



Irish Science Teachers' Association
Eol Oidí na hÉireann

Saturday April 1st , Room 8A702, 2.40pm & 3.30pm
Irish Science teacher Association Annual Conference 2023
Afternoon workshops session

Engaging students in cellular biology with Cell Explorers

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Scoil na nEolaíochtaí
Bitheacha agus Ceimiceacha
School of Biological
and Chemical Sciences



Who are we?



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Director of Cell Explorers*
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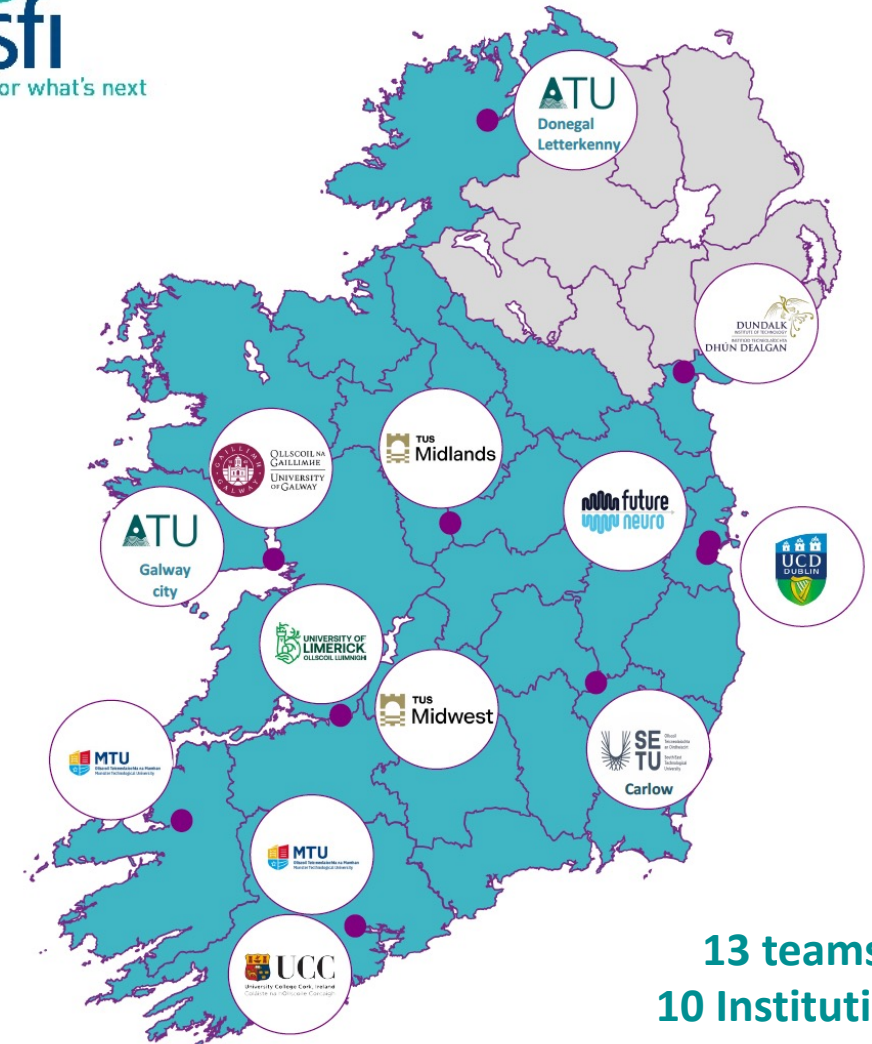
Dr Talia Arcari

*Postdoctoral researcher
National Coordinator*
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The Cell Explorers Network



- science outreach programme
- Volunteering programme
- Double educational benefits



**13 teams,
10 Institutions**

Public engagement objectives



Inform, Inspire, Involve



Promote modern biology, biomedical sciences and research



Combat the **stereotypical image** of scientists



Change perceptions on science and inform on **scientific careers**



Contribute towards addressing the **national shortfall** of science graduates



Train the next generation of science communications/educators



@cellexplorers



www.cellexplorers.com

The Cell Explorers Ethos

Based on pedagogical best practices and research evidence

Authentic Science

Participants do **real science experiments**, using laboratory reagents and equipment

