



# Stem Cells

*The miracle cure, or just another big hype?*

Stem cell research grew from the findings in the 1960s by two Canadian scientists, Ernest A. McCulloch and James E. Till; and in the last 40 years since its birth, stem cell scientists have promised miracle cures to almost every disease and glorified stem cells prophesising about the giant medical and scientific leap we will no doubt experience soon enough. But 40 years on and this has not even begun to happen, there is still a lot of controversy on stem cell research and we are still in confusion as to what they actually do.

Well, one of the reasons why stem cells remain so mysterious is that they we are constantly finding new aspects of stem cells, and our previous theories are constantly changing to adapt to its new characteristics.

In reality, cells have to comply with two rules to become stem cells:

*Self-renewal* - the ability to go through numerous cycles of cell division while maintaining the undifferentiated state.

*Unlimited potency* - the capacity to differentiate into any mature cell type. ( i.e. the ability to specialise into any of the 200+ specialised cells in our body when given specific signals.)

Essentially there are two types of stem cell, adult and embryonic. The origin of adult stem cells is unknown, however, they are found in some of the tissues and organs of the body, their primary role is to maintain and repair the tissue/organ in which they are

***“We are still in confusion as to what they actually do.”***

found; however recent research has shown that stem cells found in a specific area can actually differentiate to a number of different cell types. If the differentiation can be controlled in labs, it may be possible to use adult stem cells to treat many common serious diseases; in fact adult bone marrow stem cells have been used in transplants for the last 30 years.

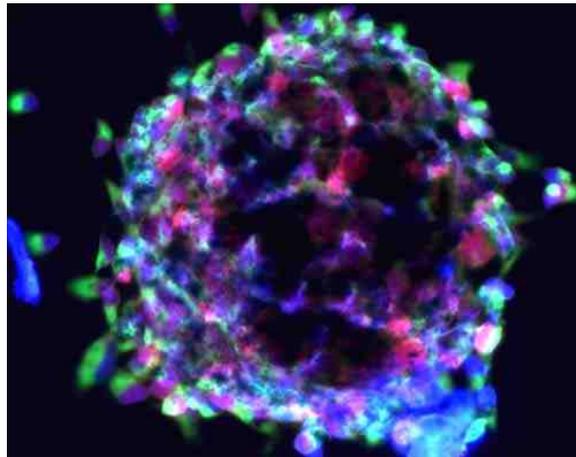
The embryonic stem cells found in a young embryo (approximately 4-5 days old) consists of approximately 150 cells. They are not removed from a fertilised egg in a womb, instead use embryos are used that are to be discarded from in-vitro fertilisation (in a fertilisation clinic). Despite the controversy over embryonic stem cells with regards to

to using possible humans, it is clear that the only embryos used are going to be destroyed anyway; and there are strict regulations to ensure that there are no money incentives for a patient to donate stem cells.

Embryonic stem cells are also regarded to be more valuable because of their ability to become any of the specialised cells in the body, when the right signals are produced; the process of turning unspecialised cells into specialised cells is extremely complex and unclear, however, scientists do know that it is to do with turning genes ‘on and off’. Therefore looking at how stem cells specialise and when, could help to treat genetic disorders, or treat diseases like cancers which are caused when replicating cell are mutated. Indeed embryonic stem cells are have been used to treat diseases such as cancers and genetic disorders due to cell mutations in abnormal cell division. However, a significant hurdle to pass is understanding how the signals are controlled, which

would then give a new insight into how the mutations occur and so possible methods of prevention and treatment.

However, with regard to cancer treatment, a startling new discovery shows that stem cells could be the true culprits of some cancers. Indeed the potential for stem cells to turn malignant is now thought to be the root of many cancers, which is startling and very worrying for cancer specialists. These rogue stem cells do not divide very rapidly like ordinary cancerous cells and so are not targeted by cancer treatment (such as chemotherapy) and so patients who had thought they were cured are not because of a pocket of malignant stem cells. *Continued on page 4*



Magnetically labelled neural stem cells.

