



Cell
EXPLORERS



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For what's next



NUI Galway
OÉ Gaillimh

School of Natural Sciences

Cell EXPLORERS

Cellular and molecular biology in the primary school classroom

Scientix Future Classroom Lab



M. Grenon, PhD & S. Mc Guinness, PhD, NUI Galway

Scientix, 28 June 2018, Brussels

Content of this workshop

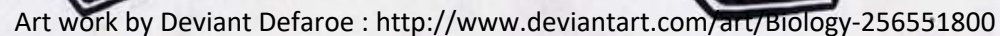
- Introduction
 - Inspiration
 - Modern Biology
- Hands on Activities
 - Little Cells - Cellular Biology
 - Fantastic DNA – molecular Biology
- Conclusion
 - Activity suggestions
 - Resources

Course objectives

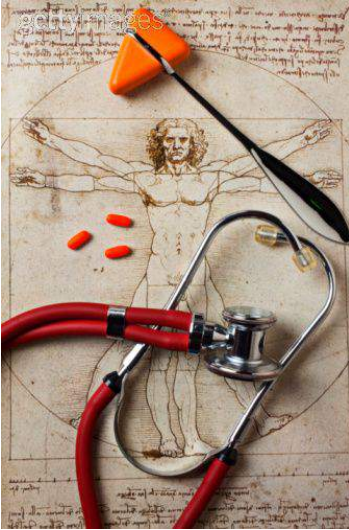
After this workshop you will be able to:

- Understand and explain the basic concepts of cellular and molecular biology in lay term
- Run hands-on activities on these topics in your classroom

Cellu
Biolo



Why is it important?



1. Medicine of the future:

- Personalised:
 - based on genomic information
 - Will reflect what your cells can or cannot do
- New technology
 - Faster drug development process
 - Cell/Tissue specific
 - Preventive (Test)
 - Corrective (DNA)
 - Regenerative (Organ, tissue)



2. Health & society implications:

- New profession
- New technological need
- New ethical impact

How does this workshop work?

- This is a teacher presentation pitched at your level
- You will do activities as the children would
- The presentations aimed at children, and resources, to run activities in the classroom are in the teacher section of our website
- www.cellexplorers.com:
 - Free login
 - Little Cells, Fantastic DNA as today
 - Other resources

Little Cells

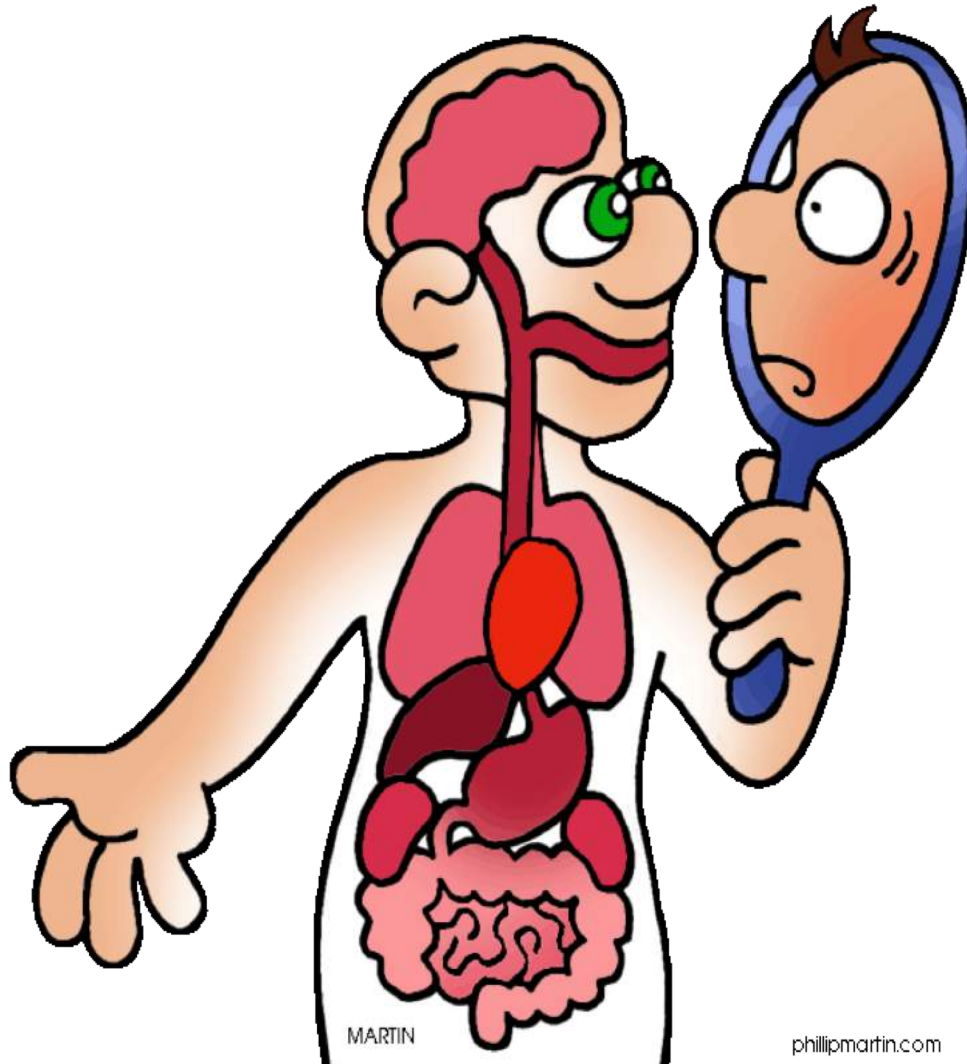
An introduction to Cellular Biology

5-8 years old

Key concepts

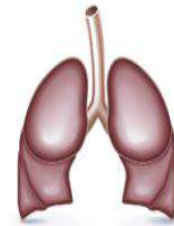
- Essential functions of body carry out by organs
- All body parts are made of cells
- Cells are the smallest unit of life
- Cells going specific jobs have specific shapes
- Cells work together in our body

What are we made of?



