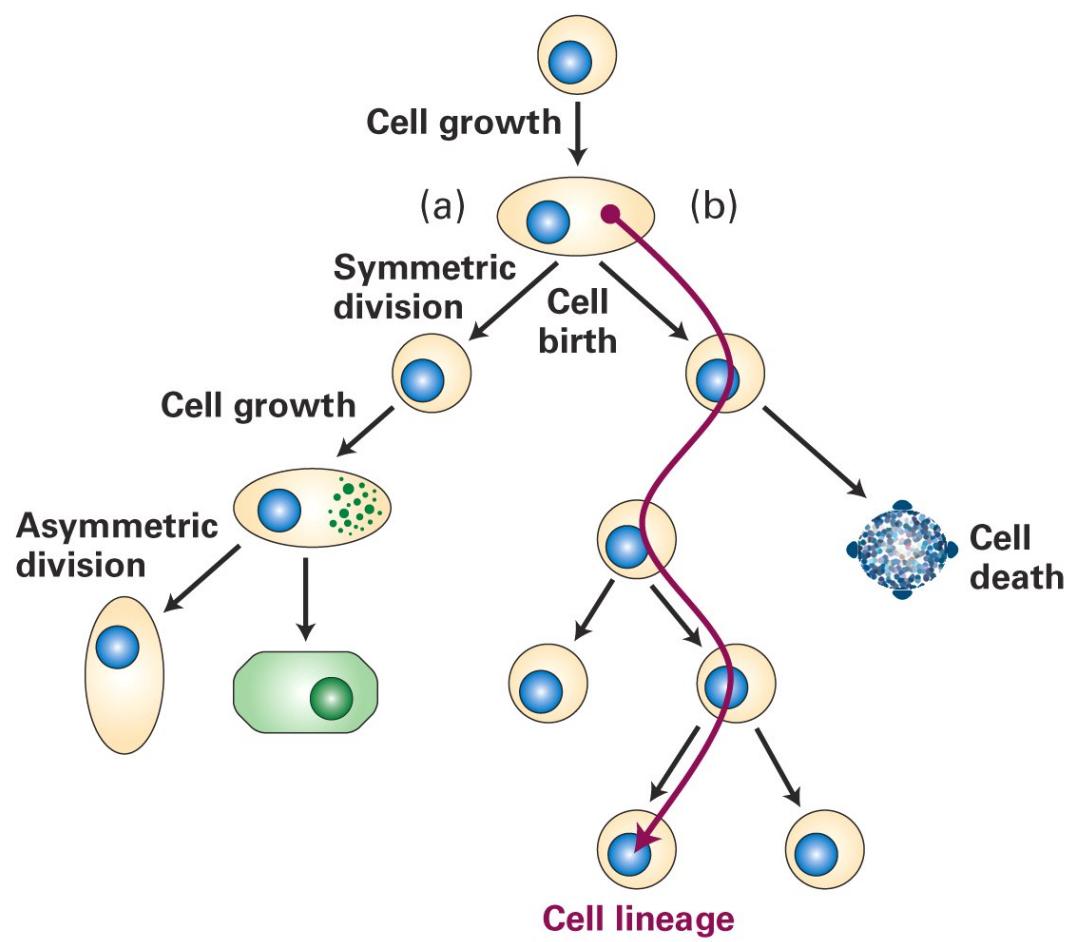


Not all cells in an organism are the same - they differ in size, shape and function

Cells also differ in their ability to proliferate

Most cells in the adult body don't proliferate after 'birth'

Terminally differentiated (specialised)



Terminally-differentiated cells are:

- Cells that are unable to divide
- Example: neurons, adipocyte, cardiomyocyte, skeletal muscle cells, skin cells

Stem cell division.

A – stem cells;

B – progenitor cell;

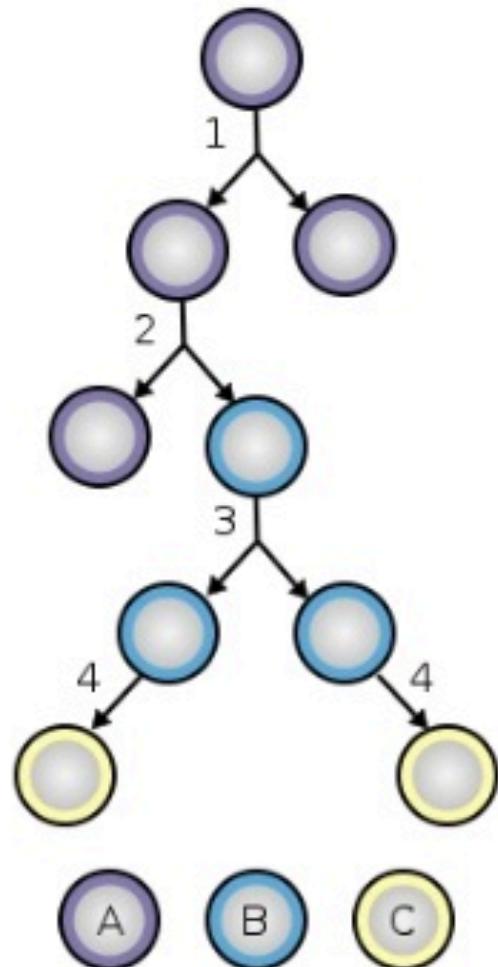
C – differentiated cell;