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# The Broken Leg - Injuries from sport

## What is a broken leg?

A broken leg, or fracture, is a break or crack in one of the leg bones. In general there are two main types of fractures: open or closed. An open, or compound, fracture means that an end of the bone has broken through the skin. A closed fracture has not broken the skin. The type of break often depends on the cause. The break could be a simple break straight across the bone or it could be one of many other specific types of fractures.

## What are the symptoms?

- Pain, tenderness, swelling
- Limited range of motion
- Pain made worse by movement
- Grating of bone ends
- Muscle spasm during slight movement
- Inability to walk
- Deformed looking leg

## How does it occur?

Leg fractures can occur in many ways such as falls, direct blows, and overuse. Sometimes diseases or problems such as osteoporosis can cause bones to become weak and break more easily

## How is it diagnosed?

To diagnose a broken bone, your health care provider will review your injury and symptoms and probably take x-rays of your leg

Your provider will check your foot to see if vessels or nerves are damaged. He or she may also examine your knee to check if you also have a knee injury.

## How is it treated?

Your provider will need to set the bones back into the proper position. Sometimes this requires surgery. Your leg may need to be set in a splint or cast to keep it from



Because you will not be moving your leg for awhile, it can cause the joints to stiffen and muscles to weaken, even in some uninjured areas of your body.

**Midfielder Alan Smith** hopes to make a full recovery after suffering a horrific leg break in Manchester United's FA Cup defeat by Liverpool. On February 18, during a 1-0 defeat by Liverpool at Anfield in the FA Cup, while attempting to block a free-kick from Liverpool's John Arne Riise, Smith broke his left leg and dislocated his ankle after falling awkwardly. "When I looked, the leg was lying one way and my ankle was 'pointing towards Hong Kong' so I knew I was in serious trouble." As a result of this injury it was confirmed that Smith would miss action for at least 12 months.

By John Gorringer, George Butcher and Adam Gillis

moving. If there is an open wound over the site of the leg fracture, you may need surgery. The provider will cleanse the wound and cover it with a sterile dressing. You may need to have a tetanus shot and need to take antibiotics for several days.

You may need to use crutches or a cane for awhile. Your provider will tell you when you should start putting full weight on your leg again.

# Medicine: Medlink 2006

Medlink is a four day conference for Years 12 and 13 students considering a career in medicine. During the four day conference, held at the University of Nottingham, a wide range of presentations are given by medical school deans, surgeons, hospital and community medicine specialists, representing a wide range of medical specialities. Collectively they offer students an essential understanding of medicine and a thorough preparation for applying to medical school,

coupled with the students' perspective in the medical forum.

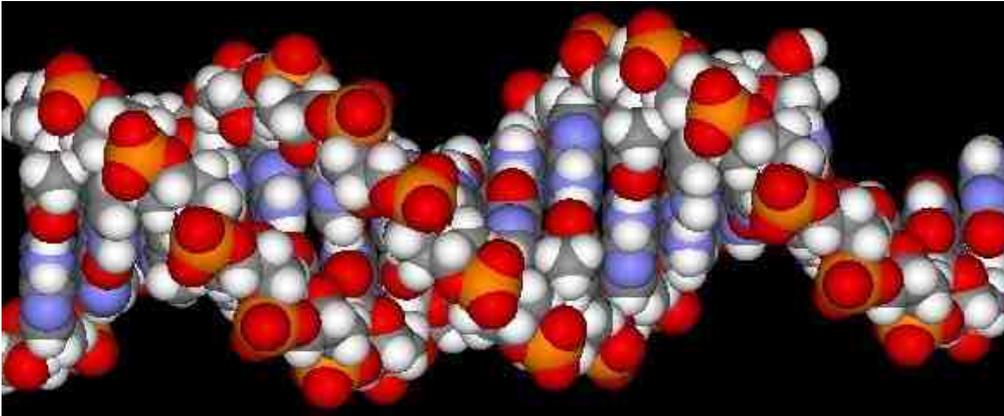
A central feature of Medlink is the 'Interview Workshop' that has been designed to ensure that those attending have the opportunity of significantly improving their chances of a successful application to medical school. Moreover, there is advice on selecting medical schools, producing a winning UCAS statement and delegate to delegate practice interviews, after which students will be given feedback on their per-

formance.