phillipmartin.com

Resources:
Little Cells Presentation
The Body Games



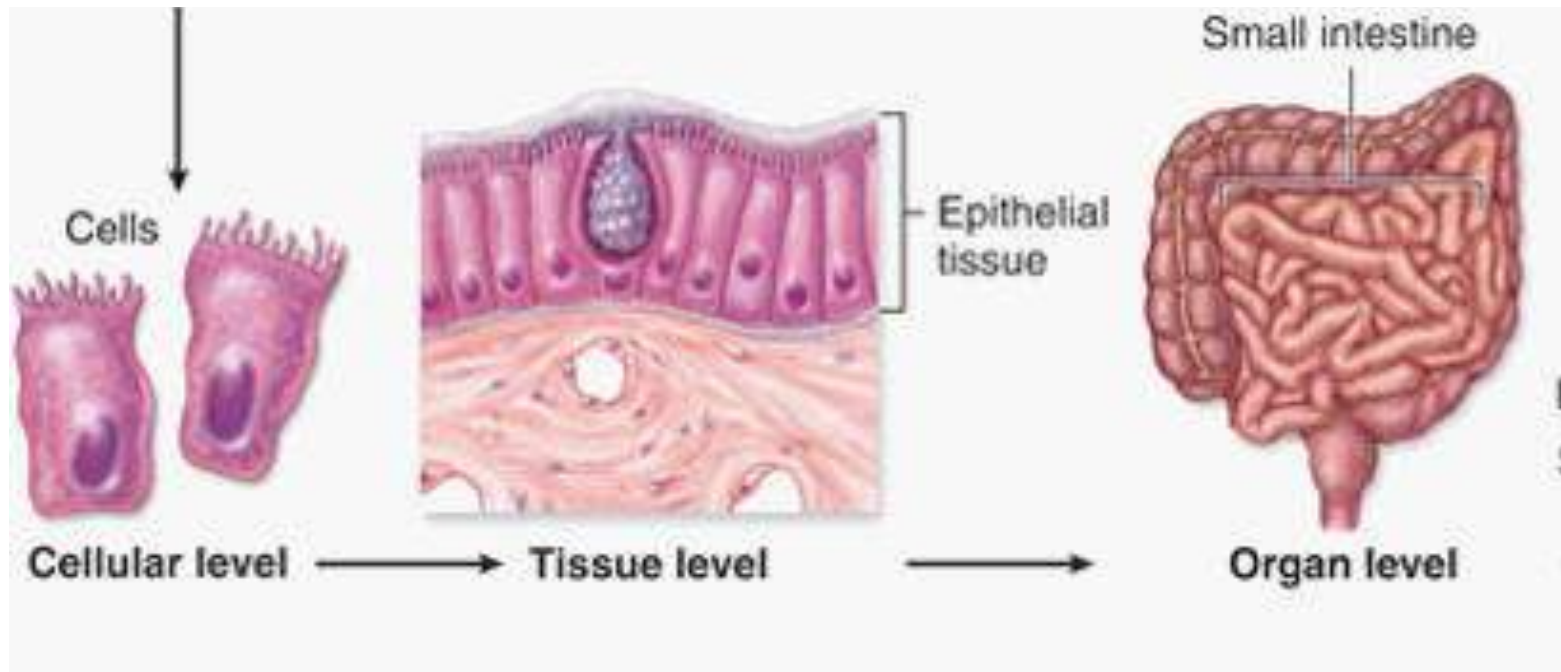


Hi!

The Body Game

What are organs made of?

Resources:
Little Cells Presentation



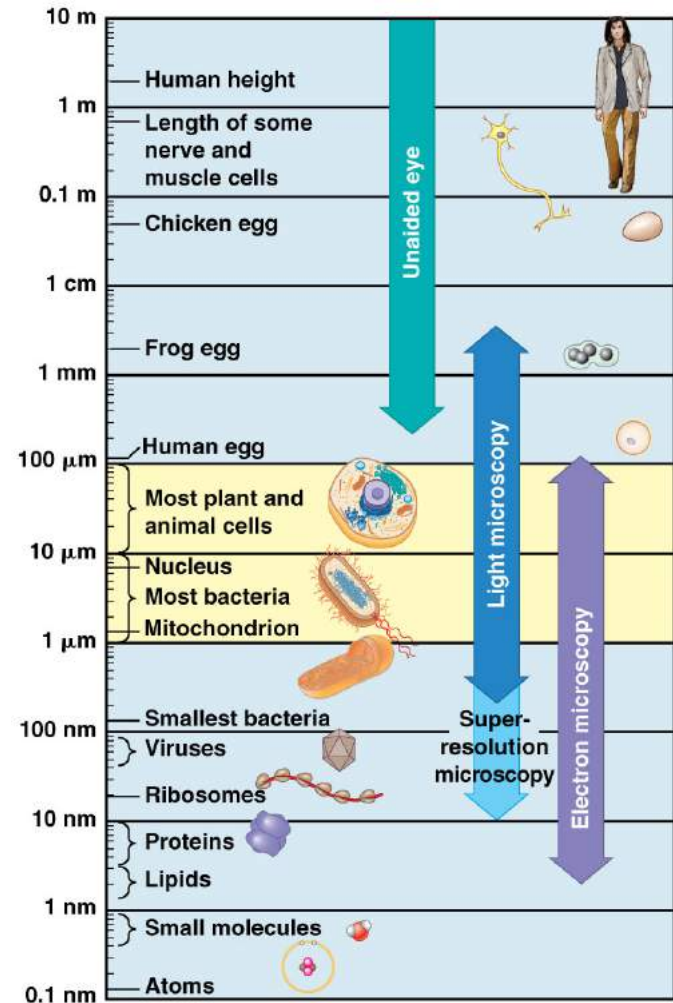
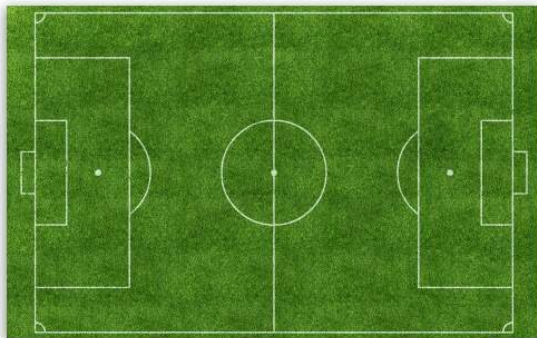
- 100 000 000 000 000 of Cells in our body
- Very small : 10 to 100 micrometers
- They do specific jobs: 200 Cell types
- They look different depending on the job they do

How small are cells?

