



**PUBLIC UNDERSTANDING OF
BIOTECHNOLOGY**



What is cloning?

- Duplicating a person e.g. identical twins. This is called **“Reproductive” cloning**.
- Duplicating part of a person e.g. a heart or liver, or even just a few cells. This is called **“Therapeutic” cloning**.

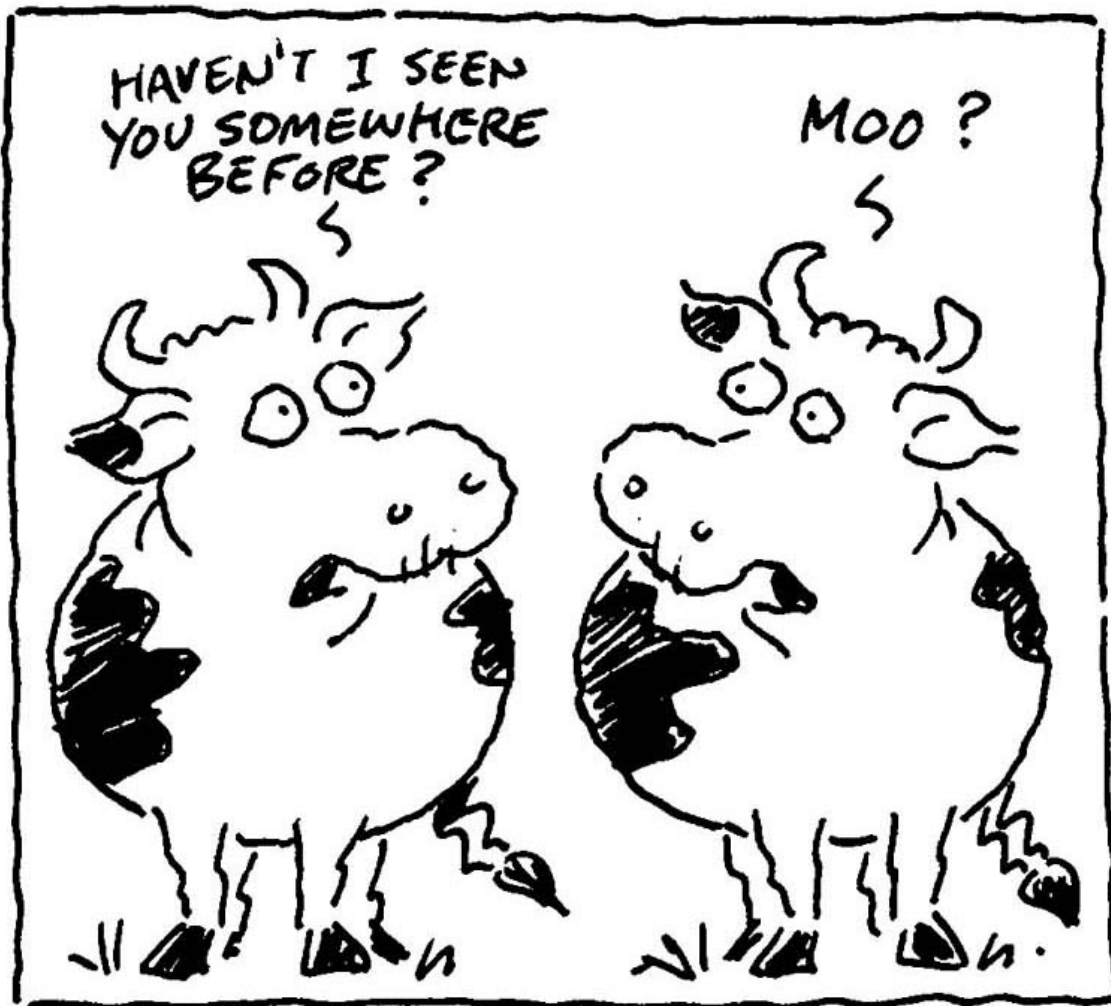
In cloning...

- 100% of genetic information comes from one individual. E.g.



Could
produce





REPRODUCTIVE CLONING

Is a clone genetically identical?

Almost – but not quite.