In addition to the lectures held during the conference, there is a wide and exciting range of practical sessions. All those attending receive a free stethoscope with which they can practice their auscultation skills, along with the art and science of making a diagnosis. Working in small teams, delegates have the opportunity to diagnose the condition of genuine patients from the information which they provide.

One of the most fascinating features of the conference is the live surgery, in which students are able to interact with the surgeon before surgery, which is beamed in real time to the lecture theatres, taking delegates step by step through the surgical process live. The surgical procedure observed is a thoracoscopic decompression of the spine, in which the curvature of the spine is instrumented with implants to straighten the spine. *Continued on the next page...*

# Genetics: Mutations



A mutation is a change to the base pair in the genetic sequence of a cell. It can be caused by the environment or be deliberate. If caused by the environment it can be because of ultraviolet (UV) or ionizing radiation and viruses.

Deliberate changes happen during meiosis or a hyper mutation. A hyper mutation is a mutation that happens very quickly and works to diversify the antigen receptors of a cellular body or single cell as to prevent a specific antigen from infect-

ing the cell. This is an adaptive immune response.

Mutations which are deleterious to an animal are removed by the process of natural selection when the animal is wiped out. If the mutation is beneficial then the animal will survive for longer and will pass the mutation on to its offspring. This is when an evolutionary change occurs. This is rare however as most mutations are removed by the body.

Mutations can be split into

two categories: germline and somatic. Somatic mutations are considered permanent in that they cannot be passed on by inheritance, but not permanent as in the sense that they cannot be removed. Germline mutations are rarer and can be passed on to offspring. Plants, (always breaking clear rules), however can transmit somatic mutations through both asexual and sexual reproduction when the bud (ovary) develops in a mutated part of the plant.. On the whole mutations can be very important changes, but more often than not they are pointless and

have no effect.

By Garad Stacey

## Medlink Continued

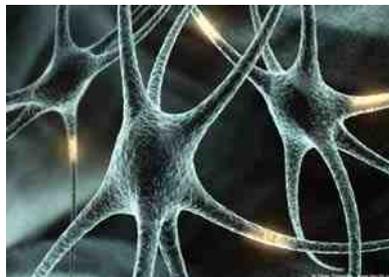
The Medlink Exhibition is another feature of the conference which offers a single day and location in which students and parents may meet and talk with most of the UK medical schools. Students and parents are able to put their questions and concerns directly to admissions tutors and medical students at each medical school in turn, in a relaxed and informal atmosphere. Coupled with the chance to explore future career paths with representatives from many of the Royal Colleges, this is a truly outstanding opportunity.

Medlink is valuable for students in years 12 and 13, as not only will they hear guidance on applying to medical school but also on what to do if things go wrong and they need to reapply. Advice on surviving medical school will be given by medical students, and everyone will have the opportunity to talk with practising doctors and medical students, in addition to the opportunity of meeting face to face with the majority of the country's medical schools admission tutors during the Medlink Exhibition.

# Trust your Instinct

A study by the UCL has found out that you are more likely to solve a problem correctly if you trust what you think is right, rather than pondering for a long time about it. 10 participants in the study were asked to pick the odd one out from several different shapes in both 2 seconds and in as much time as they needed. The shapes were flipped over and the participants needed to choose which one did not match from the set. The participants were 95% accurate when they trusted their instincts compared to only 70% when they thought about the problem for a long time.

The reason for this is because the sub



The neural pathway

conscious brain recognises rotated versions of an object as different from the original, whereas the conscious brain sees the two objects as identical unless the participant studies the shape very closely. Dr. Li Zaoping, of the Department of Philosophy at the UCL, said, 'You would expect people to

make more accurate decisions when given the time to look properly. Instead they performed much better when not given time to think... Involuntary subconscious processes for certain tasks are more effective than using our cognitive functions (functions of the brain). If our higher level cognitive processes are leading us to the same conclusions, there is no issue. However, our instincts are often silenced by our conscious mind. Participants would have been able to have improved their performance in the survey if they had acted quicker.'