1 – symmetric stem cell division;

2 – asymmetric stem cell division;

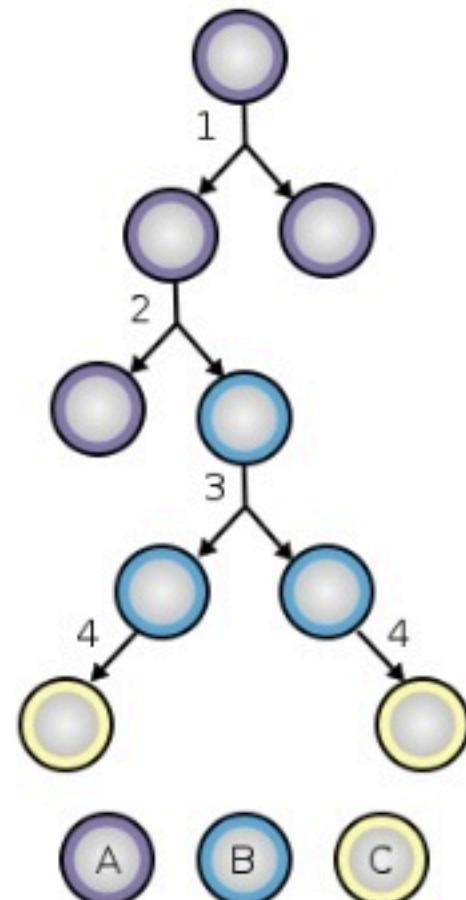
3 – progenitor division;

4 – terminal differentiation



Stem Cells

- Unspecialized / undifferentiated cell
- Has the potential of becoming a specialized cell with a specific function
- Property of self-renew for long periods of time (immortal)
- Formed during the development of the embryo



Types of Stem Cells

- Embryonic stem cells
 - Stem cells taken from the pre-implantation stage of the embryo
 - Totipotent or pluripotent
- Somatic / Tissue / Adult stem cells
 - Exist within specialized tissue
 - Able to differentiate into certain types of cells
 - Multipotent

In adult humans, some terminally differentiated cells can re-gain the ability to proliferate like stem cells

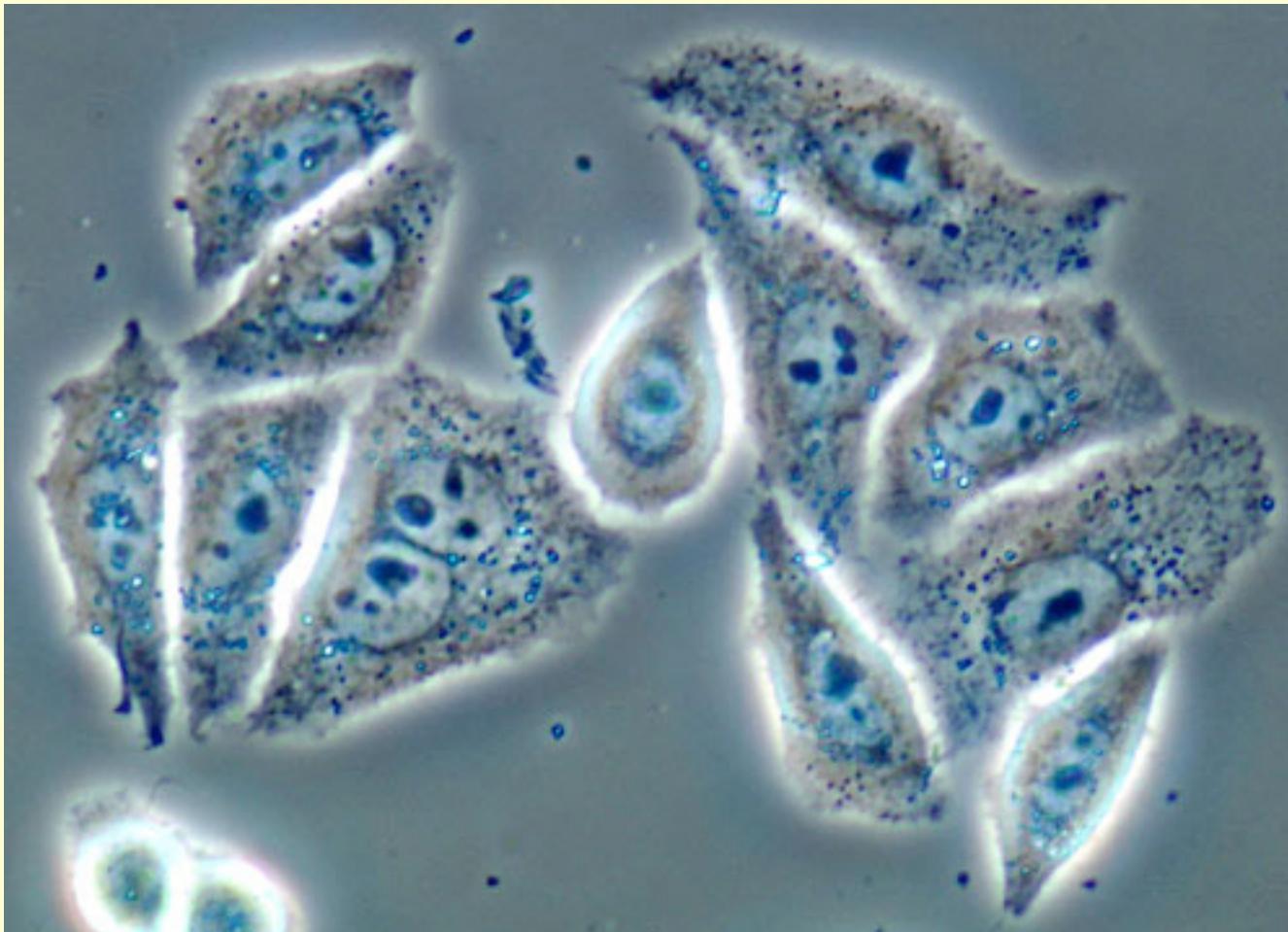
Cancer cells are derived from differentiated cells → mutation leads to proliferative capacity

