or not humorous. Or is that really the case? Is there a biological explanation for humour?

Rowan Atkinson once said that an object or person can be made funny by behaving in an unusual way, being in an unusual place or being the wrong size. While it is certainly true that things can be made funny in this way, these rules are by no means foolproof. A person behaving in an unusual way is not always funny. There are also many other theories which try to explain humour. A common theory is of superiority, with humour an expression of pleasure resulting from feeling superior to someone. An obvious example of this is laughing at someone who is fat or ugly because you feel superior to them. However, a main flaw in this argument is that not all humour mocks someone else. Puns do not have to involve the misfortune of others.

Also, even when someone is mocked it is not necessarily humorous; people often feel remorse after insulting others. Another theory is that something is humorous when a situation is incongruous with (different to) normal behaviour, with laughter coming as a result of recognising this incongruity. This links to Rowan Atkinson's ideas, and again has some flaws. As before, not every situation which is incongruous to real life is humorous, and much of stand up comedy (Michael Macintyre for example) is simply talking about

common things in real life rather than making jokes which differ to it. A third theory is the Benign Violation Theory, which says that something is humorous when it threatens your view of how the world should be but you simultaneously recognise that the threat is benign. This theory is similar to the incongruity theory, meaning that it has the same flaws: sometimes humorous things are in line with how we feel the world should be and that not everything which fits these criteria will be funny.

The obvious conclusion to make from these is that there is no one rule which governs when something is funny or not, which might explain why so many attempts at jokes are not funny. No one theory on its own will explain what humour is. Different theories could be applied together to form one overarching theory stating that something is humorous if it fulfils any of these criteria, but there will always be exceptions to the rules. Just because something fits the criteria does not make it funny. Some jokes will continue to be deemed in bad taste and not humorous and some jokes will continue to be unfunny even though they fit the criteria. Ultimately, the only conclusion that can be made is that it is impossible to completely explain humour. Something is either funny or not funny, and that's what we're stuck with, at least for the moment.

Aside from wondering what humour is, another question is where has humour come from. Those with religious beliefs may argue that humour is one of God's gifts to mankind to allow us to enjoy ourselves; others will inevitably turn to evolution and natural selection to explain the existence of humour. However, on the face of it it is difficult to see how humour could have developed through natural selection; how can humour be an advantageous characteristic? It does not seem to hold any survival value. It could even be viewed as disadvantageous, causing humans to spend time enjoying themselves rather than working and become less efficient. It does not seem likely that this trait would have helped men in the past to hunt for food and defend themselves from hostile animals and tribes.

Evolutionary psychologist Geoffrey Miller agrees that a sense of humour does not hold survival value and instead argues that it may have evolved by sexual selection, whereby a species evolves due to an animal with certain attributes seeming more attractive to the opposite sex or more intimidating to the same sex, allowing it to reproduce more and over time causing all members of the species to share the same attributes. Perhaps, like now, a sense of humour may have been attractive in the past and caused all of humanity to evolve to develop one. Miller also reasons that humour is an indicator of other characteristics which are of survival value, such as intelligence.

However, more recent theories argue that a sense of humour is of survival value to humans. It has been suggested that humour is important because it increases the brain's ability to identify mistaken reasoning and allows people to be better at problem solving, something which would have been very valuable to early humans in terms of survival by allowing them to determine how to survive a threat or capture prey. This argument would allow humour to have evolved by natural selection.