Each child does an activity

Helps to increase confidence and **empower participants** in science

One to one mentorship

Provides opportunity to **meet a real scientist** in a meaningful way



About this workshop

Part 1: Engaging in molecular biology with Cell Explorers - 10 mins

- Understand Cell Explorers strategy to widen participation in science
- Potential application in the classroom
- Share access to relevant resources

Part 2: Discovering the Fantastic DNA in a Box Classroom Kit – 15' mins

- Try out the classroom kit
- Ask questions

Part 3: Feedback Completion & Good bye – 5'

Part 1 - Engaging in cellular biology with Cell Explorers



The need to widen participation in STEM

Inequity of access
& under representation



- Women
- Socio-economically disadvantaged
- Minorities

Benefits of widening STEM
participation

Importance of
scientific
literacy in
general public

Increased
Achievement &
developments
in STEM
community



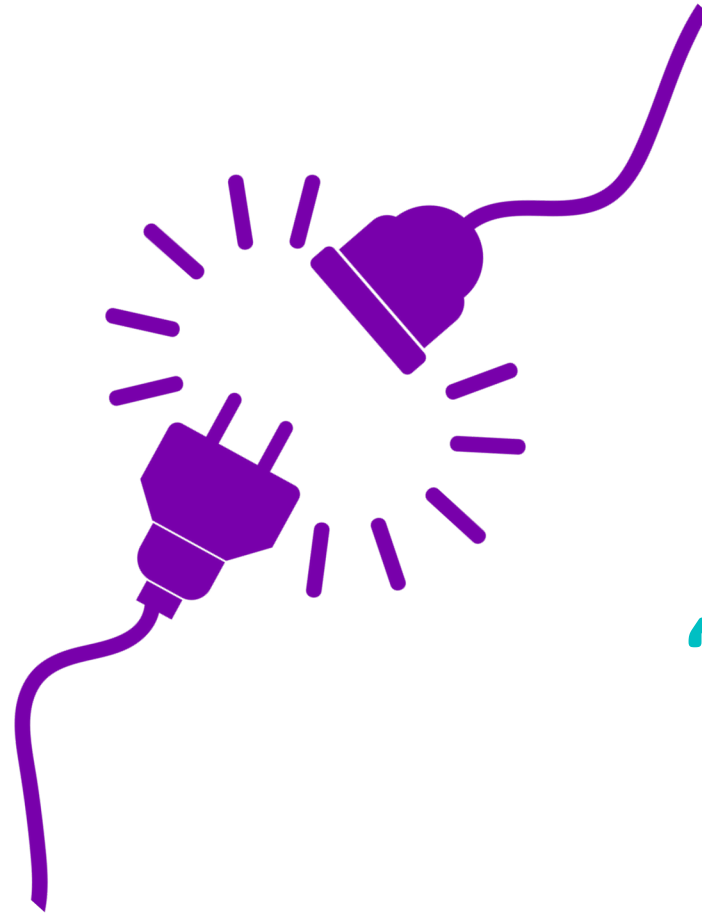
Encourage
young people
from pursuing
careers and
engaging in
STEM

Many young people view science as...