Module F (Rod Dunbar)

Cancer cells are a useful tool in experimental cell biology

Why?

Because they divide in culture - they are immortal



HeLa Cell Culture

HeLa cells have been cultured continuously for scientific use since they were first taken from the tumor of a woman suffering from cervical cancer in 1951.



THE IMMORTAL LIFE OF HENRIETTA LACKS

Doctors took her cells without asking.
Those cells never died.

They launched a medical revolution
and a multimillion-dollar industry.

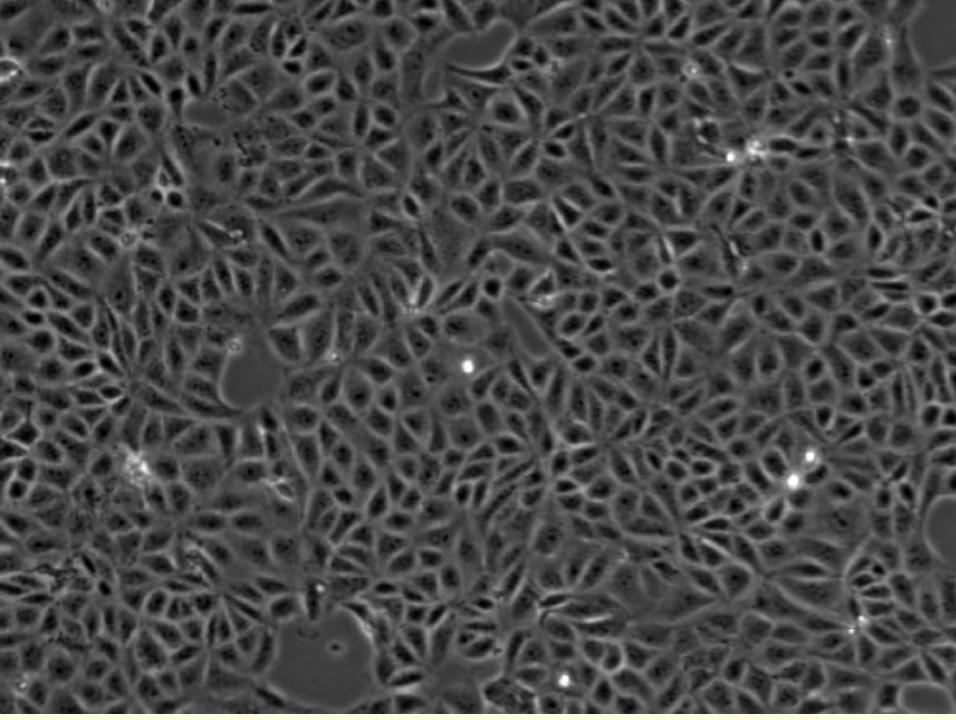
More than twenty years later, her children found out.
Their lives would never be the same.