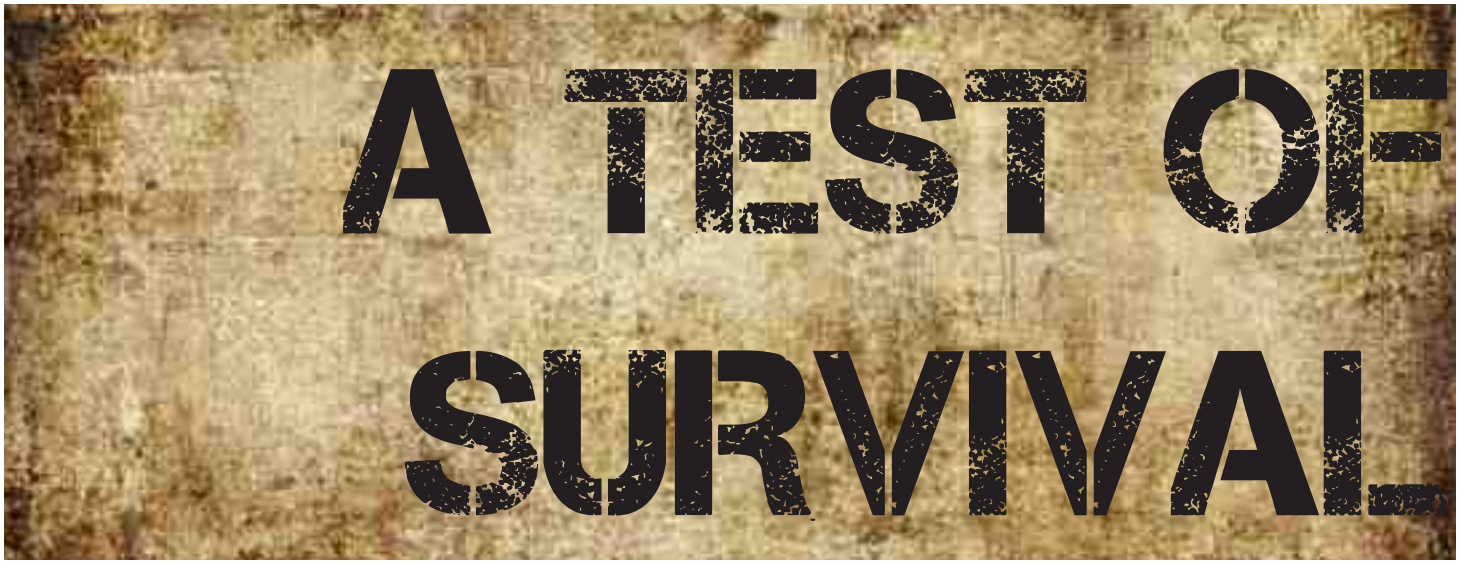
These theories certainly could explain the origins of humour and fit in with existing ideas about Darwinian evolution. But whether it was by natural or sexual selection or a combination of the two, or something different entirely for that matter, is still impossible to determine.

All we can really decide about humour is that it does not seem to have a set of rules and cannot be explained, yet anyway. ■

Matt Grayling

DID YOU KNOW?

In groups, women laugh more than men. Women also laugh more at men, more than men laugh at women.



IT is true that humans have been able to live in the harshest conditions and that we have made it possible to live in the most remote regions of the planet. This is because of our big brains and our ability to think and adapt.

Plants, on the other hand, have no brain yet they exist with greater numbers than us. All they need to survive is sunlight, water, carbon dioxide and certain trace elements from the soil. The world is covered in plants of many different types and with many different adaptations.

To understand how this has happened, we must look at the basis of all life as we know it. At the centre of all of our cells is DNA. It contains our genetic information for the cell. It is the molecule that encodes all of the proteins in our body. The proteins are created when RNA (ribonucleic acid) reads the information off the DNA. The RNA encodes the proteins based on what it has read off the DNA.

A good example of this is a cook book. It contains lots of information and it has many recipes. The product of the recipe is the protein and we read the ingredients and how to put them together. This is like how the RNA reads the amino acids needed and how they are to be put together to make the protein.

This is the case in humans and plants but plant DNA has changed over time significantly more than human DNA. This is because modern humans (Homo sapiens) have been on earth only 200,000 years. This is a tiny fraction of the age of the earth. Plants have been on earth for an estimated 540 million years. They evolved from a species of multi-cellular green algae.