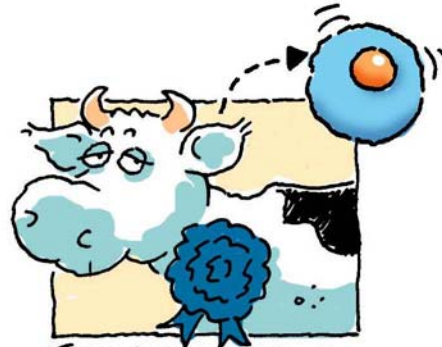
Even identical twins are different due to the slight differences in environment they experience.

Clones would be even more different as they would live in a very different environment and time as a form of “delayed identical twin”.

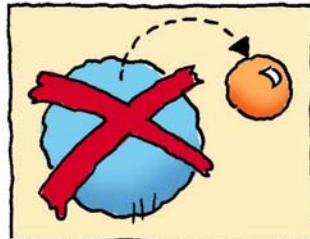
HOW FUTHI WAS CLONED.



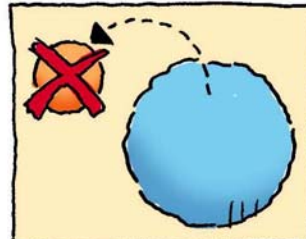
REPRODUCTIVE CLONING



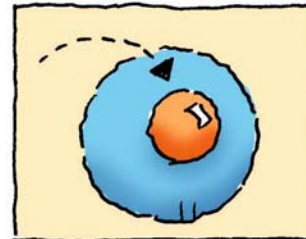
TAKE A CELL FROM A CHAMPION COW...



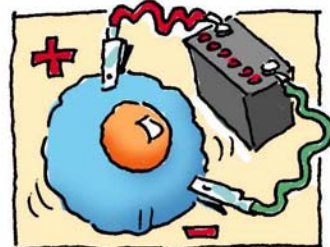
...REMOVE THE NUCLEUS AND DISCARD THE REST.



TAKE AN EGG CELL FROM A DIFFERENT COW... REMOVE AND DISCARD ITS NUCLEUS



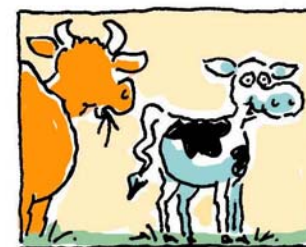
INSERT FIRST NUCLEUS INTO EMPTY EGG CELL...



...GIVE IT A SHORT ELECTRICAL PULSE - IT STARTS TO DIVIDE...



... AND IMPLANT IT INTO THE WOMB OF A SURROGATE COW.



THE RESULT IS A CALF GENETICALLY IDENTICAL TO THE ORIGINAL CHAMPION COW.

Therapeutic cloning

- Made in the same way as reproductive cloning except the embryo is not implanted;
- Stem cells are harvested from the embryos which kills it;
- The stem cells are used to grow different types of cells;

The hot debate

Stem Cell Research

Embryonic

Adult

When do you believe life begins?

Potential uses of cloning

- Replacing organs and other tissues
- Infertility
- Replacing a lost child
- Creating donor people
- Gene therapy
- Saving endangered species
- Reversing the ageing process

Problems with cloning?

- Low success rate (Dolly took 276 attempts)
- Tumours
- Genetic defects
- Over-growth syndrome
- Pre-mature ageing (genetic age)
- Massive quantities of human eggs required
- Reduction in adaptability – genetic uniformity
- Insertion of genes
- Lack of knowledge

Is cloning allowed?

Different countries have different laws for the different types of cloning.

Some countries (led by USA) want a global ban on all types of cloning, while others want a ban on certain types.

In South Africa there are currently no laws against cloning.

Ethical questions?

- Do you think cloning is ethical for humans?
- If you had a clone would it be your child or your delayed twin?
- Does a clone have a soul?
- What about all the duds?
- What about creating clones for organs?
- Who should decide who is cloned?

Ethical questions cont...

- Who should have access to cloning technology – only people with good genes?
- Who should pay for the cloning?
- Should we be able to use this technology to design our children? (*Gattaca*)
- Who does genetic information belong to?
- Should people with genetic diseases be cured? Should they have children?