

Clones vs Progeny



Cloning in Biology can have different meanings

Making clones of a gene

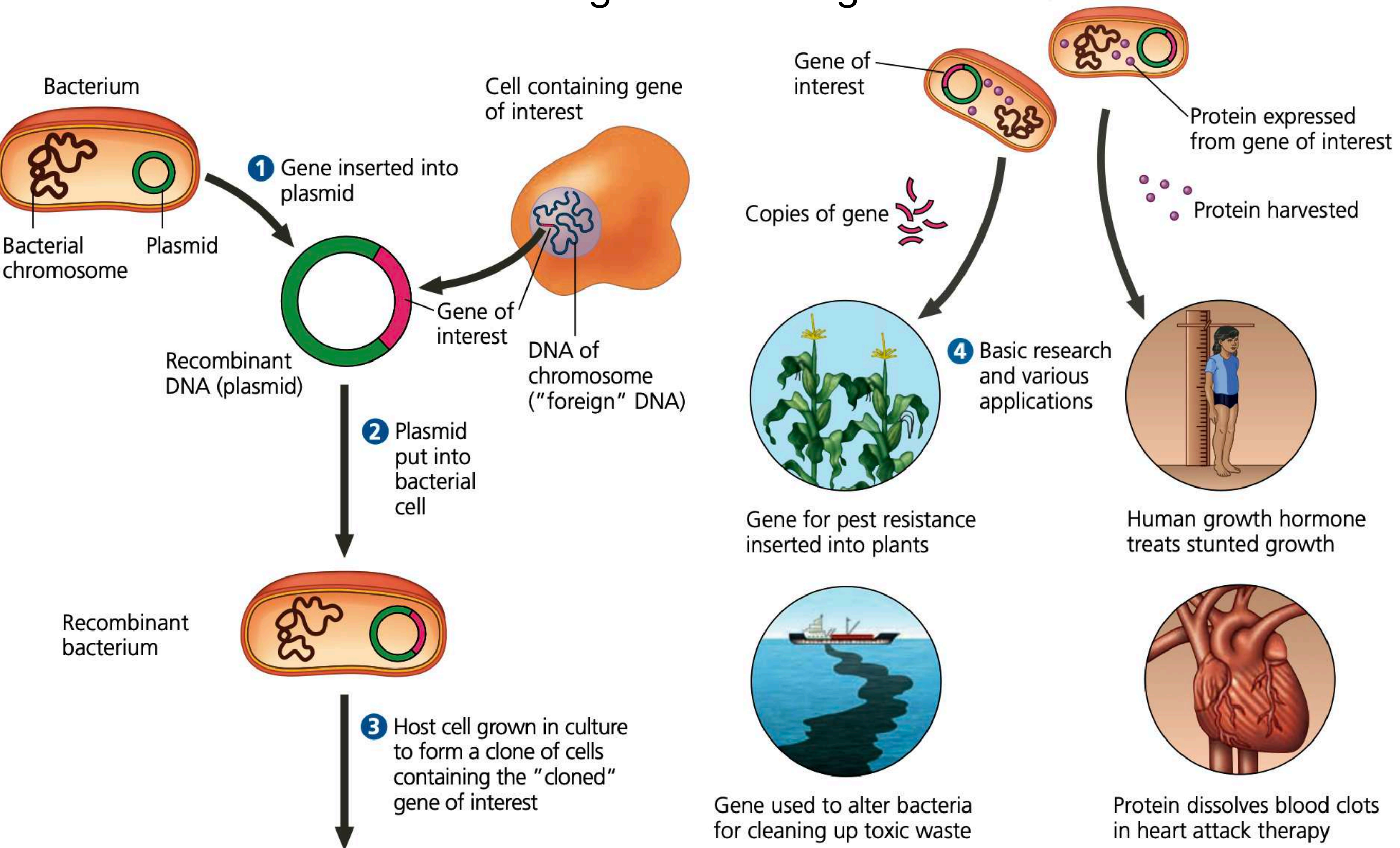
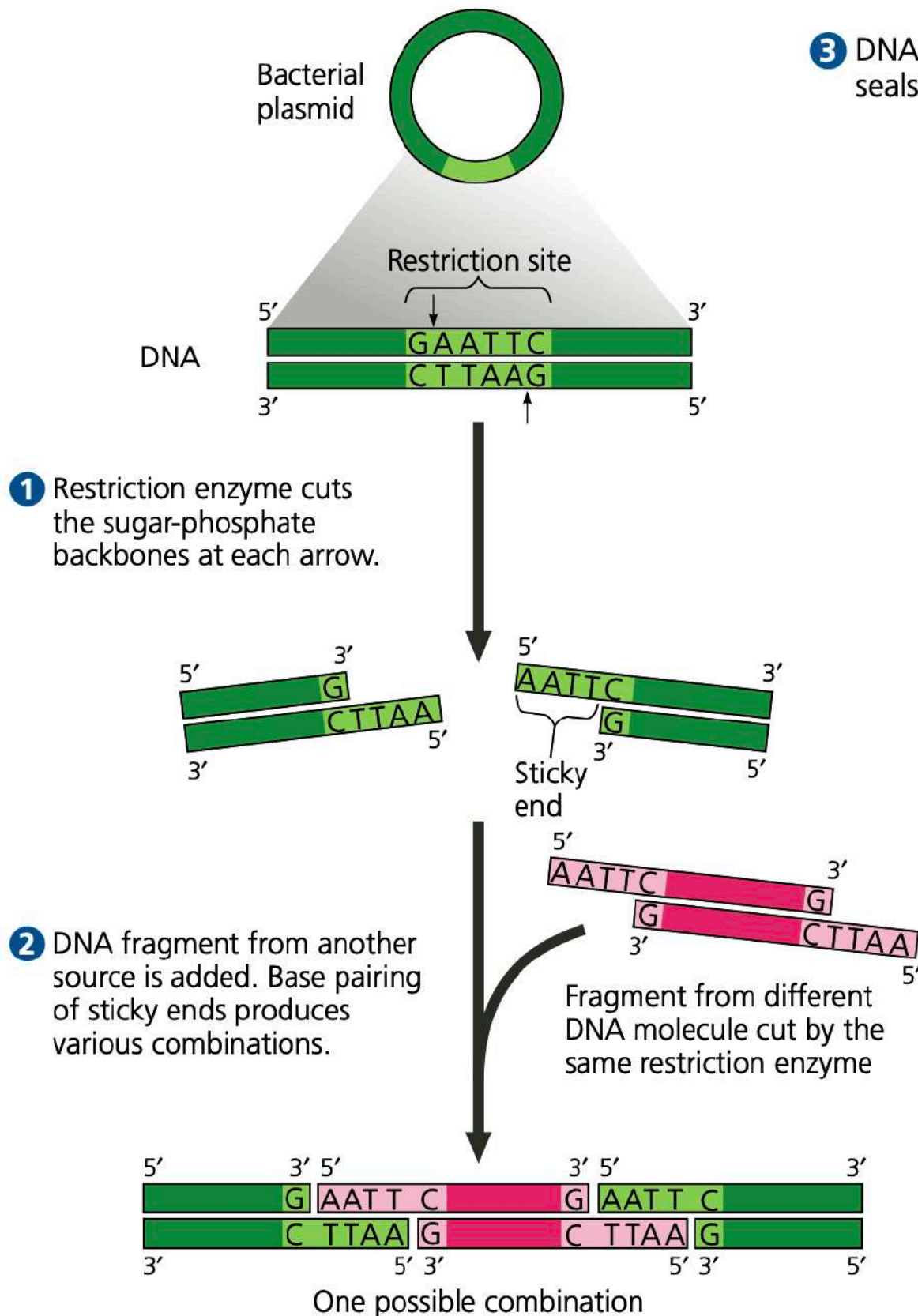