Resources:
Little Cells Presentation
The Sizing Game



Cell



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How small is a cell?



Out of all these pictures which of these is the biggest and which is the smallest?

Label them from 1 to 8: Number 1 is the biggest and number 8 is the smallest.

1

2

3

4

5

6

7

8



LARGEST

SMALLEST

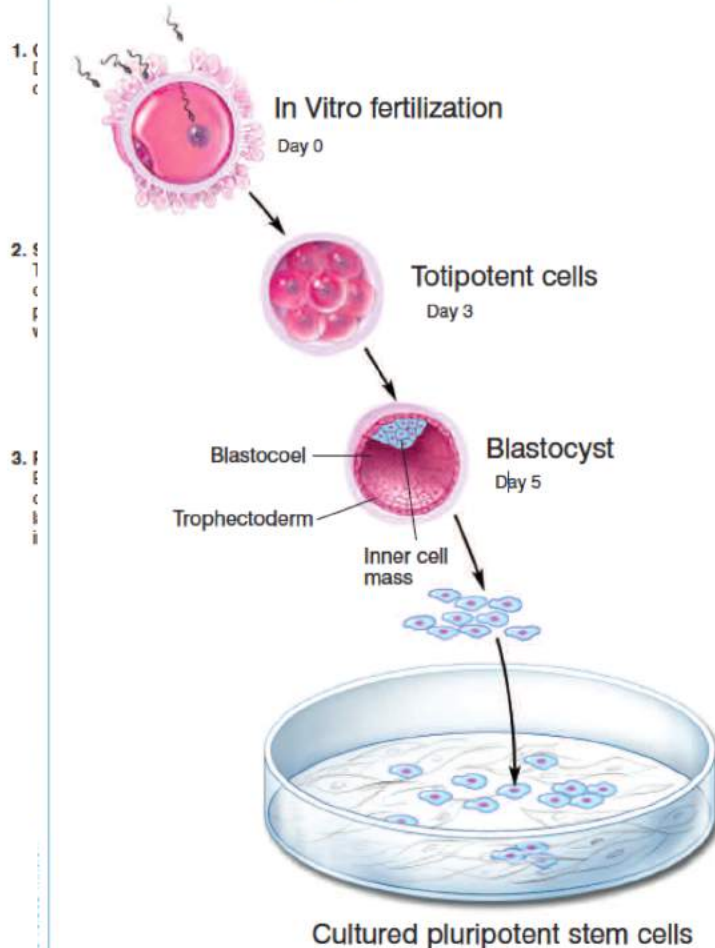
From 1 cell type to 200

Resources: (8years old+)
Amazing cells Presentation

Origin

- Fertilization of egg by sperm results in a zygote
- Zygote divides rapidly to form a compact ball of cells called a **morula** - **totipotent**
- Self-renew indefinitely to produce more stem cells
- Create any cell type of the body: **Morula** develops into embryo consisting of a small hollow cluster of cells called a **blastocyst**
- Two layers to the **blastocyst**
 - Outer layer forms the placenta
 - Inner cell mass is the source of **human embryonic stem cells (hESCs)** **pluripotent**

How Human Embryonic Stem Cells Are Derived



Adult stem cells example: Mesenchymal stem cells (MSCs)