Interesting



Enjoyable




Abstract

Disconnected
from real life

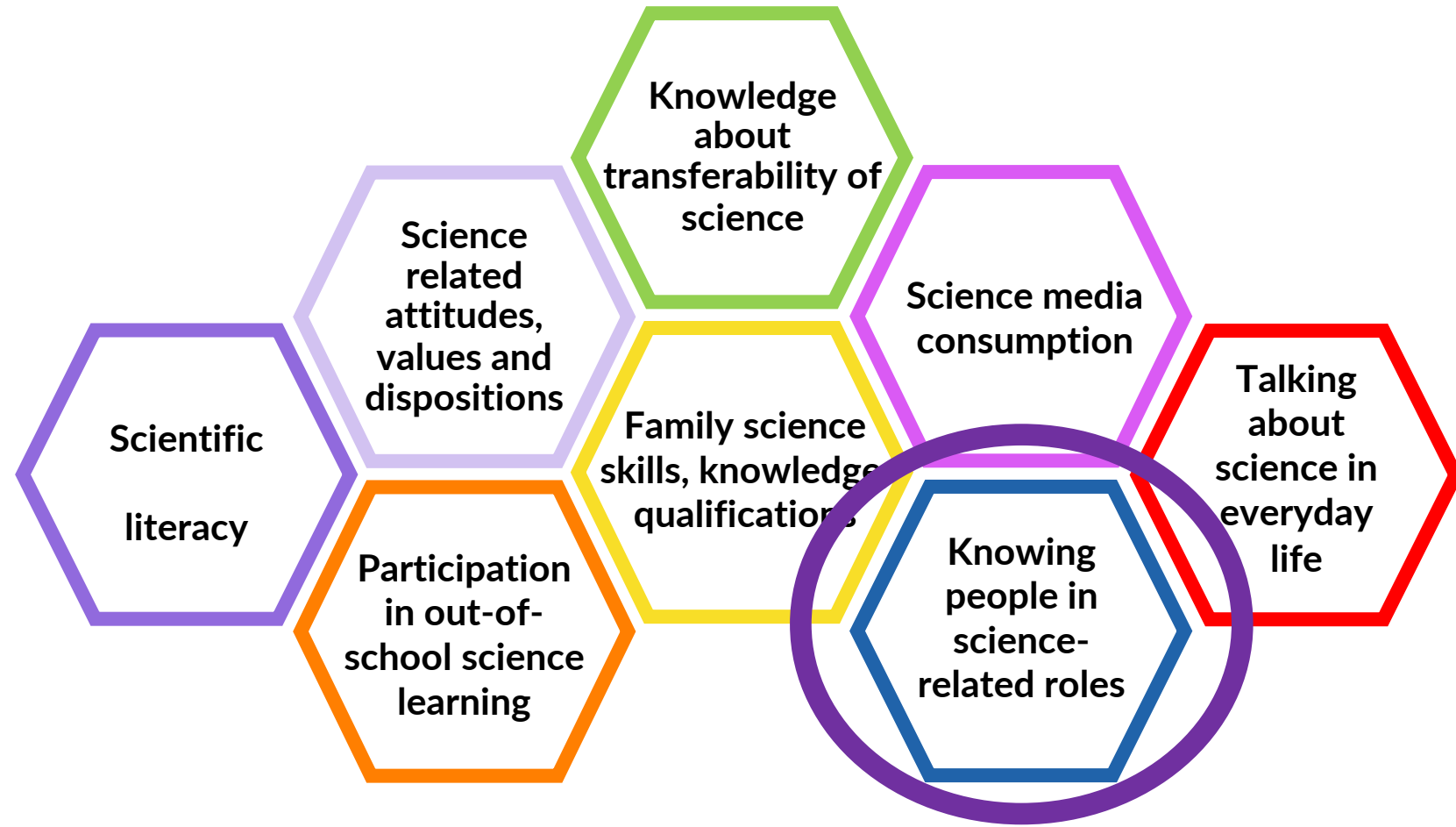
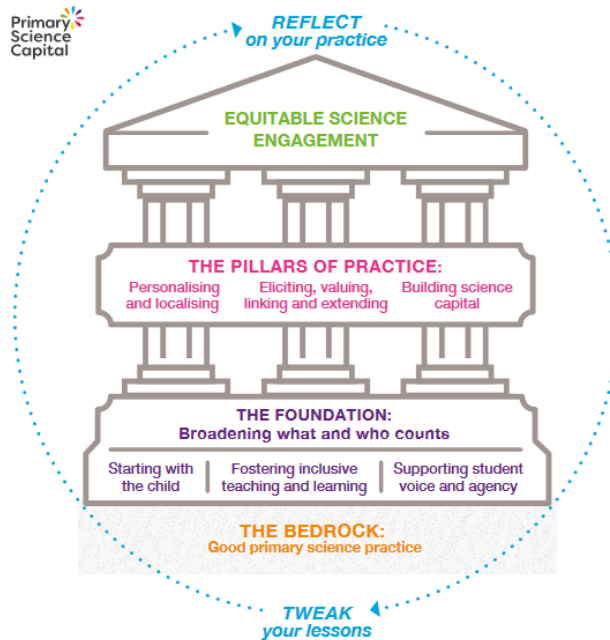
“Not for someone
like me”