Figure 20.5 of Campbell's Biology: a global approach

Cloning in Biology can have different meanings

Restriction enzymes and use in gene cloning



- Restriction enzymes are proteins that cut DNA
- These enzymes usually have a “recognition sequence”
- Prokaryotes make restriction enzymes to cut invading DNA sequence - defense mechanism
- Restriction enzymes are used as tools to cut and paste any number of DNA pieces to each other

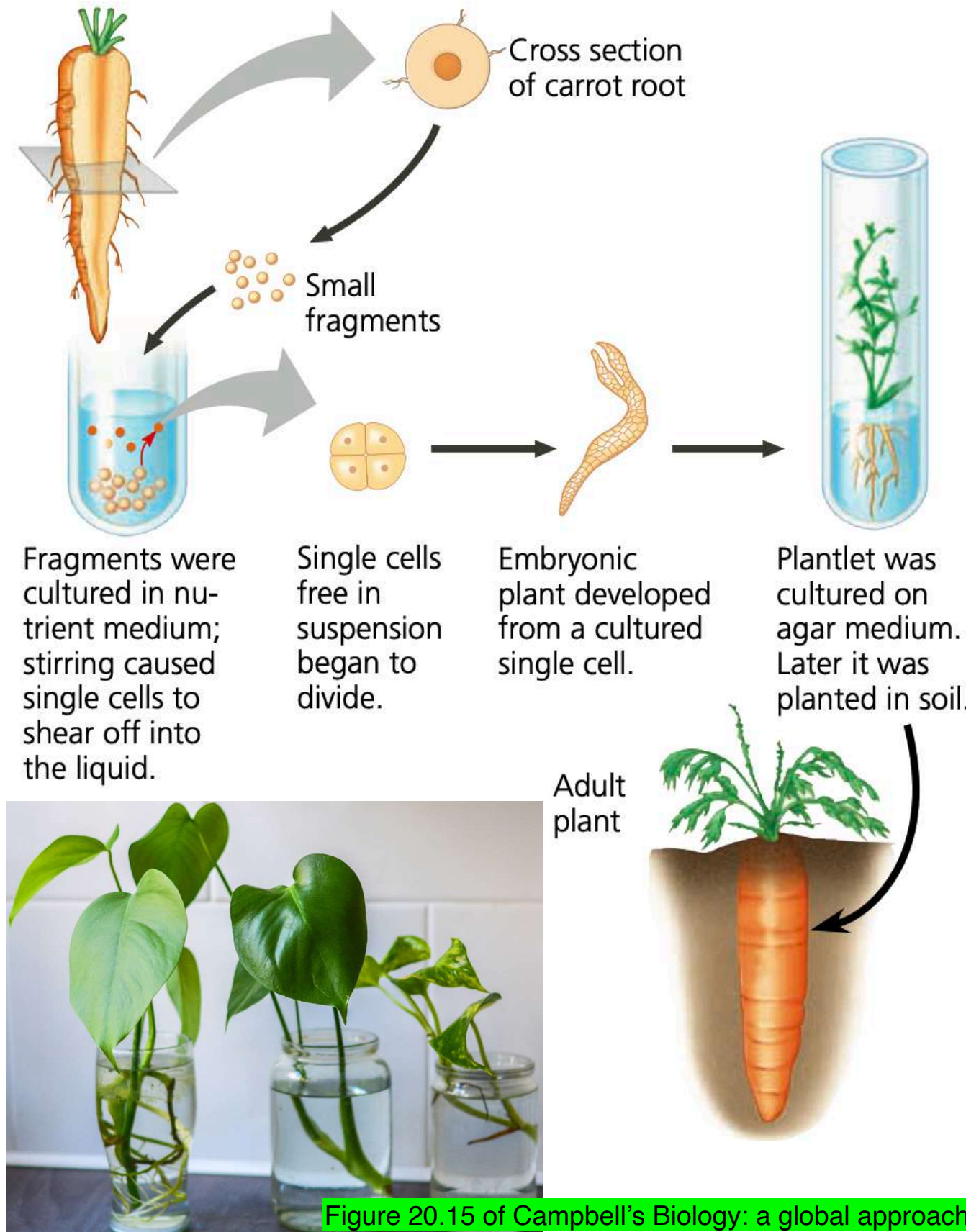
Cloning in Biology can have different meanings

Cloning mature plants

- Done by cutting and rooting different parts of plants to continue with a plant having desirable traits
- Also done from cells of adult plants cultured in specific nutrient media
- Proved that specialized adult cells have not lost the potential to make the whole organism
- Cells can de-differentiate into stem cells and re-differentiate into other cells