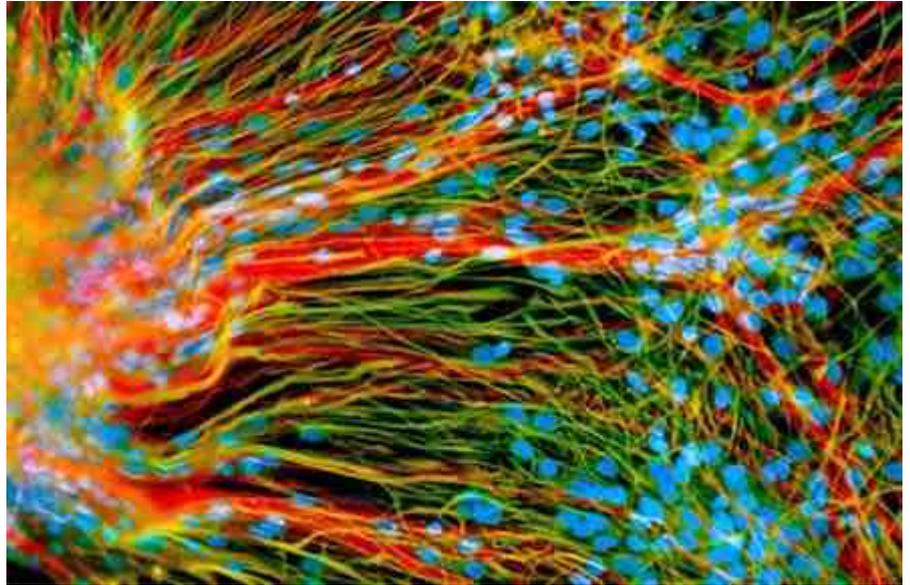
By David Crowhurst

# Stem Cells *The miracle cure, or just another big hype?*

(Continued from front page). This discovery in patients with leukaemia is startling and worrying as normal stem cells are essential, which creates the problem of being able to differentiate and finding the malignant stem cells, especially since stem cells make up about 0.01% of the type of cells they are found in. Currently there is no treatment that targets this, and therefore majority of research is trying to find a simple way of identifying between malignant stem cells compared to normal ones; and possible treatment, which only targets the malignant cells.

However, this is not the first time stem cells have been associated with cancer. Indeed, patients that have stem cell treatment are thought to be more likely to suffer from cancers in general, as artificially placing cells in tissues can have un-anticipated effects and with stem cells, the rate of cell production could be altered, if there is no inhibition of cell production; (which leads to exponential growth (the primary cause of tumours).

Despite these problems regarding stem cells, they may offer the only option for patients who need treatment, and a successful form of stem cell treatment commonly used for the last 30 years is in treating cancer patients with leukaemia and lymphoma, using bone marrow stem cells. Furthermore, new treatments are emerging, with new research showing scientists using stem cells to repair defective insulin-producing pancreatic cells



*A microscopic look at a lab dish whose contents are derived from human embryonic stem cells.*

responsible for diabetes in mice. This could be used to tackle type 1, or insulin dependant diabetes of which around ¼ million people in the UK suffer from. Possible stem cell treatment is huge, from treating strokes and cancers, to baldness and missing teeth. It is clear that in the future where experimental problems, including: successfully expanding stem cell populations extracted from patients and successfully implanting stem cells that expand and grow sufficiently enough to be beneficial for treatment are overcome, stem cell treatment will be much more common.

From the birth of stem cell research, par-

ticularly embryonic research, there has been widespread controversy on the topic, fuelled by bad press, superstition and lack of public knowledge; stem cell research has accumulated an extremely bad press. Primarily the facts that a human embryo has to be destroyed to obtain embryonic stem cells; which anger and motivate movements such as the pro-life movement, that claim human life begins when an egg and sperm cell fuse and so the destruction of a human embryo is as bad as committing murder. However, most embryonic research uses cells to be discarded that are produced in-vitro not created. In the USA alone there are 400,000 such cells. However, there is a majority stance that embryonic stem cells should not be used, as it involves destroying a 'human life', the fact that scientists can use adult stem cells, and the lack of results promised by scientists.