The Science Capital Teaching Approach helps more school students relate to science

Impact on



- What they know
- who they know
- what they do
- how they think



Fantastic DNA



Scientific literacy

It provides an authentic & autonomous hands-on experience to children *

Children
(N=627)

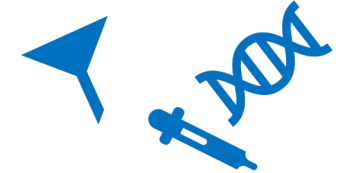


21%

Learning something completely new

I got to do my first experiment without someone doing it for me

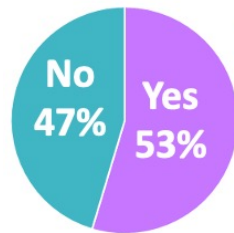
* Improves children's confidence to do skills of the session and answering questions on Cells & DNA



Knowing people in science-related roles

It supports children's social science capital by meeting a real scientist *

Have you met a scientist before?



99% liked meeting the CE scientists because...

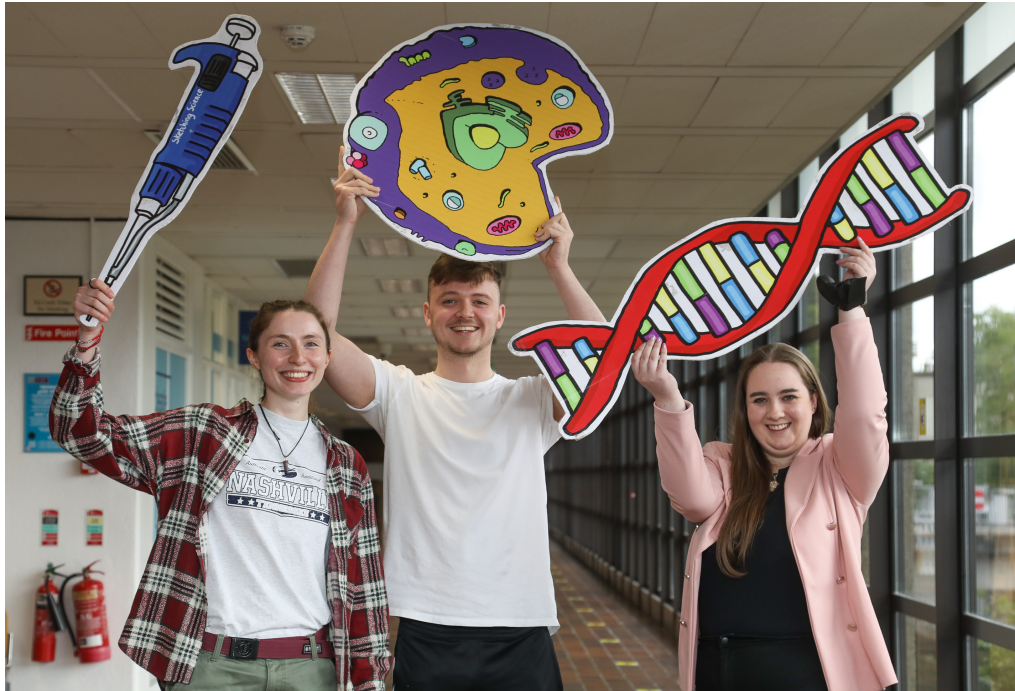
1. They were helpful 15%
2. They were nice/fun 12%
3. Learned about science/what a scientist does/did science 9%

*



- Children view CE scientists as **competent in science**
- their confidence is increased by the **positive atmosphere & helpful guidance** provided by the CE scientists

Scientists Q&A can contribute to Science Capital



- Act as behavioural models
- Represent the possible
- Inspire
- Builds science capital

Knowing people in science-related roles

Meeting scientists inside and outside the classroom

Scientific literacy

Answer science questions **accurately** and using appropriate, easily understood language!