REBECCA SKLOOT



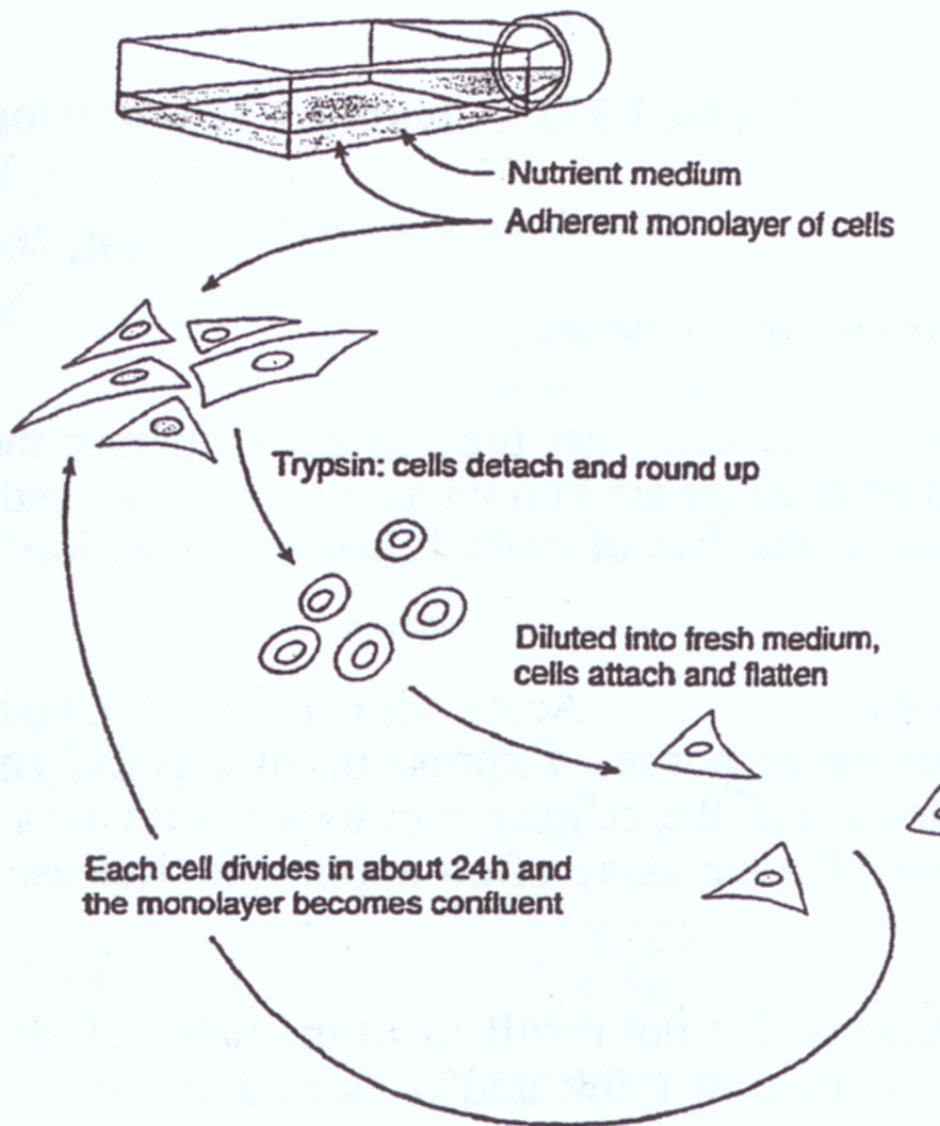
Most cancer cell lines grow by attaching to a surface (plastic) and mitotic cell division.

When the surface area is covered the culture is termed confluent and cells stop dividing



The monolayer of cells can be detached from the plastic, the cells separated by treatment with protease enzymes and diluted into a new culture or stored at low temperature

sub-culturing (or *passaging*) mammalian cells.



Cell monolayers are detached from a substrate by treatment with trypsin.