Indeed, the future of this popular and very controversial area of science will promise to be on the minds of the public for a while yet. Lately the US have passed a bill backing embryonic stem cell research, marking a major challenge to president Bush, who used his presidential authority and vetoed it. However, it is clear that the stem cell research cannot be held forever and the potential uses of stem cells are clearly enormous, if only they can be successfully implemented.

By Ravi Raval

## Fact or Fiction?

*Life. takes a look at some biological myths*

### “Vitamin C prevents a cold”

During the Winter months our parents force many oranges upon us saying “It will do you good, you don’t want a cold” but do oranges and vitamin C actually help with a cold? US Nobel Prize of 1970 winner Linus Pauling thought so. However more modern research shows that vitamin C does nothing to prevent a cold. In fact a large amount of vitamin C causes extreme diarrhoea. However before you throw out your

oranges and vitamin C pills you might like to know that vitamin C does shorten the length of a cold by up to 19% and can relieve stress.

### “Cracking knuckles gives you arthritis”

I’m sure that teachers and parents have always told you to stop cracking your knuckles or you’ll get arthritis. Although it appears that it’s just an empty threat to stop you making the annoying noise.

*Continued on the next page...*

# More Potent Than Morphine

## The New Natural Painkiller



French researchers have discovered a natural painkiller in humans which has potential therapeutic uses in reducing pain. The compound is a short peptide of five amino acids and it has given a name of opiorphin.

Catherine Rougeot and her colleagues at the Institut Pasteur in Paris identified that opiorphin from humans is similar to a potent pain inhibitor in rats. For further studies, they extracted opiorphin from

human saliva and learned that opiorphin exerts its effect by changing the activity of two enzymes, (ectopeptidases) found on the outer membrane of nerve cells.

When a person feels pain, compounds called enkephalins are released by the body as a counter measure. After several seconds they become catabolised by the enzymes but opiorphin deactivates these en-

zymes, possibly by chelating zinc which is necessary for the enzyme's activity.

The research team is carrying out further studies on the molecule and look at possible mimetics. Her team is also investigating whether the molecule is related to any other potential effects on areas such as depression, memory and panic.

Jack Morley, a consultant neuropharmacologist with the Pain Relief Foundation

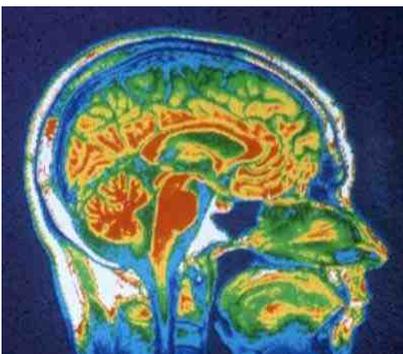
in the UK, said that the discovery of opiorphin could lead to new a understanding of the human body response to pains.

The current most widely used morphine, enkephalins, was discovered over 30 years ago. Since then, its pathways affecting pain and mood-related states have been postulated in natural neurotransmission. However, the availability of opiorphin promises that many of these issues will be resolved.

However, successful therapeutic implications of opiorphin are not 100% promising, as previous clinical trials with similar effect to opiorphin have been disappointing.

By Kyung Hoon Moon.

## Fact or Fiction? Continued...



An MRI brain scan

Research in 1990 proves that there is no link between cracking knuckles but before you crack your knuckles in celebration, you should know that cracking knuckles does lead to soft tissue damage so the threat may have just got muddled up over the years.

**“Humans use only 10 percent of their brains”**

This is just a myth. MRI (Magnetic

Resonance Imaging) has revealed clearly that humans are always using most of their cerebral cortex (brain structure that controls most of the conscious thoughts at the top of the brain), even whilst dozing!

**“Chickens can live without a head”**

This is strangely enough, true. A chicken often stagger around without its head for a few minutes after being beheaded. This is because the technique used to behead often leaves most of the brain stem intact, the brain stem controls most of the reflexes. The longest recorded case was of a chicken living for 18 months after being beheaded, eventually choking to death.

**“Hair and fingernails continue growing after death”**

It appears that after an organism dies, the hairs and nails continue growing afterwards. This is actually only a myth, what

people see is an illusion. Because the body gets dehydrated, it shrinks (quite a bit). This causes the skin to tighten, revealing more hair and nails.