Knowledge about transferability of science

Talk about the **transferrable skills** they gain from science and the range of **non-typical careers** available to students after they graduate

Science related attitudes, values and dispositions

Actively dispel and **address misconceptions** about science and scientists

Meeting the Cell Explorers scientists = evidence for impact

The scientists are perceived as relatable and interesting

"Hearing about their lives gave me an idea of what being a scientist is like and if I want to do it"

82% children agreed that scientists are like normal people

"They are pretty similar to us"

"I thought they were nerdy but they are actually cool"

61% think they are able to study science more than before the intervention

50% feel like they can do science more than before the intervention



When you invite a scientist in your classroom

Ask them to

**Broaden
perceptions of
Scientists**



**Interact with the
students**



**Address misconceptions
& stereotypes**



What should they talk about?

Science



- Their scientific area of expertise – without using jargon
- Why did they decide to become a scientist?
- What do they like about being a scientist?


Themselves







- Where are they from?
- Their background – what were they like at your student's age?
- Their failures, as well as their successes!


Part 2 – let's try out Fantastic DNA in a Box

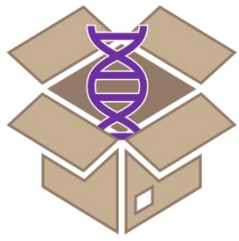




DNA preparation from a banana

Steps of the experiment	Why do we do this step?
 <p>STEP 1 Squash the banana in the plastic bag and mix with saline</p>	<ul style="list-style-type: none">• Squashing separates out the banana cells.• The saline will help clump the DNA so we can collect it later.
 <p>STEP 2 Filter the banana suspension to recover 5 ml of liquid</p>	<ul style="list-style-type: none">• Filtering removes the big clumps of banana cells to leave a clear cell suspension.
 <p>STEP 3 Add 1 ml of liquid soap to the cell suspension</p>	<ul style="list-style-type: none">• Liquid soap breaks down the fats in the cell membranes so that the DNA is released.
 <p>STEP 4 Add <i>slowly</i> 10 ml of coloured ethanol to the cell suspension Leave to settle for 2 min</p>	<ul style="list-style-type: none">• DNA is insoluble in ethanol (it will not mix). After this step, DNA will clump and float to the top so we can collect it.• The food dye colours the ethanol so we can see the DNA better.
 <p>STEP 5 Collect DNA with loop and transfer into a small tube</p>	<p>You can bring this banana DNA in the tube of ethanol home. The tube containing DNA is not a toy. Do not open it without adult supervision.</p> <ul style="list-style-type: none">• Tubes containing ethanol (alcohol) should be kept away from sources of heat, sparks & flame.• Do not drink or smell the contents of the tube.• Discard safely by emptying the contents in a sink and flushing with plenty of water. The empty tube can then be put in a recycle bin. <p>Fruity DNA in a test tube!</p>





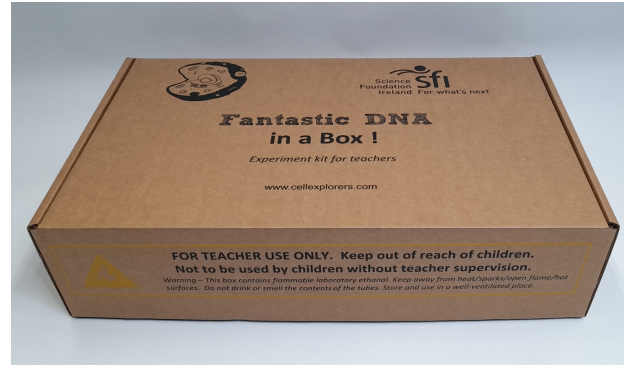
Fantastic DNA! in a Box

Fantastic DNA in person Facilitator's box

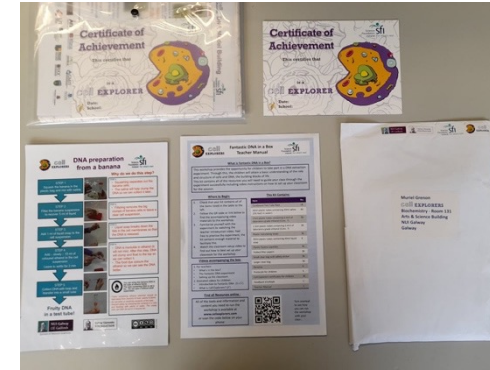


A science kit for teachers

Kit delivered to school



Individual child kit



Cardboard rack



Box contents checklist:

Item	No.	✓
Health & safety notice	1	<input type="checkbox"/>
Cardboard Test Tube Racks	18	<input type="checkbox"/>
Teacher Folder Containing:	1	<input type="checkbox"/>
• 1x Teacher handbook		
• 15x Protocols for children		
• 36x Cell EXPLORERS certificates		
• 1x Envelope with feedback forms		
Folding Cardboard Box	1	<input type="checkbox"/>
Tissue Paper Bundles	3	<input type="checkbox"/>
Children's Bags containing:	36	<input type="checkbox"/>
• 1x 50mL tube labelled Saline		
• 1x 15mL tube labelled Ethanol		
• 1x 1.5mL tube with clear Ethanol		
• 1x folded filter paper		
• 1x pipette		
• 1x plastic loop		
• 1x safety bag		
50ml plastic tubes containing 40mL liquid soap	6	<input type="checkbox"/>

Complementary videos:

For teachers:

- Video 1** - What's in the box? (A description of the box contents)
- Video 2** - The Fantastic DNA experiment (How to set up the working station, how to do the experiment, and tips and tricks on the experiment)
- Video 3** - Classroom set up & Tips to get ready

For children:

Fantastic DNA Narrated presentation, or Animated videos (to be released in 2021).

A simplified DNA extraction protocol!

1. Suitable for:


- Junior cycle
- Successfully used by teachers with TY & Leaving cert students

2. Simplified experiment






- Focus on 2 key steps: cell lysis and DNA precipitation
- Does not include protease or cold treatment

3. Extraction:


- nucleic acids
- complex carbohydrates that precipitate at low ethanol concentration



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Fruity DNA in a test tube!



CC BY NC SA 2022

A simplified DNA extraction protocol!

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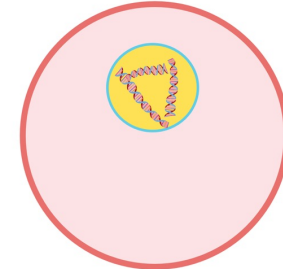
2. Simplified experiment

- Focus on 2 key steps: cell lysis and DNA precipitation
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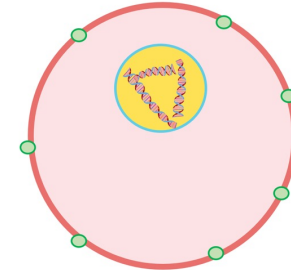
3. Extraction:

- nucleic acids
- complex carbohydrates that precipitate at low ethanol concentration

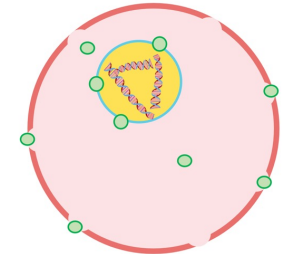
① DNA is trapped in the nucleus!



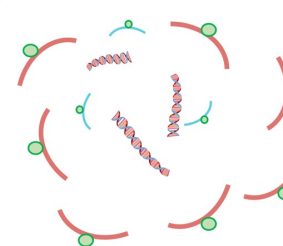
② We add soap...



③ ...to break down the cell membrane...



④ ...and release the DNA!