Cell-cell interactions are broken by addition of EDTA

Pg 47

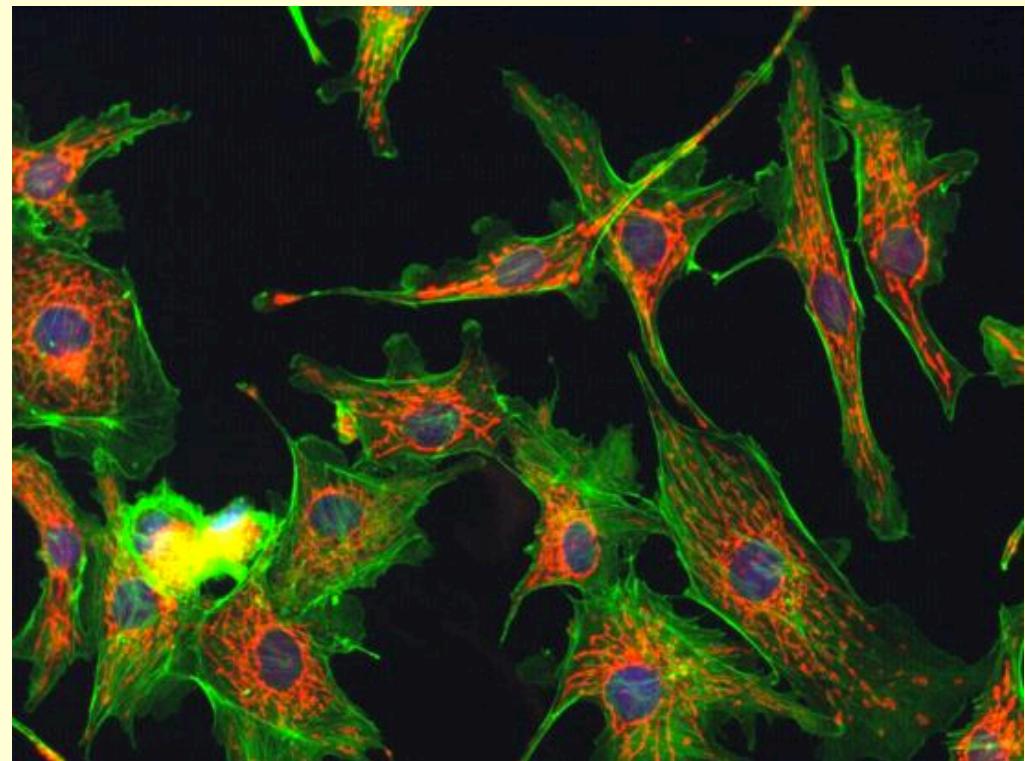
Pg 47

ITION 2028
Tissue Culture Lab

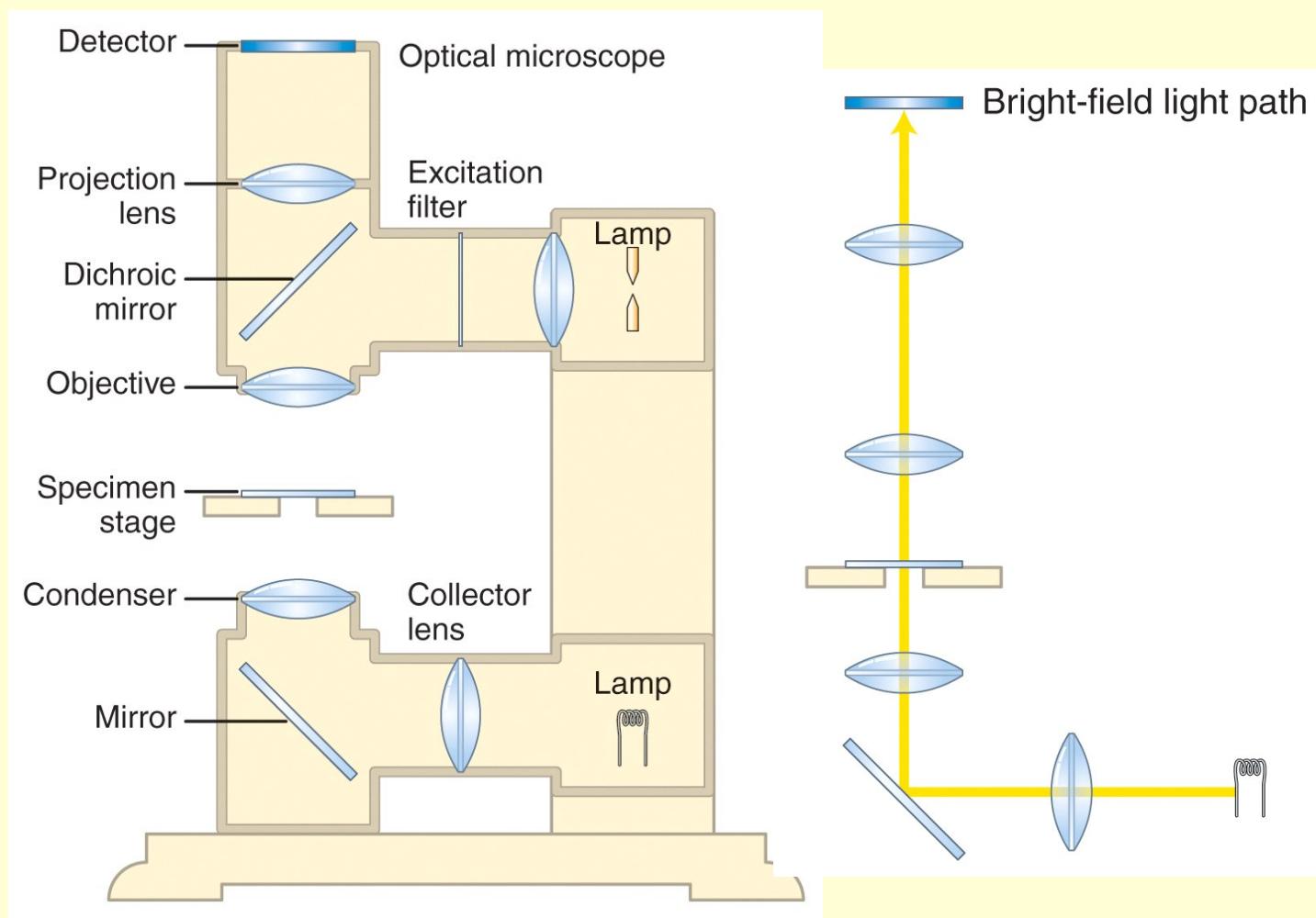
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How can we manipulate cancer cells in culture to obtain information about biological processes ?

Microscopy (Laboratory 1 and 2).



Optical Microscopy (1) Bright Field



See Figure 9-8 Lodish et al (7th ed)