Multipotent stem cells found in bone marrow

Resources: (8years old+)
Card game by Curam

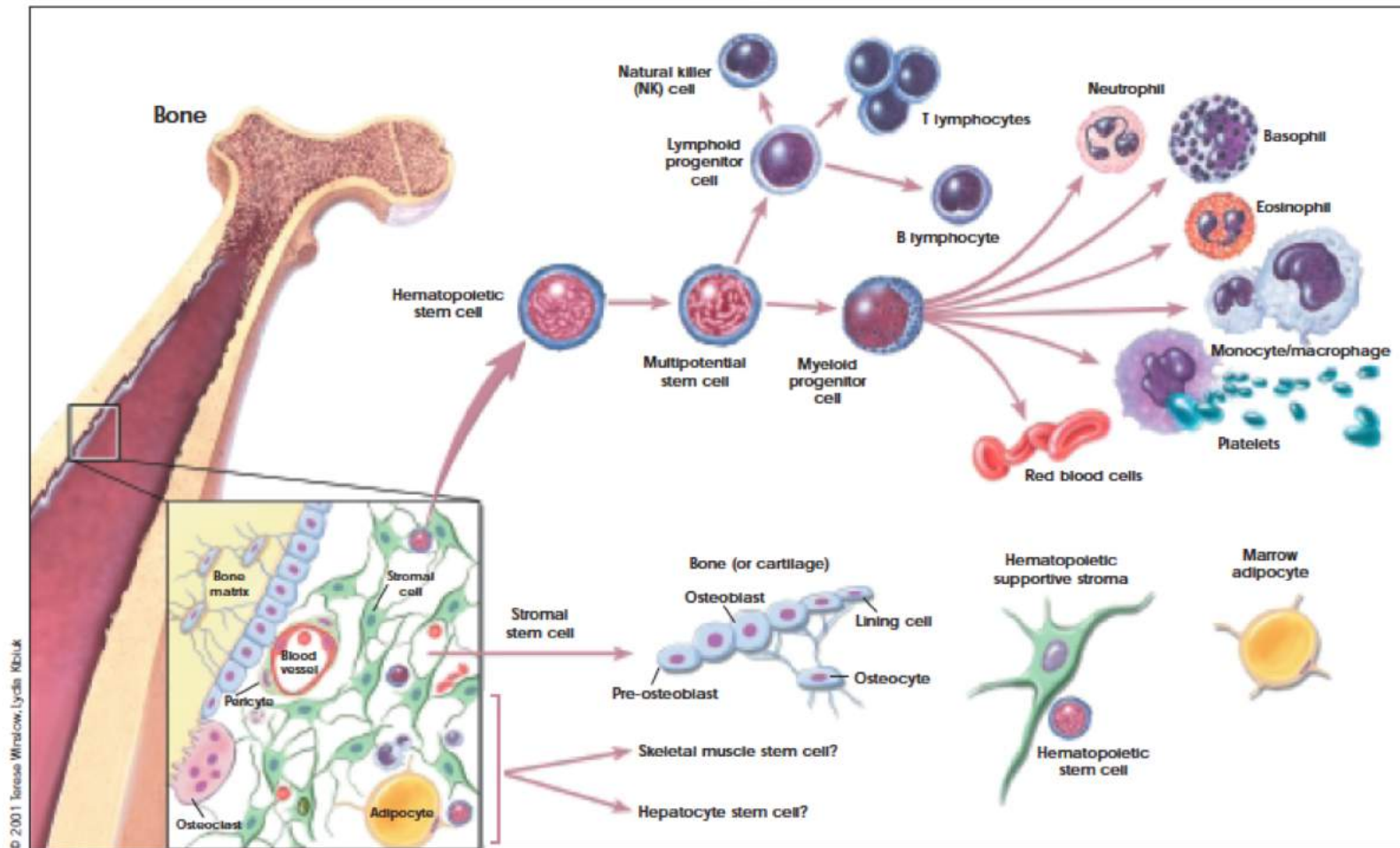
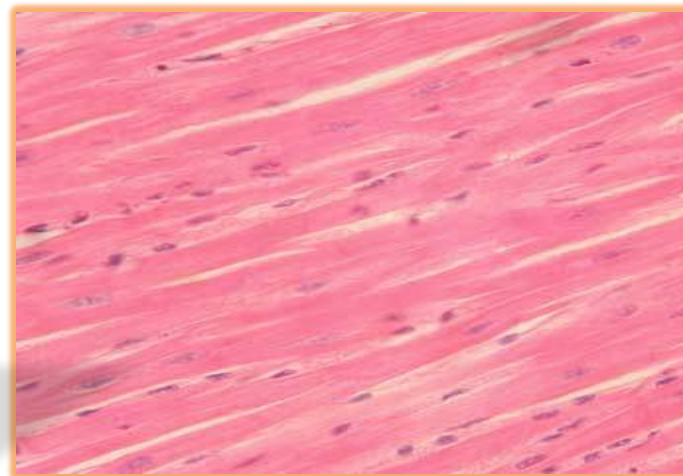


Figure 4.3. Hematopoietic and Stromal Stem Cell Differentiation.

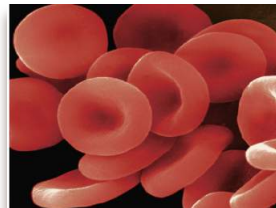
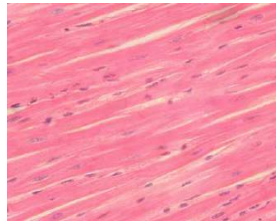
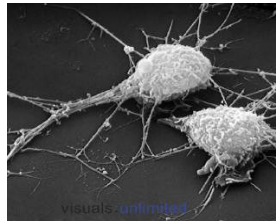
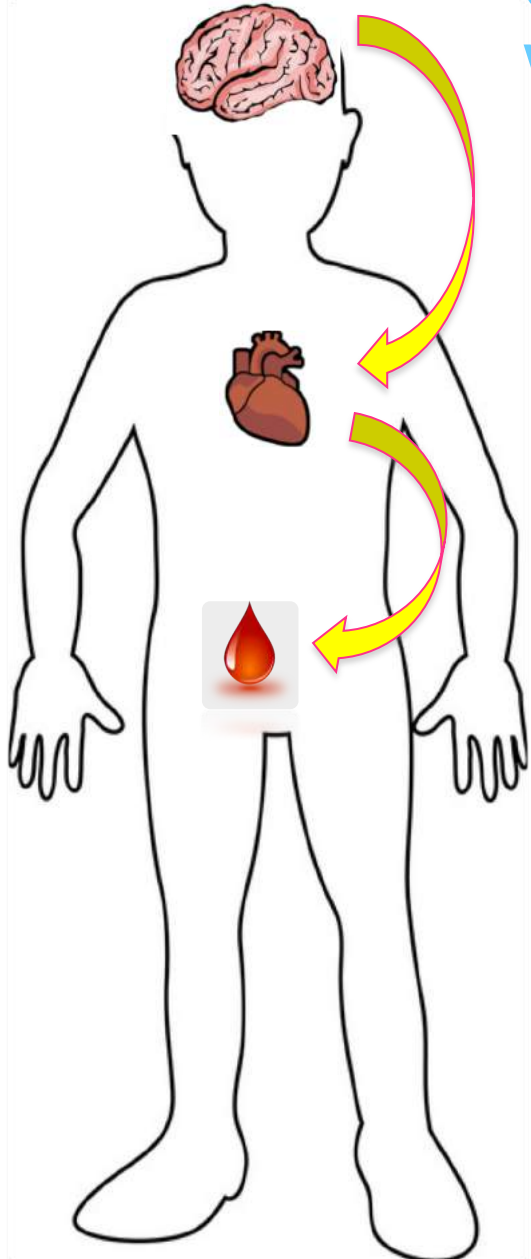
We have many different cells!



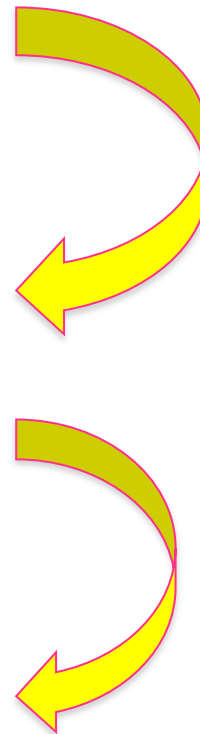
Around 200 different cell types!