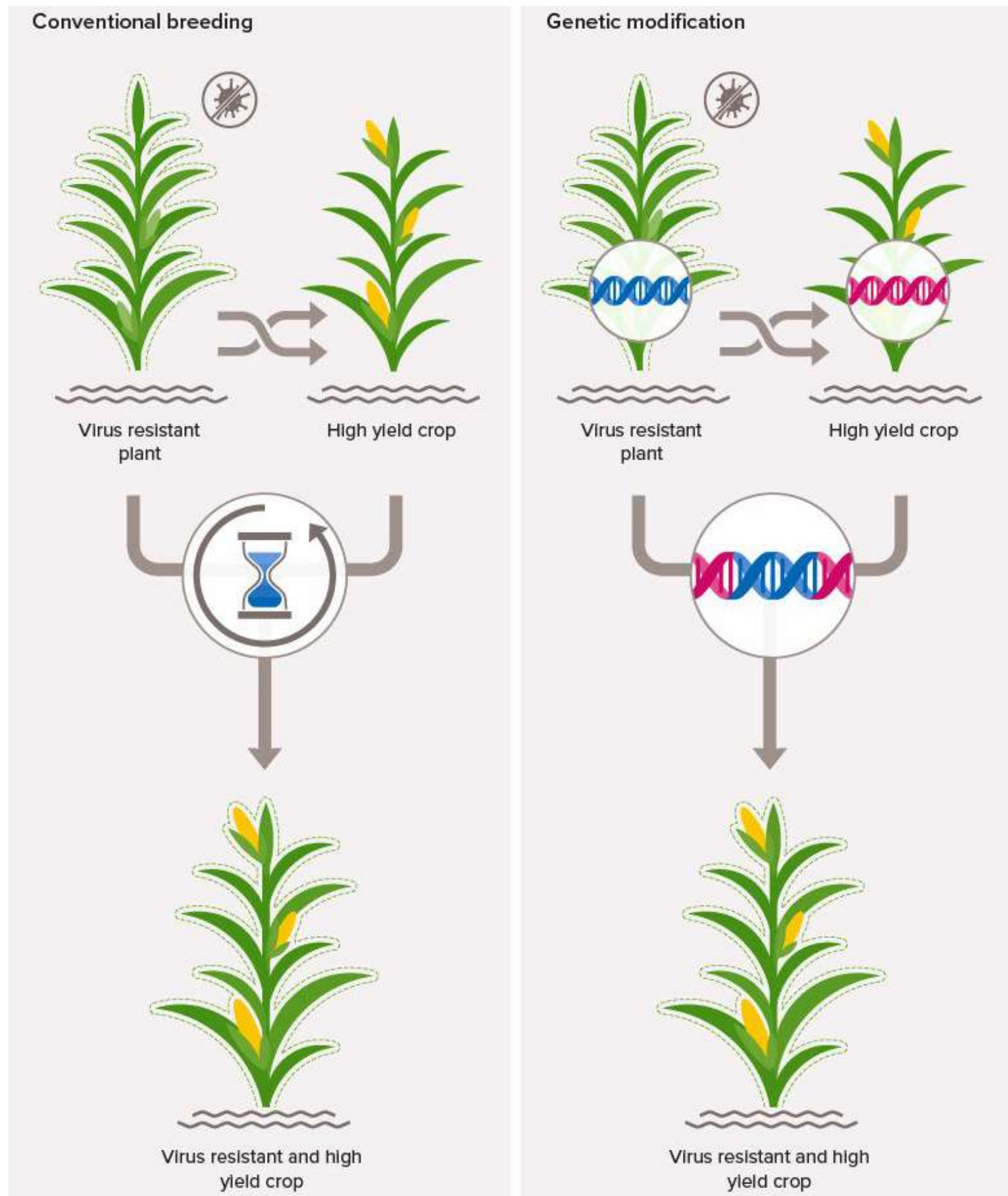
This property of cells to de-differentiate and re-differentiate is because of the information contained in the cells, i.e the nucleus (DNA)

What is the potency of the nucleus (DNA) of a differentiated cell?



Selective breeding vs Genetically Modified Organisms

Has always been
in practice:
Plants
Pets
Humans
etc



Has become a
possibility, with
technological
advancements in
biology,
especially with
CRISPR and
other gene editing
tools

BT cotton
BT Brinjal
Mustard
Potato

A cell and its potency

Nucleus (DNA) in that cell is “committed” to different extents

Totipotent: SN as a baby - can become anything - astronaut, scientist, actress, dancer, singer, engineer, doctor, banker, economist, journalist, etc