Optical Microscopy (2) Epifluorescence

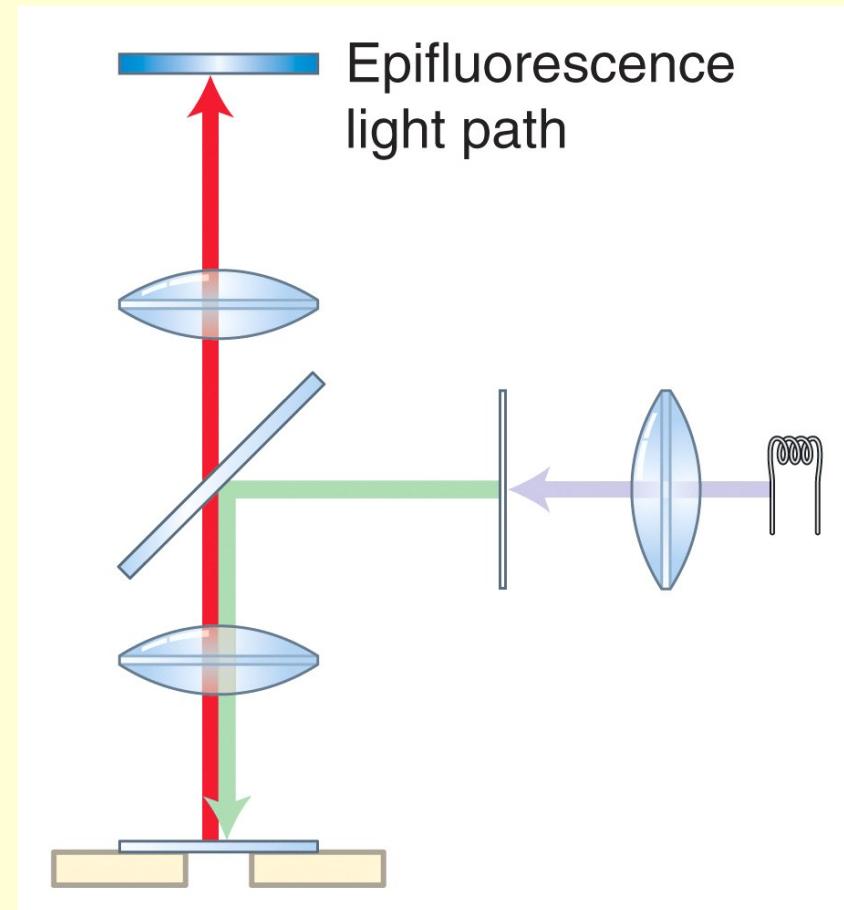
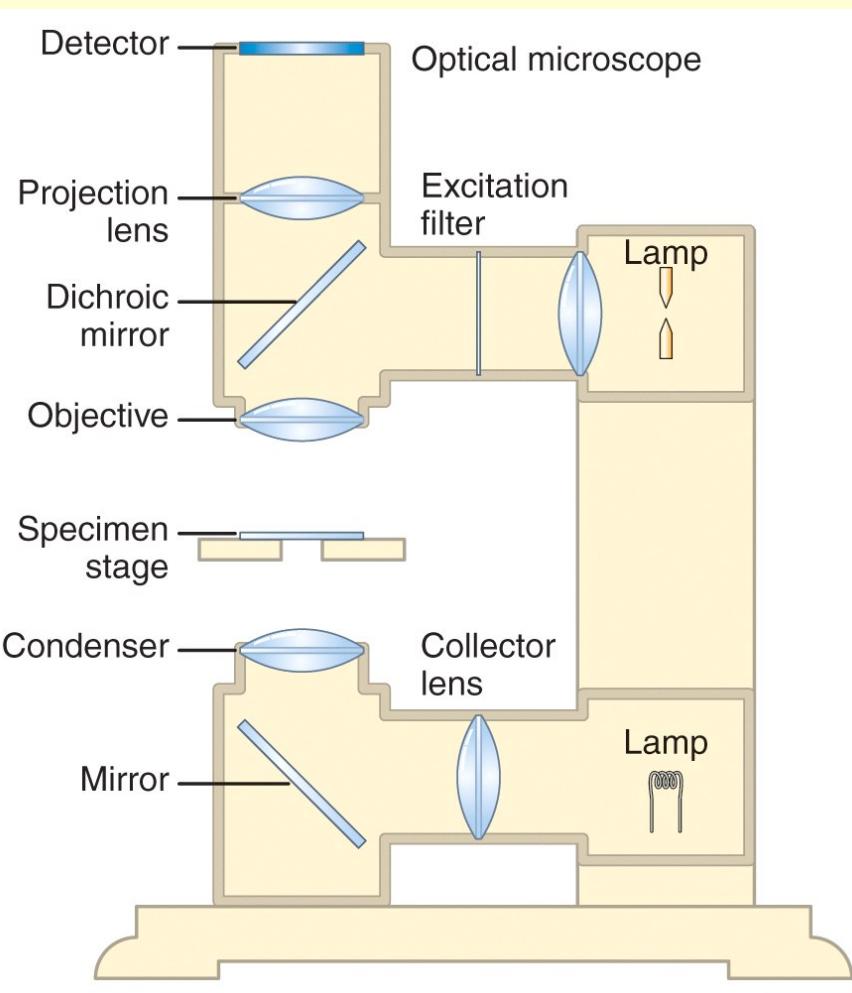


Figure 5-42 Lodish et al 7th ed Figure 9-8

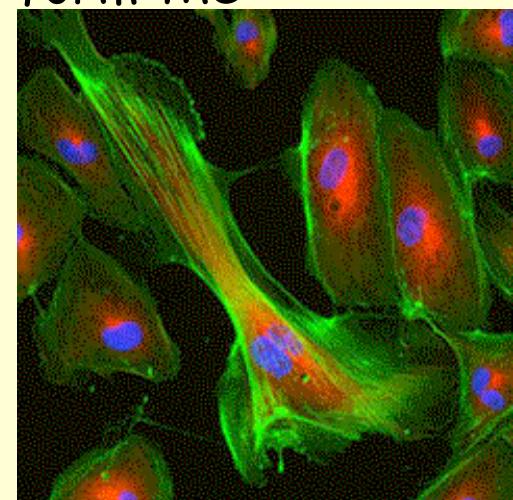
Fluorescence Microscopy

Observation of specific subcellular components by staining with fluorescent chemicals (fluorophores).