This shows that plants have had more time to adapt to the world. They have been on earth about 2700 times as long as Homosapiens have existed. This explains why within the plant kingdom, there is far more biodiversity. Another reason for this is that some plants reproduce every year. Humans do not have children every year. Some of the poorer nations have very high birth rates but this is because of a very high infant mortality rate meaning only some of these children will survive through to adulthood and pass on their genes to offspring.

Plants produce asexually; this means the offspring is genetically identical. We reproduce sexually meaning that some genes are passed on from each parent. This results in a completely different child. Most of the DNA will be the same but some genes will not be, meaning the offspring looks different.

In organisms, the DNA can mutate, leading to genetical changes. These mutations are the cause of cancer but on a brighter note, they are the cause of evolution.

Charles Darwin introduced the concept of evolution. The idea of survival of the fittest is what we all accept now as the reason for natural extinction and the emergence of new species. If a species inherits a genetic mutation and the mutation is beneficial to its way of life, this new organism will thrive and produce more offspring with this mutation.

Reproduction in plants involves the DNA being copied to the new cell. If the DNA is copied wrong, a mutation will occur. This can also happen in the process of mitosis in humans as well as plants.

In my opinion, plants can adapt faster to changes in the environment than humans because these mutations take place more often in plants. This is because the plant reproduction cycle can be once a year, while the human reproduction cycle is less frequent.

Another piece of evidence for more evolution in plants than humans is the packing of DNA within the nucleus. In human cells, we have 46 chromosomes. If the entire DNA in our cell was to be laid out end to end, it would measure about 2 metres considering each chromosome is about 5 centimetres long. It is amazing to think that this length of molecules could fit inside a structure as tiny as the nucleus. The average diameter of an animal nucleus is 6 micrometres.

Some plants have fewer

chromosomes, showing they can survive with fewer instructions but the adders tongue fern plant has the highest known chromosome number in the world. It can have up to 1260 chromosomes in one cell.

Adaptations in plants and animals are caused by mutations in DNA. Plants have a very wide range of adaptations. If there is a shortage of water, some trees will drop their leaves to minimize water loss. This is not a conscious decision because plants have no brains. This is a natural reaction; the plant has not enough water so the DNA makes a protein that makes the leaves drop. If we are thirsty, we will decide to have a drink of water. It is amazing to think that plants can solve their problems automatically when we need to make a decision to solve most of our problems.

An example of a well adapted plant is a cactus. The Sonoran and Mojave deserts in western America are inhabited by very well adapted plants like cacti:

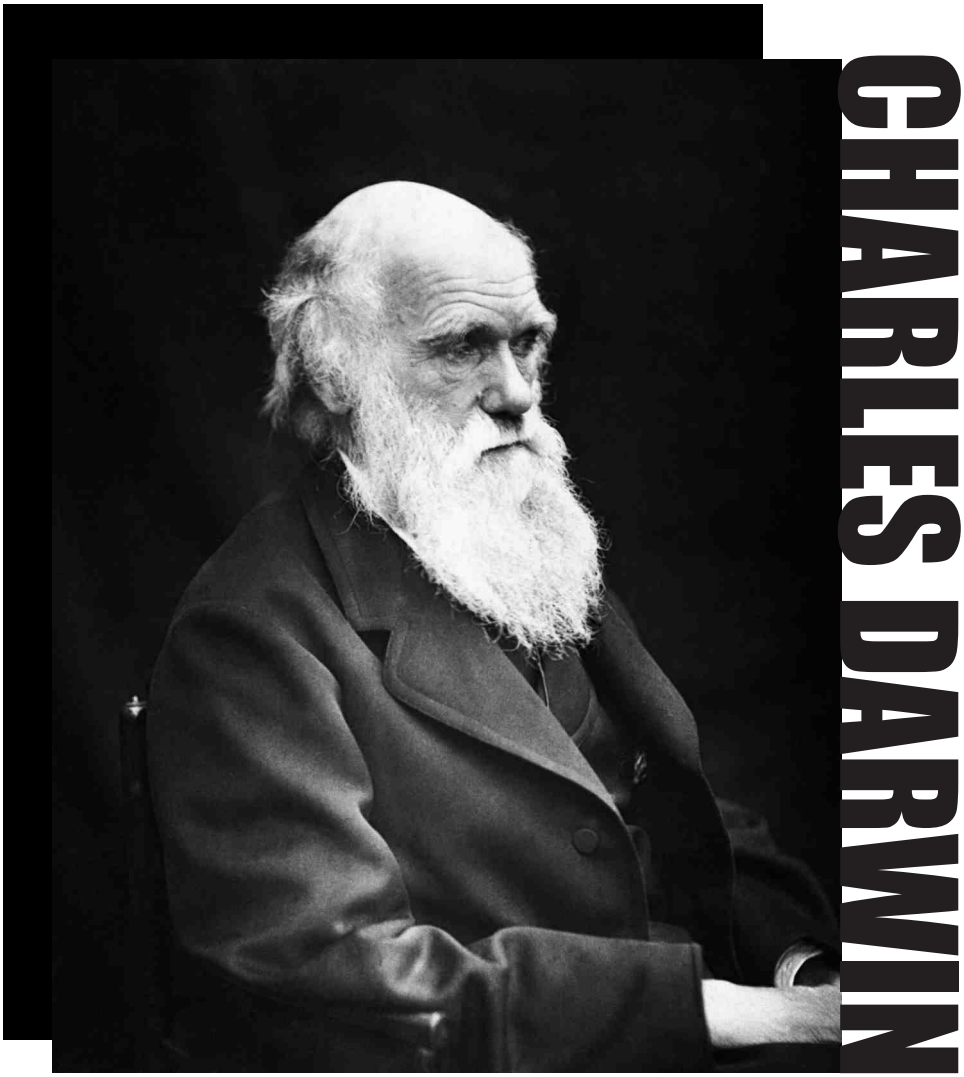
These strange looking plants have many adaptations for instance they are covered in very sharp spines. This protects them against predators. The spines can also catch water in the rare occasion that it rains. Cacti also have a very low transpiration rate - they don't lose much water. Some cacti have a corrugated shape meaning they can store huge amounts of water. A fully grown saguaro cactus can store around 3000 litres in 10 days. They also have the capability to grow new roots very quickly. This high growth rate means they can remain dormant throughout times of severe drought and they can grow very quickly when there is lots of water available. This characteristic is shared by the seed. There is a very large flower to attract insects and the seed can lie dormant in the soil for years until there is enough water to grow.

Plants have spread out across the desert without any technology of any sort apart from the ingenious adaptations they have evolved throughout the years. In the Mojave Desert is a city called Las Vegas. For humans to have survived out here in the desert, they have needed huge irrigation systems and very large amounts of imported food. This costs vast amounts of money.

It shows that we are dependent on what we make. We have become dependent on our feats of engineering and our technology to survive. Plants, on the other hand, are self sufficient. They have their own method to create food; they absorb all they need from the air and the soil. They can survive almost anywhere on the planet from the coldest tundra and the hottest desert to the bottom of the ocean. Not only do plants survive the harshest conditions, they bring life to the world. They form the basis of our food chains and they provide us with oxygen and nutrition.

The existence and biodiversity of plants is the reason for the existence of so many of the organisms today including us. ■

Ollie Blagg



CHARLES DARWIN

cover story

NEURAL INTERFACI

A neural interface is a direct connection between the brain and another device such as a computer. The idea of using the mind alone to control computers and machinery is a popular science fiction topic, and lots of ideas as to how it could be used in future have been suggested. However, the technology itself actually exists today: headsets that can be bought for as little as £200 are able to detect the brain activity of the wearer and send this data to a computer program that recognises specific thought patterns and performs different commands according to the thought pattern detected. For example, thinking about solving maths problems will cause the program to perform a certain function, while exercising a different part of your brain will cause the program to perform a different function.