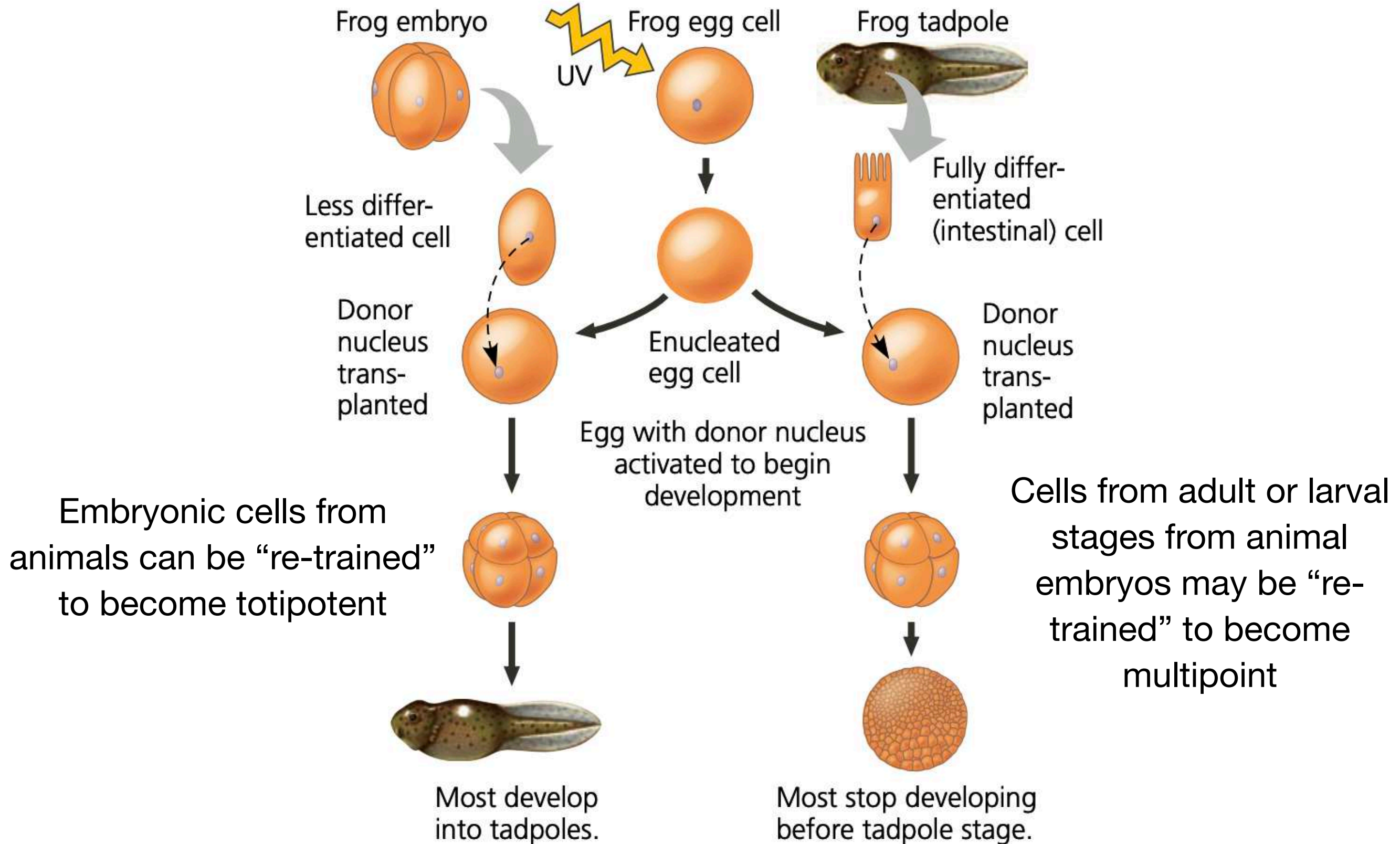
Pluripotent: SN in BSc - can become anything in science - astronaut, biologist, physicist, chemist, engineer etc

Multipotent: SN as faculty in BSBE - Developmental Biologist, Molecular Biologist, Bioinformatician, Cell Biologist, teacher, dancer, writer

Unipotent: SN hopes this does not happen to her
But for cells, it is a cell that does only one thing

