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HEADLINE: STEM CELLS: THE FUTURE OF MEDICINE?;
AMAZINGLY VERSATILE, THESE HUMAN **CELLS** - OFTEN TAKEN FROM EMBRYOS -

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HIGHLIGHT:
Picture: ZEFA

BODY:
THE world's first **stem cell** bank opened in the UK yesterday bringing with it new hope of finding cures for a whole host of serious illnesses, from heart disease through to blindness and paralysis.

Stem-cell research uses **cells** taken from human embryos that can grow into many types of tissue or body parts - and it could revolutionise healthcare.

Britain is at the forefront of studies and the new centre, based in Hertfordshire, will give scientists a ready supply of **cells** to work on.

Much of the **research** is still in its infancy but it is likely that within the next decade huge advances will be made, transforming medicine and bringing the prospect of longer lives.

What are **stem cells?**

Stem cells are the body's basic building blocks. In an embryo they go on to form every body part and organ, including skin, bones, muscles, heart and brain.

Scientists believe that the earlier in life **stem cells** are taken from the body, the greater their ability to develop into the widest possible range of tissue types.

This means **cells** taken from embryos just a few days old can develop into most specialised tissues anywhere in the body. **Cells** from an adult are far more limited in what they can do.

Stem cells can also be taken from the umbilical cord blood of newborn babies but these, too, are thought to be limited in their possible uses.

Even if donor **stem cells** are used, there is still the risk of tissue rejection. But eventually scientists hope

to create tailormade embryos so that patients have their own personal body repair kit of **stem cells.**

Ethical issues

Human embryos - the fertilised egg before it begins to turn into a foetus - are the source of the most useful **stem cells.**

But many people, including anti-abortion campaigners, are opposed to any **research** being carried out on the embryos because they say they are still a human life, no matter how young.

The US has already outlawed **stem-cell** studies carried out on human embryos in public institutions, although the work can carry on in private clinics.

Under British law, scientists are allowed to conduct **research** on embryos up to 14 days old. At this stage an embryo is a small bundle of **cells** about the size of a pin-head.

Most embryos are supplied by IVF clinics after being deemed unsuitable for fertility purposes. They would otherwise be disposed of and patients must sign consent forms for **research.** But pro-life campaigners are concerned that one day embryos might be created for the sole purpose of **research.**

Breast enlargement

MAKING "natural" breast implants is one cosmetic way in which

stem cells could be used. Fat **cells** are taken from a woman's stomach or thigh and are combined with **stem cells** found in the fat before being injected into the patient's breasts.

The **stem cells** encourage the growth of new fat and blood vessels, according to University of Tokyo **research,** leading to healthy, natural-feeling breast tissue.

Previous attempts to increase breast size with fat have failed because some tissue dies, forming hard lumps. But it could eventually become a safer alternative to silicone.

Available: Possibly within three to five years.

Replacement organs

THERE'S a shortage of organs for transplant but this could be solved if patients' own damaged organs were repaired or

replaced using **stem cells.**

Doctors in Israel have managed to make **cells** taken from human embryos grow into fully functional kidneys in a mouse.

They say similar results can be achieved with pig embryo **cells** to create tissue that could be used in people.

Lung tissue, too, could be grown artificially. Researchers

from Imperial College, London, have created lung **cells** from mouse **stem cells** and say it could be a

lifeline for those with lung conditions or illnesses, including cystic fibrosis.

Available: 10 years or more.

False teeth

DENTURES could be a thing of the past as scientists are working on a project which would see people growing replacement teeth.

Researchers from King's College, London, hope to treat a patient's **stem cells** in a lab before re-implanting them in the patient's jaw under the gum where a tooth is missing.

It's hoped the **cells** would grow into a new tooth within two months, meaning an end to false teeth. The technique has already been tested successfully in mice and human trials could start within two years.

Available: Five years or more.

Brain damage and stroke

CREATING new brain tissue to treat tricky neurological conditions is another area in which **stem-cell** use could prove revolutionary.

Scientists in the US have discovered that in three human subjects some adult bone marrow **cells,** originally transplanted to treat leukaemia, also ended up in their brain tissue.

The team, from the University of Florida, hope this means that the technique could be refined to help regenerate malfunctioning or damaged brain tissue.

As the **stem cells** come from adults rather than embryos or foetuses, it is far less controversial. The **research** is still in early stages as it is not known what causes the bone marrow **cells** to become brain **cells**

Available: Possibly in five to 10 years.