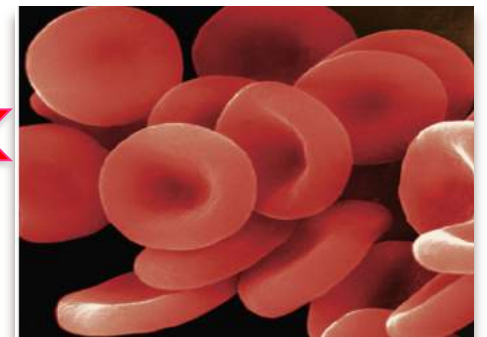
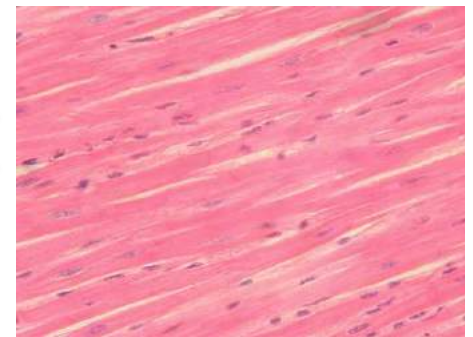
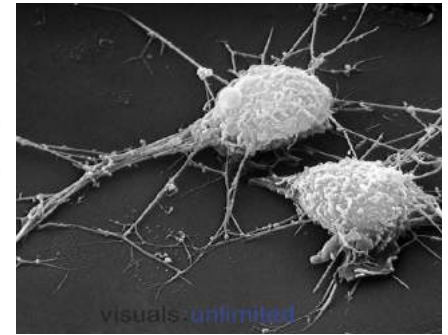
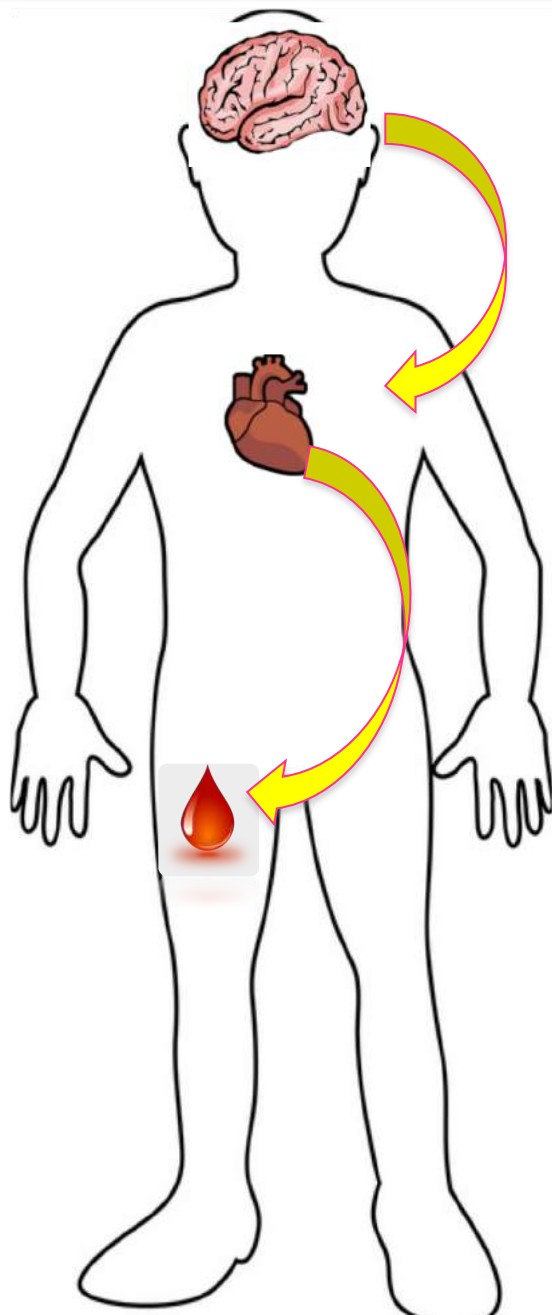


Cells *communicate* to make the body work properly!



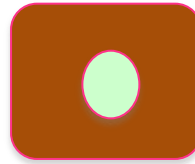
Resources:
Little Cells Presentation
Playing Little Cells Game





Brain and Nerves

1



Teachers Table +
Buzzer!

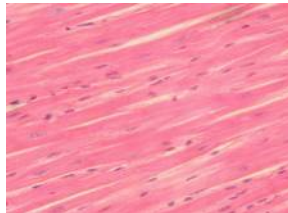
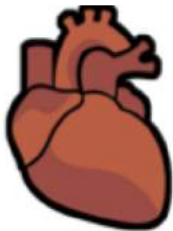