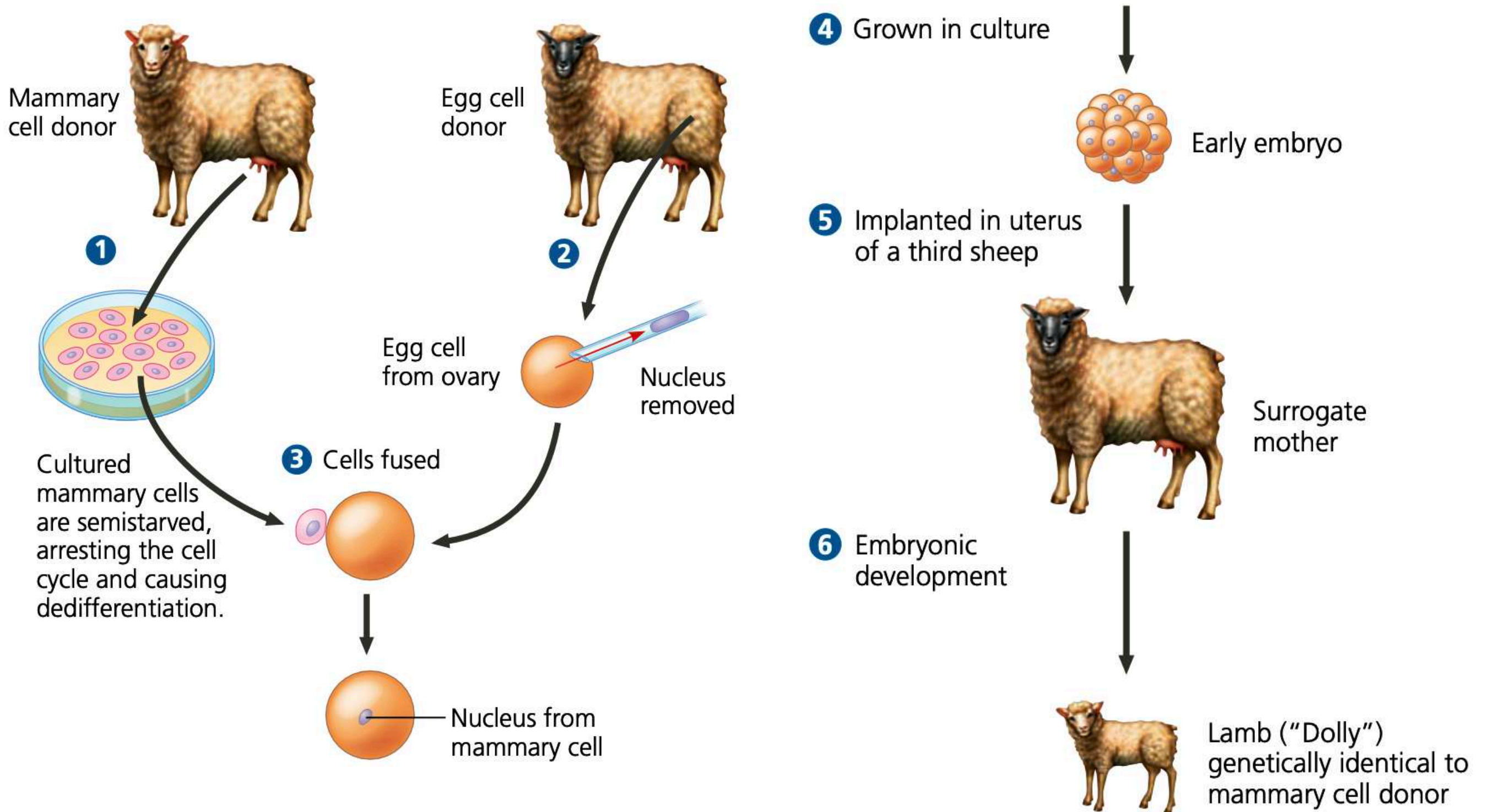
When does the nucleus lose its totipotency?

Embryonic cells lose their potency as they differentiate into cells in adults



Can nuclei from adult cells be forced to re-gain totipotency?

The cytoplasm of the egg can "re-write" the epigenetic status of DNA
Re-sets the potency to nuclei from adult cells to totipotent state



Romulus, Remus and Khaleesi

A company Colossal Biosciences made 20 genetic changes across 14 genes in Gray Wolves - designed to make them larger, change their facial features, and give them a snow-white appearance

Dire wolves?

Efforts are underway to de-extinct several species