The technology has already been used for many different purposes. For example, Toyota have made a wheelchair (see picture) that can be driven by thoughts alone – there is no need for the user to move any muscles at all, and so the concept could be useful for people suffering from paralysis. Video games controlled by thoughts, not buttons, have also been created (there is actually a world record for the highest score on a mind controlled Space Invaders arcade game) and a thinking cap that changes colour in response to the wearers emotions has also been developed.

Unfortunately, the technology does not yet have many practical uses, because it is very difficult to use neural interfaces at the moment. The user needs to be able to concentrate very hard and think of nothing else but the one thought that triggers the desired reaction (to get an idea of how difficult this is, try to think about nothing but the sensation of stroking a cat, for example. It is difficult to do this without getting distracted or thinking about something else). However, new developments with the technology are still being made so it will gradually improve over time. In future, bionic replacement limbs for disabled people may be controlled by the nerve impulses of the user. It may be possible for vehicles or machines to be controlled by nerve impulses too, effectively making the machine part of the operator.

Toyota's mind controlled wheelchair

Neural interfaces with computers can work both ways too – scientists have been able to stimulate and control a mouse's brain activity by shining pulses of light onto genetically modified light sensitive neurones in the mouse's brain. Using similar methods, it might be possible one day to download information from the internet directly into our brains. One of the ultimate goals of this technology is to be able to upload a human consciousness into a computer, although scientists are not sure whether this will ever be possible. The ability for our brains to interface with computers certainly has a lot of benefits, but could it also be dangerous? If we were all connected to a computer, could our brains become infected with a computer virus? Could our memories be erased (or new ones implanted) or could we be programmed to do things against our will? Could it be possible for our thoughts, opinions and personalities to be manipulated as easily as the files on a computer? The simple answer to questions like this is that we cannot really be sure about how much control we will have over computers and vice versa – only time will tell how we will use this powerful technology. ■

Gregory Brooks

Addiction to Recreational Drugs

What is an addiction?

An addiction is where you depend on a substance or behaviour. An addiction, depending on the seriousness, can ruin school grades, relationships with friends and family. The word addiction actually derives from Latin, in which it means 'enslaved by' or 'bound to'. It used to be thought that only strong drugs and alcohol could cause addiction, when in fact loads of things can, for example gambling or shopping.

What is an addiction to drugs?

An addiction to drugs is when someone physically relies on taking drugs and if they don't, then they feel like they absolutely must take the drug to survive. They also sometimes believe quenching their thirst for whatever they're addicted to, emotionally uplifts them and they feel happy. Out of 23 million Americans, almost 1 in 10 have an addiction to drugs or alcohol.

What are drugs?

A drug is a substance that if eaten, inhaled or introduced into the body in any way, has a physiological effect on the user. Many people say that the drug Marijuana is harmless and is good for you. Say Marijuana has 10 positives; it would have 20 negatives. It is smoked so it makes respiration harder for the body.

1. When smoked, carbon monoxide goes into your blood and takes up the spaces in the Haemoglobin which carry oxygen round the blood. So it leaves you with less oxygen overall, which is why smokers run out of breath quickly during exercise
2. The smoke contains Carcinogens which make it more likely for the smoker to get cancer.

Some smokers of cigarettes and drugs manage to smoke them with no acute problems, but a lot do and die. Before taking drugs, you have to think about whether you wish to take that risk.

Who's at risk?

Anyone is at risk of an addiction but the people at most risk are: people who genetically are easily addicted to objects or activities, people who were brought up around families or peers with addictions or a person's current peer group or situation. Genetics contribute, on average, 40% to the likelihood that a person will become an alcoholic or drug addict. Many cases of drug abuse will happen during the teenage period, where teenagers strive to find something to do that makes them different. So they resort to drugs in some cases to prove themselves an individual. One of the biggest risks about taking drugs is that some people react very differently to the drug. So for one person, taking cocaine could be a very enjoyable experience but for another person, it could result in a fatality.