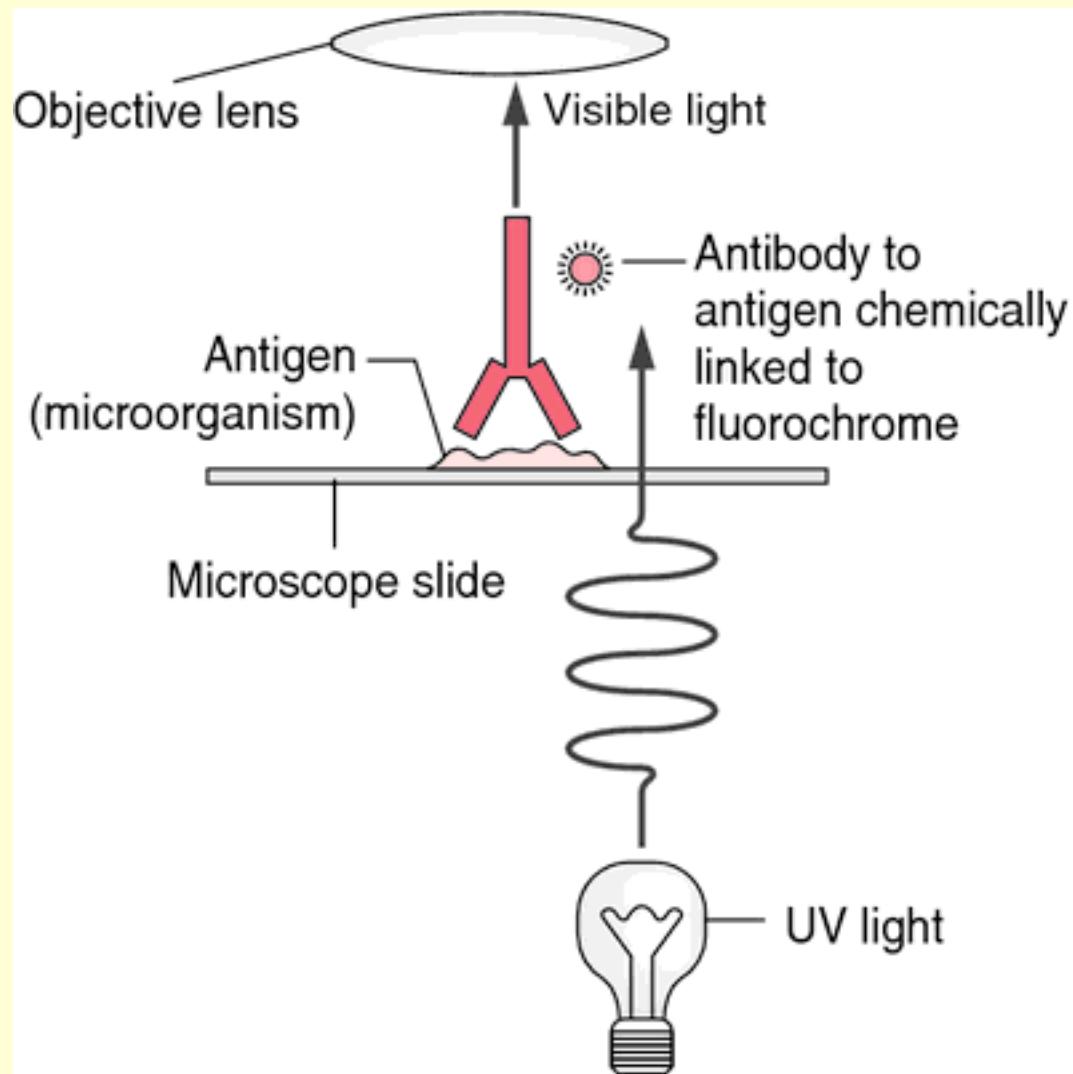
Excitation of fluorophore → emission of light

Only light emitted by the fluorochrome used to form the image.

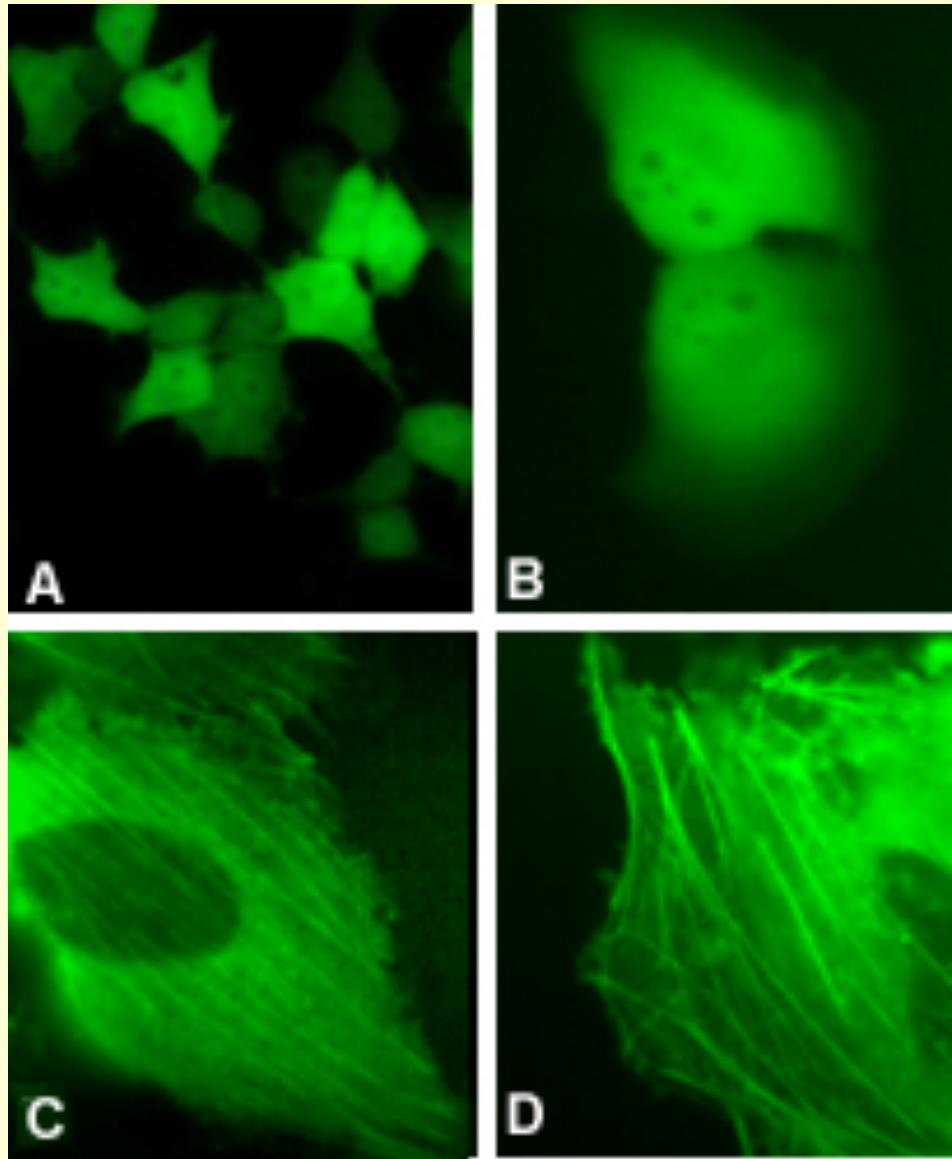
Can use fluorochromes specific for;
DNA, lipid, ions (e.g. Ca^{2+})