3



Blood and Red Blood Cells

2



Heart and Heart cells



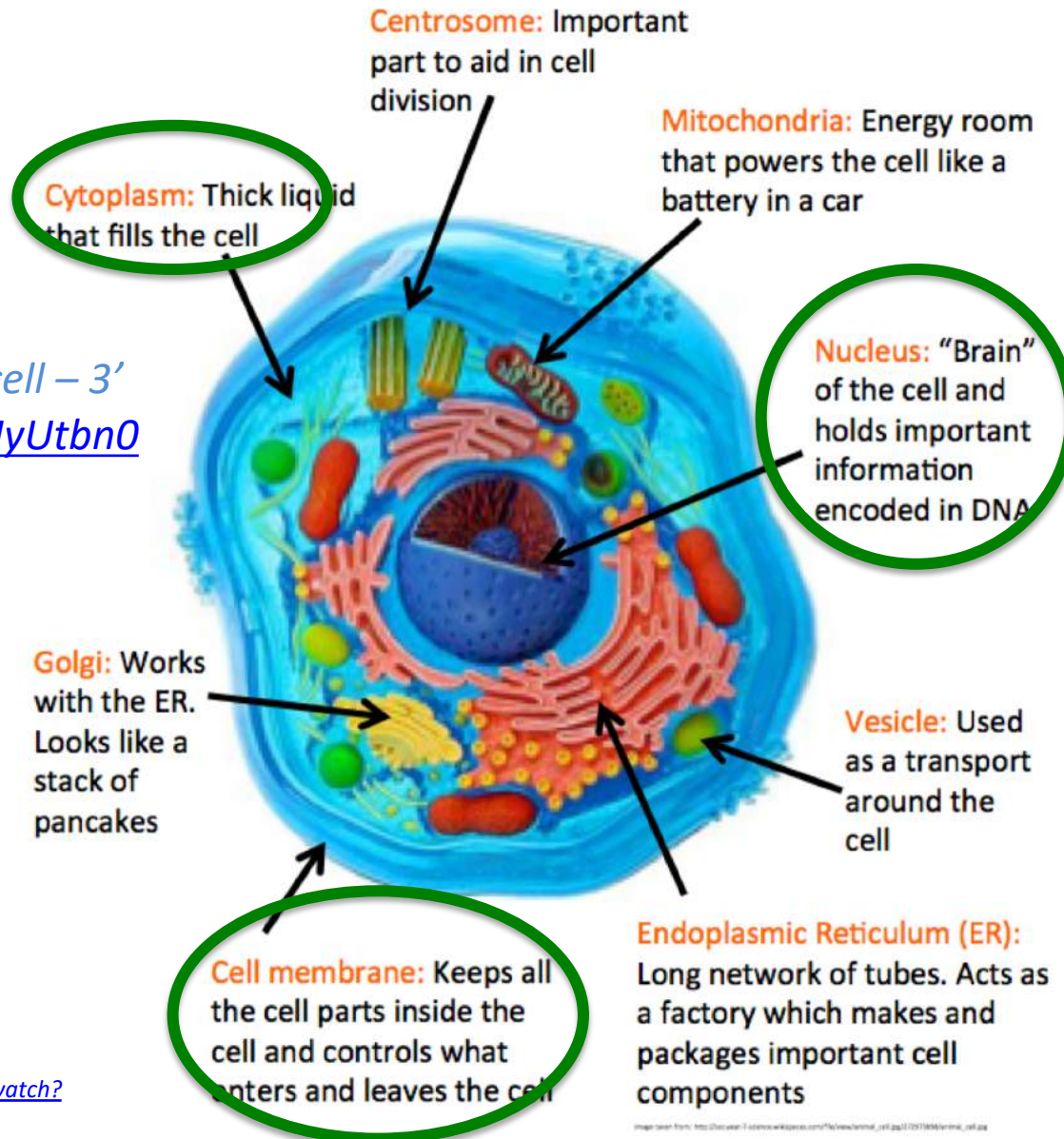
Fantastic DNA

An introduction to Molecular Biology

8 - 13 years old

Parts of the cell

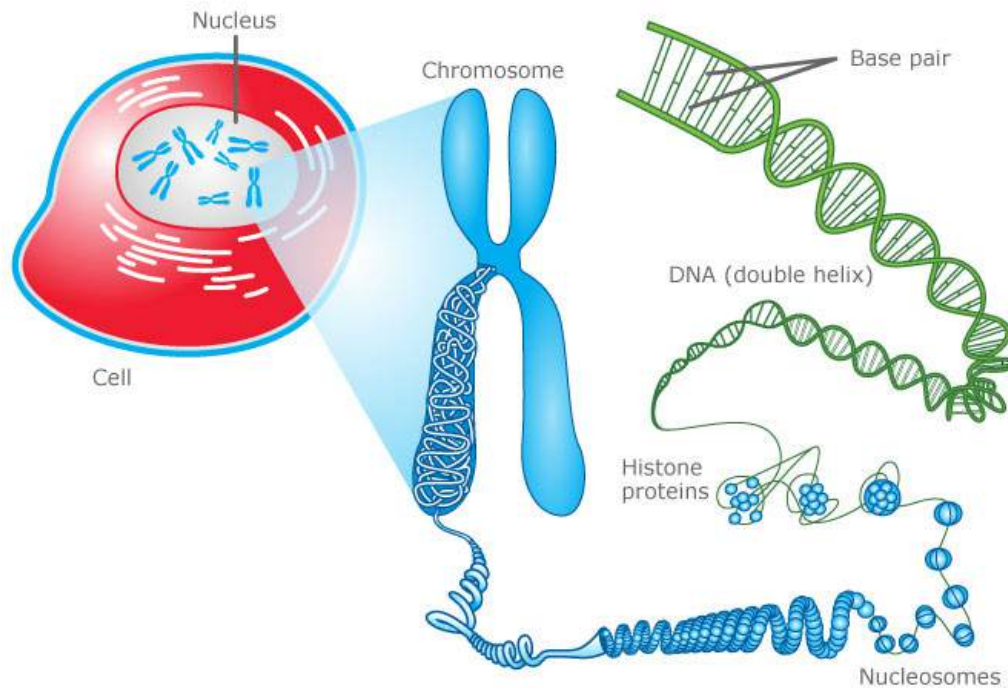
Resources:
Fantastic DNA Presentation



Youtube Video:
The inner life of a cell – 3'
<http://youtu.be/wJyUtbn0Q5Y>

Long narrated version:
<https://www.youtube.com/watch?v=FzcTgrxMzZk>

DNA is located in the cell nucleus



Resources:
Fantastic DNA Presentation



1. Contain cellular instruction
2. Instruction encoded in a 4 letters code
3. Species specific
4. Highly structured to allow its replication