Could Marijuana be the cause of getting addicted to crack/cocaine and heroine?

Marijuana, being one of the least addictive drugs, still could be a 'gateway' as such, to the use of crack cocaine and heroine.

There has been a 12 year study at The University Of Pittsburgh which shows that Marijuana is what could be considered a gateway drug - a drug which leads you to take others.

Overall, drugs are no use taking. They may have a few minutes of pleasure, but becoming addicted to them makes it very likely that they will ruin your life in the long run. ■

Matthew Ward

PUTTY FOR BONE FRACTURES

Innovative 'putty' could significantly reduce time taken for bone fracture to heal

When you break a bone, the time it takes to heal is a lengthy process (usually about six weeks). However, scientists from the University of Georgia Regenerative Bioscience Centre have now created a 'putty' that can dramatically reduce the time it takes for a bone to heal.

Adult stem cells have been used to create a protein that helps bones heal. Stem cells, like normal cells, display a characteristic set of protein molecules on their cell surface that are referred to as markers. Using fluorescently tagged antibodies that attach to these markers, an instrument called a fluorescence activated cell sorter (FACS) can separate and isolate these markers (proteins). These markers are then extracted to recover the protein. The protein is then incorporated into a gel to make the 'fracture putty'.

The family of proteins used are called Wnts (pronounced "wints") which regulate bone formation in vertebrates by sending signals between cells and also aids calcium absorption into the matrix of bones. Though, the practicality of injecting this protein into the body was an issue as Wnts does not fully dissolve in water. However, this has been overcome now by packaging the Wnt proteins in liposomes, which are artificially prepared vesicles.

With the help of a doctor from a College of Veterinary Medicine, the scientists working on the project inserted the 'putty' into the bone fractures of rats to observe the effects.

The yellow staining shows the regeneration phase of recovery where new bone tissue is being generated at a rat's fracture site, following treatment with the fracture 'putty'.

Within two weeks the scientists were able to observe that the rats were running around and standing on their hind legs with no sign of any injuries.

As a result, the researchers are now trialling the 'putty' on bigger animals such as sheep and pigs and so far have seen positive results. Between 2009 and 2011, the group received a grant of $1.4million from the U.S Department of Defence (DOD) for testing the putty in sheep. The DOD is seeking ways of revolutionising fracture treatment for injured soldiers to help soldiers get fit sooner and reduce the number of amputations due to complex fractures. Also, as the recovery time is potentially sped up, the mental health of soldiers is less of an issue as they are less likely to be confined to a bed for a long period of time.

However, the group of scientists are in competition with other researchers who are looking at polymers and engineering approaches like implants and replacements which may eventually be combined with the 'putty' to improve spinal fusion outcomes (a surgical process used to join two or more vertebrae). The 'putty' could be inserted between the bones to encourage bone growth and if this were to work, this would prevent the need for a graft. This would be very beneficial since grafts are usually taken from another part of the body meaning more incisions and stitches. Hopefully though, the fracture 'putty' would not only aid a speedy recovery but it would also allow areas that are difficult to treat to recover more easily. ■

Sean Canyon Sathiyajit

Editorial Life.

Life. biology magazine is under new management this year and its design has been changed. We hope the new design makes it easier and more entertaining to read.

Special thanks to pupils of Sutton Grammar School, who have committedly written very informative articles to be included in this issue of *Life*, especially those whose names frequently appear in the author section in past issues (Ollie Blagg comes to mind, so gave his article a special title as a small reward).

Also big thanks to Mr. Davis who set this up and gave us lots of support and guidance.

Visit http://www.sgsbiology.co.uk for past issues of *Life*. If you wish to become an author for *Life*, please get in touch with Mr. Davis, head of Biology, in person or email him at pdavis@suttonlea.org.

We hope you enjoy reading *Life*.

The Editorial Team, March 2012

> Knowledge is the food of the soul.
>
> *- Plato*