Blindness

EYESIGHT damaged by disease or injury could be saved with pioneering work to grow fresh eye tissue.

Moorfields Eye Hospital in London is already working on new **stem-cell** techniques to regenerate tissue in the cornea - at the front of the eye - as well as the retina at the back.

In the US a similar procedure has already been performed on a man who had been blind for 40 years. Mike May, from California, had **stem cells** implanted into his eye to repair scar tissue. This, together with a cornea transplant, has restored his vision enough to see people or large objects.

Available: Now, though techniques are still being improved.

Baldness

HAIR follicle **stem cells** could hold the key to an effective cure for baldness. US scientists isolated

stem cells from mouse hair follicles and then implanted them in the skin of other mice - and the animals grew new follicles and sprouted fresh hair.

The **cells** were from adult mice, which normally don't form new hair follicles, and the same is true for humans as we don't form new follicles after birth.

Researchers from the University of Pennsylvania Medical Centre in

Philadelphia now hope that **stem cells** in human scalps could be isolated and transplanted.

Available: Not for at least five to 10 years.

Deafness

SCIENTISTS say that **stem cells** could be used to reverse hearing loss.

One cause of deafness through injury or ageing is a reduction of hair **cells** in the

inner ear - these convert sound vibrations into electrical impulses, which the brain then interprets as sound.

Now researchers in the US have taken **stem cells** from a mouse embryo and transplanted them into the inner ear of a chicken to successfully create new hair **cells.** The same technique should, theoretically, work in humans to tackle age-related hearing loss, although the work is still at a very early stage.

Available: Perhaps within 15 years.

Parkinson's disease

ONE of the greatest hopes for **stem-cell research** is the treatment of Parkinson's, a potentially devastating brain condition that is currently impossible to cure.

The disease happens when the brain doesn't produce enough of a chemical messenger called dopamine, which normally helps control body movement, resulting in uncontrollable shakes. Actor Michael J Fox, right, is a well-known sufferer.

But researchers in New York found that mice with a Parkinson's-type disease

had their symptoms reduced after they were injected with **cells** taken from the rodents' tails and grown into nerve **cells** in the lab.

Available: Likely to be at least 10 years.

Infertility

SCIENTISTS might eventually be able to tackle many cases of infertility by creating sperm or eggs using a patient's **stem cells.**

US researchers from Harvard University have already developed a mouse sperm using **stem cells** from a mouse embryo and successfully fertilised a mouse egg in the lab.

And a University of Pennsylvania team has made eggs grown from mouse embryo **stem cells.**

But neither the sperm nor eggs resulted in a pregnancy or birth and scientists say there's doubt whether either are fully functional. More **research** is needed.

Available: 20 years.

Diabetes

ABOUT 1.4 million people in the UK have been diagnosed with diabetes and another million have the condition but don't know it yet. The disease means the pancreas doesn't produce enough insulin - the chemical which helps control blood sugar.

Scientists are working on a possible cure, which involves creating insulin-producing **cells,** known as islets, from **stem cells** and then transplanting them into the pancreas.

Studies at the University of Florida found that **stem cells** from a patient's bone marrow could be a viable source of

islets, while researchers at New York University have had some success creating islet tissue in mice.

Available: 10 to 15 years, as **research** is in the early stages.

Paralysis

PEOPLE left crippled by disease or injury could have feeling restored and even be able to walk again thanks to **stem-cell research.**

Doctors in Brazil reported some success after taking **stem cells** from the blood of 30 patients who had paralysed limbs.

The **cells** were injected back into the affected area, eventually leading to increased movement and sensation in 12 cases.

Researchers have also been able to use **stem cells** to regrow nerve tissue. A team from the University of California injected paralysed rats with the **cells** and, after nine weeks, the animals could walk again.

Available: Within two to five years.

Heart disease

STEM cells could help tackle the UK's biggest killer by being used to replace damaged heart muscle. American doctors have already treated cardiac patients using **cells** from their bone marrow.

And **research** at the Texas Health Science Center found that injecting the **cells** directly into heart muscle greatly helped patients with severe heart failure who were at risk of dying.

The **cells** formed muscle and blood vessel **cells,** leading to fewer angina attacks and greater blood flow. After two months 13 out of 14 patients were still alive.

Available: Three to five years.

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