Can link fluorophores to antibodies to detect location of individual proteins →
immunofluorescence microscopy



Immunofluorescent microscopy (see also
Lodish Fig 9-13)



HeLa cells: A+B = GFP; C+D GFP-actin

Genetic modification of cells in culture can aid visualisation of subcellular components.

Use of naturally-fluorescent proteins

GFP from *Aquorea victoria*



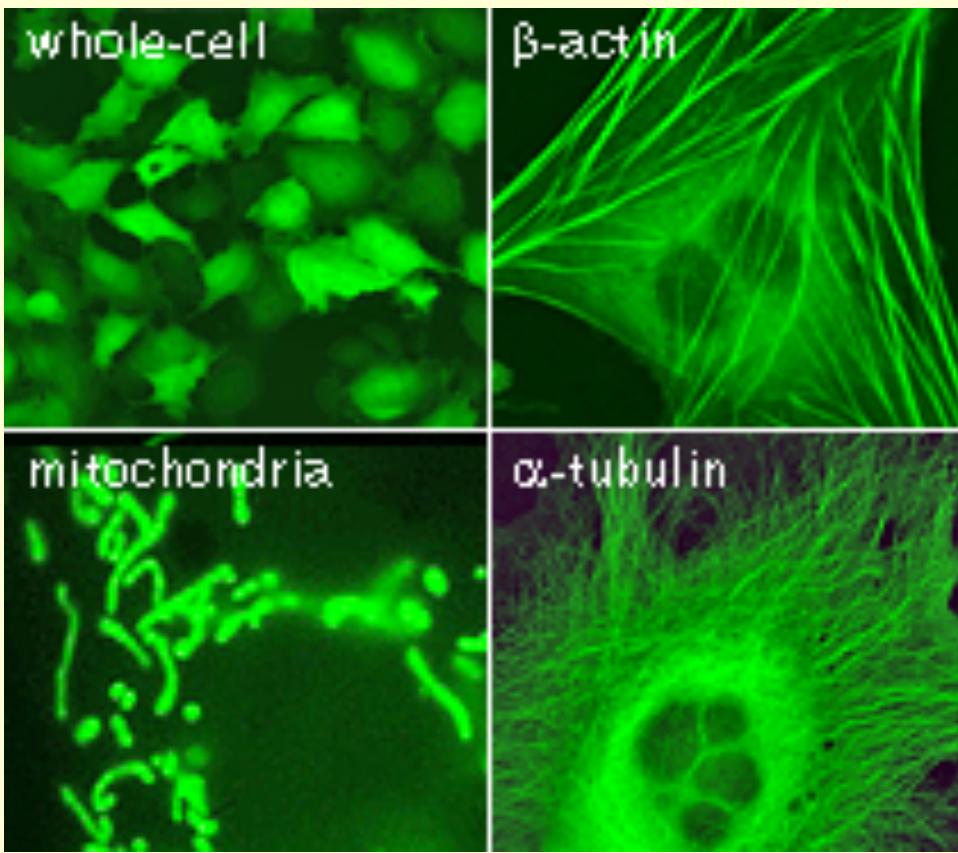
Transfection is a process by which genes are introduced into mammalian cells in culture by mixing DNA with lipids.



DNA sequence encoding Promoter + GFP



DNA sequence encoding Promoter + GFP fused to Gene X



Using genetic engineering techniques and transfection - any cellular protein can be synthesised as a GFP-'tagged' derivative to reveal information about its position and movement.

http://www.nobelprize.org/nobel_prizes/chemistry/laureates/2008/press.html