DNA structure discoverers

Francis Crick

James Watson

Rosalind Franklin



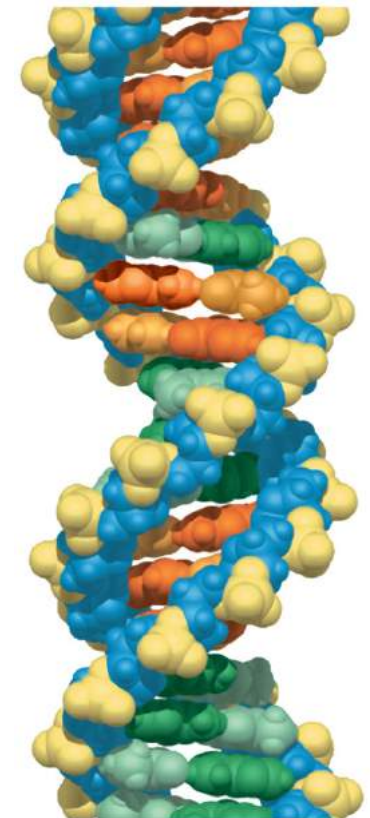
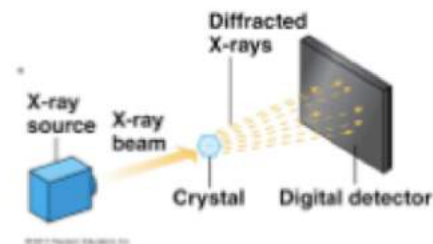
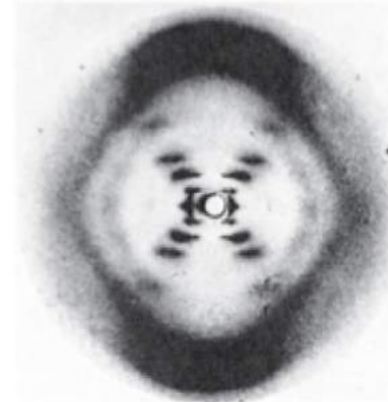
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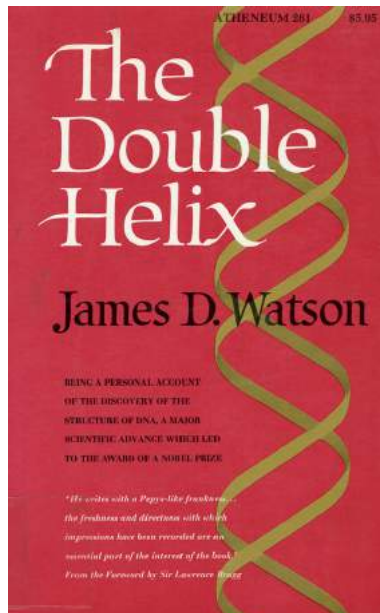
Resources:
Fantastic DNA Presentation

X ray diffraction image of DNA



(c) Space-filling model

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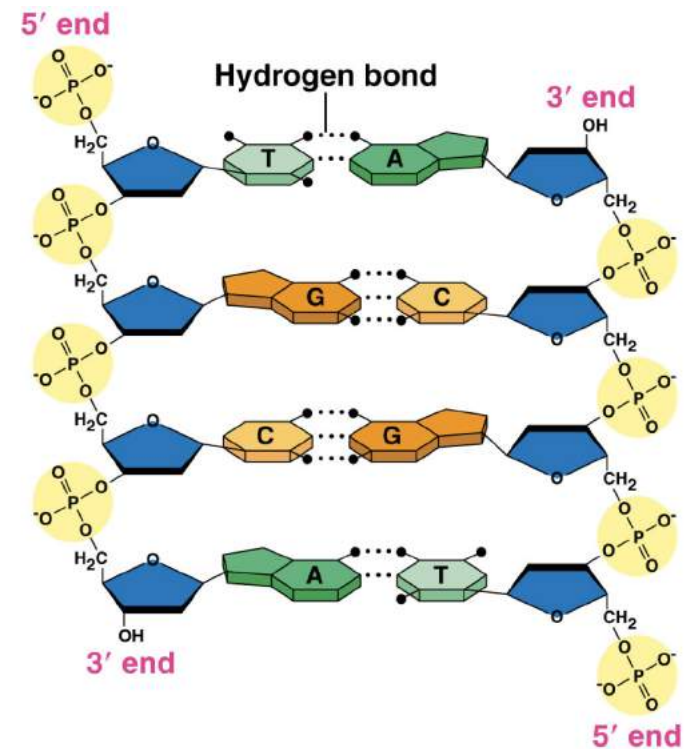
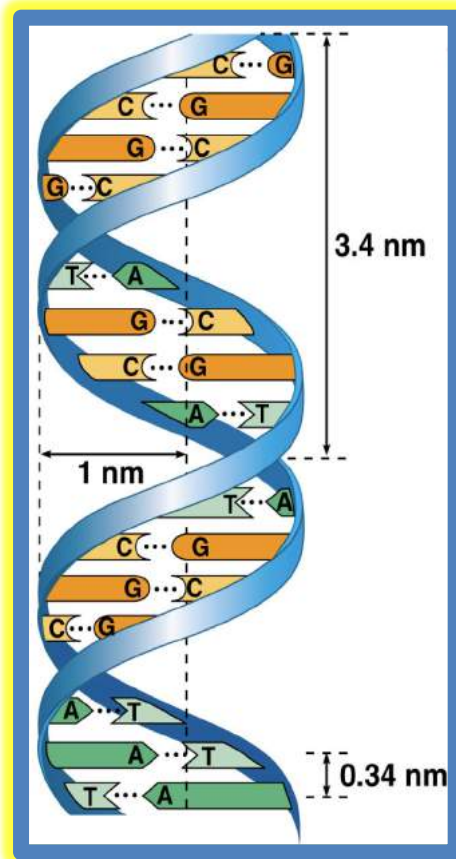
DNA structure – DNA rules

A with T, C with G

Resources:

Fantastic DNA Presentation

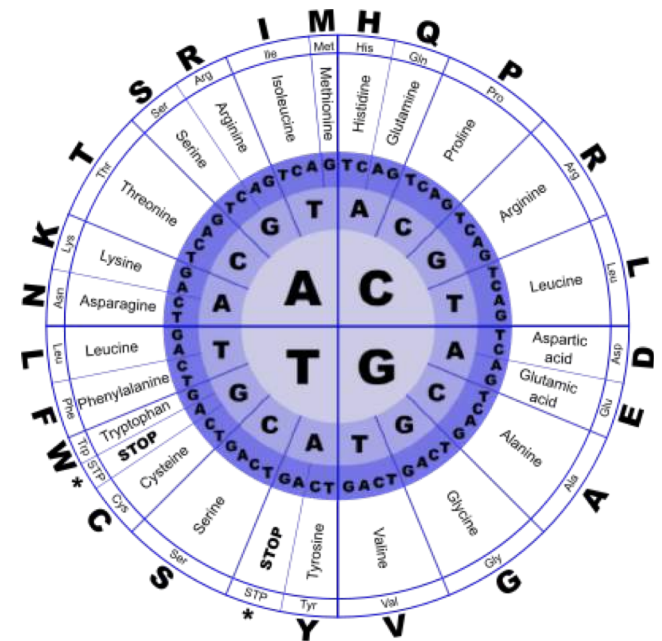
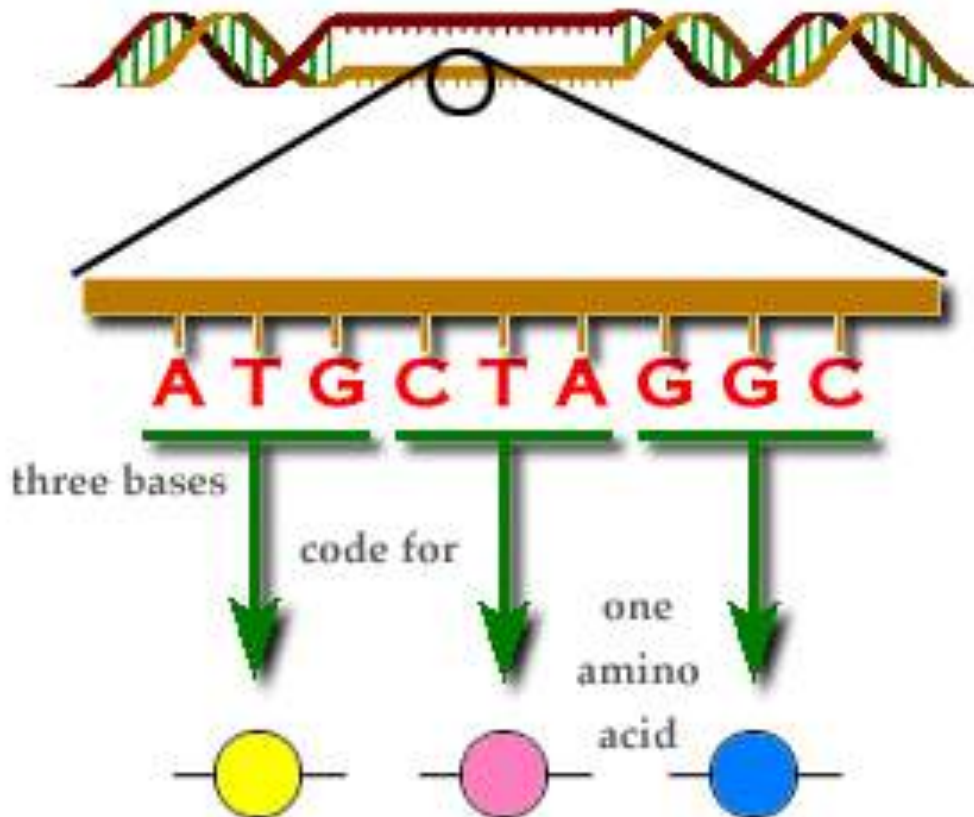
Model Building resources on Website



Reading the code

Resources:
Fantastic DNA Presentation

The Genetic Code



Extracting DNA

Resources:
Fantastic DNA Presentation
DIY DNA experiment

- Basic step in DNA profiling, diagnostic and engineering experiment
 - Extracted
 - Amplified/sequenced
- **Principle:**
 - Free up the DNA from:
 - Membrane: **mashing, soap**
 - Proteins: **salt**
 - Render DNA insoluble to collect it: **alcohol**

Activity:

Do it yourself DNA extraction

- Step 1: Collect what you need according to your checklist
- Step 2: Let's follow together the "how to do it" instruction (protocol)
- Step 3: Report on what you have done on your poster

Checklist for a pair of children

- ☐ 1 x teaspoon of Salt
- ☐ 1 x Liquid Soap
- ☐ 2 x Plastic pint glass filled with water
- ☐ 2 x A plastic Sandwich bag
- ☐ 2 x Coffee filter paper
- ☐ 2 x Wooden stirrer
- ☐ 2 x Pairs of gloves
- ☐ 1 x Banana
- ☐ 2 x Small Plastic Cups



What you can do in the classroom:

- *Variation on measure:*
Measuring volume, Weight
- *Check importance of each component*

Resources:
DIY DNA experiment

Poster report and presentation

Resources:
Poster template



Cell EXPLORERS Fantastic DNA Poster Session

Authors: _____

School: _____




Title: _____

Aim: _____


Results and Conclusion

What did you like best?


What did you find difficult?

Step	Diagram	Why do we do this?
1. Smash banana in plastic bag and mix with salty solution		Fill me in!
2. Filter to recover 5 mL of liquid		Fill me in!
Fill me in!		Fill me in!
Fill me in!	Fill me in!	DNA is <u>insoluble</u> in ethanol (it will not mix with it). After this step, DNA will float to the top separating it from the cell suspension.


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Galway Science & Technology Festival



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Youth Academy



Title: _____

Authors: _____

School: _____

Aim:

- What was the question?
- What did you want to find out?

Results:

In summary what happens during the experiment?


Conclusion:

By looking at the results obtained what is the answer to the question you asked?


Procedure:

- What did you do?
- How did you do it?
- Why did you do it?


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Youth Academy

Cell EXPLORERS resources

- **Resources:** in 'Teacher Zone' page of www.cellexplorers.com
- Currently not on Scientix yet
- Let us know what you want to have translated (if any)

Other resources – Biomedical Sciences with CURAM

- CURAM teacher in residence programme:
- Lesson Plan Kits developed by teachers in collaboration with Scientists
- Available to download:

<http://www.curamdevices.ie/curam/public-engagement/teachers-in-residence/>

Stay in touch!

- If you use the resources please let us know
 - pictures
 - summary
 - link to class blog
 - modifications

Contact us if you have any question:

Shanemcguinness@nuigalway.ie,

Muriel.grenon@nuigalway.ie

Thank you!

Please fill out the evaluation form