**“You can get long legs by eating cornflakes”**

It is, in fact, quite true that someone who eats well and nutritiously will grow taller and stronger than someone with the same genes who does not. Genes do not determine the final size of state of the adult body alone - they have what biologists call a "norm of reaction". You can see this in plants - we planted a hedge along our fenceline, and some, where the earthmoving equipment that levelled our block during construction, grow tall, while others, where an old driveway of packed clay and gravel still exists, grow short and even die. Same genes, different outcomes. Whether cornflakes qualify as nutritious is a matter for debate. *Concluded on the next page...*

# That's Life.

## The Biology Quiz

- 1) What is the most effective sleeping position?
- 2) Why do cat's eyes shine at night?
- 3) How fast can a dolphin empty and re-fill its lungs?
- 4) Name the type of fish that can climb trees?
- 5) Is it possible for sucrose to turn into Caramel?
- 6) What country has the highest amount of plant species?
- 7) What is a *Psyllophryne didactyla*?
- 8) True or false, Sharks have to keep swimming in order to survive
- 9) What is the world's smallest winged insect?
- 10) What is the name of the species with the most known pair of chromosomes?



*The frog which can fit on your fingernail*

- 1) Many scientists say that the most effective sleeping position is the fetus position. That position allows the body to experience the best blood circulation. That position allows the body to experience the best blood circulation.
- 2) Cat's eyes shine at night because of the light reflected by the tapetum, a layer of cells forming a large part of the inner eye.
- 3) Dolphins can empty and refill their lungs in less than 0.2 seconds (one fifth of a second).

4) There is a fish that can climb trees, called the mudskipper. It spends about 3/4th of its time out of water. Malaysian mudskippers live in swamps where they climb among tangled stem roots, and sometimes into branches..

5) When at 200 degrees Celsius, sucrose will melt into caramel.

6) The country believed to have the highest amount of plant species is Brazil, around or over 56,000.

7) A newly discovered frog species is so tiny that it can sit comfortably on the human fingernail. The frog, *Psyllophryne didactyla*, was discovered in Cuba in 1996.

8) Sharks have to keep swimming in order to survive. The great white shark must swim constantly at 2.2 miles per hour (3.5 kilometres per hour) to ensure oxygen reaches its bloodstream.

9) The world's smallest winged insect is smaller than the eye of a housefly. It is the Tanzanian parasitic wasp, which has a wingspan of 0.008 inch (0.2 millimetres).

10) The species with the most known pair of chromosomes is the *Ophioglossum reticulatum*, a species of fern, with more than 630 pairs (1,260 total).

By Alex Robinson

## Fact or Fiction? Concluded...

**“The Ladder of Progress explores the myth that humans are the goal of evolution, in that there's a natural progression from lower life forms leading eventually to human beings.”**

This idea of evolution or any natural process having an ultimate goal or a purpose is known as teleology. But scientists, for all their searching, haven't discovered any evidence of teleology in evolution. There appears to be no inherent drive that propels the evolution of species "upward" toward the ultimate goal of humans, or of any other species. But this idea of higher and lower levels of life has a long history, and perhaps a look at that history will explain why this image is still with us today.

**“Charles Darwin developed the theory of evolution”**

The theory of evolution existed before Darwin, it was Darwin's Theory of Evolution by Natural Selection that became widely accepted.

**“If evolution is disproven, creationism must be true.”**

A problem with logic (disconfirming evidence). Even if you disproved evolution, you would have to develop and support another model of organism diversity. Disproving one, doesn't prove the other.

**“Snakes Can Charm their prey”**

A popular myth about snakes is that they are somehow able to hypnotize or "charm" their

prey so that the prey is unable to escape. There is no evidence to support the claim that snakes charm their prey. This myth may have resulted from the observation of small animals and birds becoming "frozen with fear" when confronted by snakes, however they are not being charmed. Often an adult female bird will flutter about in front of a snake in order to distract the snake from the fledglings in her nest. Another possible explanation may be that many animals are unable to perceive the slow approach of a long thin snake as dangerous. Finally, the fact that a snake is unable to blink may have something to do with the origin of this myth.

By Joe Robinson, Alex Robinson and Tom Irons