Resources

Fantastic DNA in a BOX

1. To Request a kit:

Email the team closest to you

Or

Email

cellexplorers@universityofgalway.ie

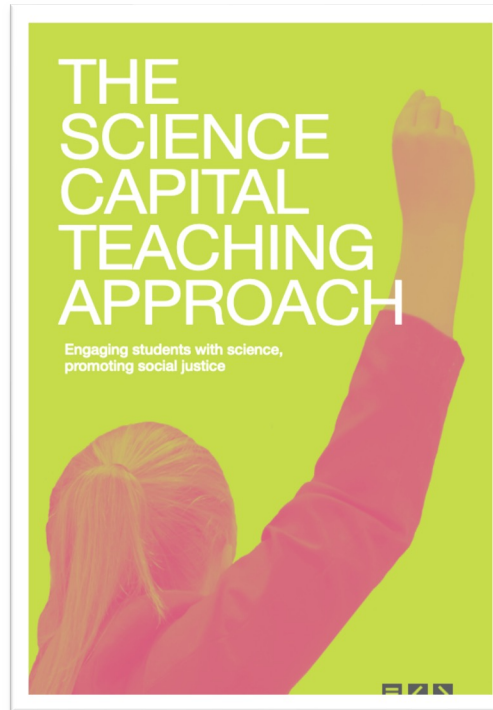
Niamh.fahy@tus.ie

2. Access the support resources online

<https://www.cellexplorers.com/teacherzone>

3. Animated videos on youtube

Science Capital teaching approach teacher resources



https://bit.ly/_SCTA

Godec, S., King, H. & Archer, L. (2017) The Science Capital Teaching Approach: engaging students with science, promoting social justice. London: University College London.

Cell Explorers Website

Science Sfi
Ireland For what's next

HOME NEWS ABOUT OUR TEAMS RESEARCH 2022 ACTIVITIES TEACHER ZONE VOLUNTEERS CONTACT US

ista Irish Science Teachers' Association
Eol Oid na hÉireann

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Please give us feedback using this short survey!

Microsoft Forms

Fill in the form

Associated Resources

1. workshop presentation

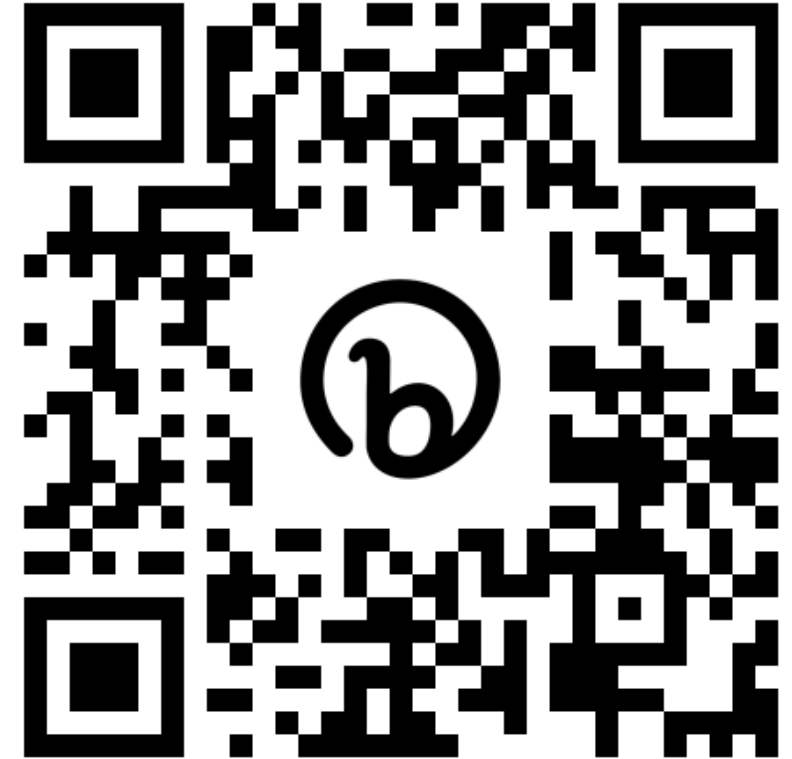
<http://bit.ly/CEISTA2023>

- Feedback
- Science capital Reading list
- All resources link
- Access to teacher zone



Part 3 – let us know what you think!

Please fill complete the short feedback survey online!



Thank You!

<http://bit.ly/CEISTA2023>