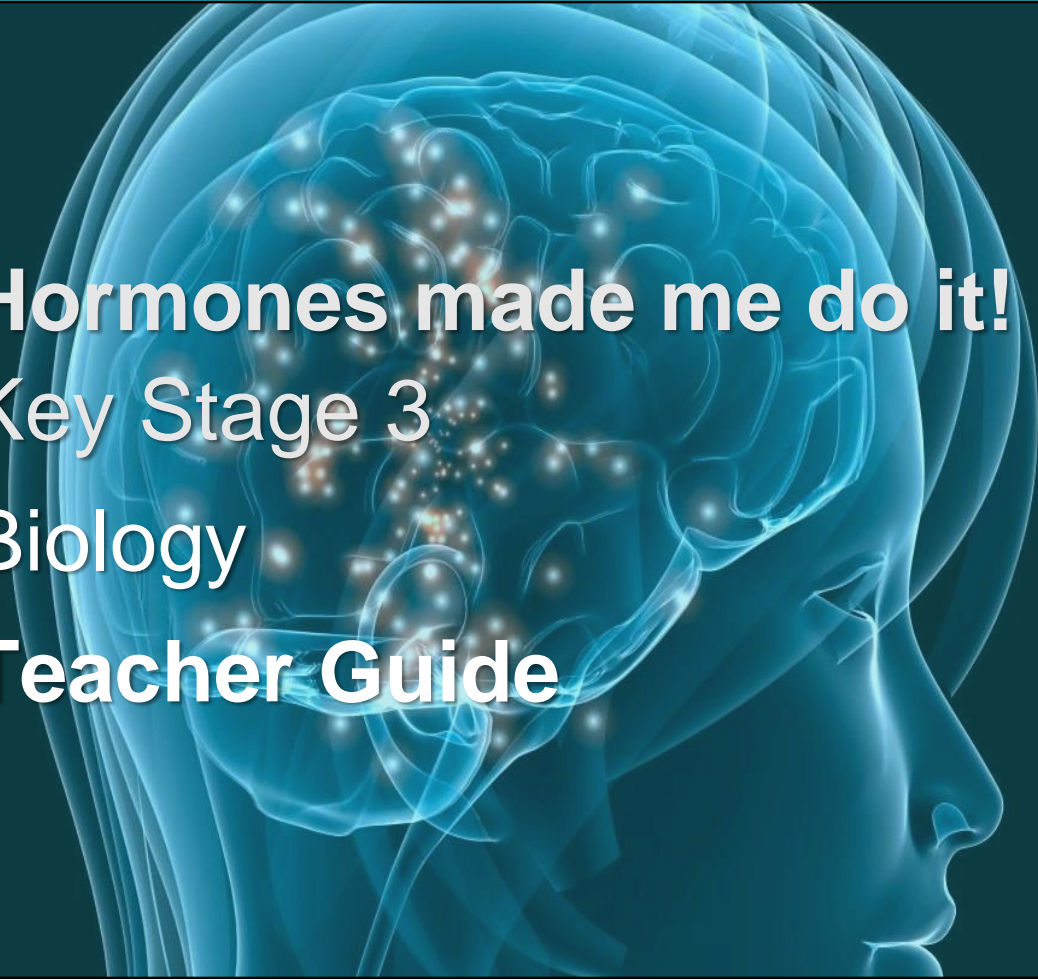


# Research-Based Curricula



**Hormones made me do it!**  
Key Stage 3  
Biology  
Teacher Guide

**2022**

**access**

**ed**

Building global university  
access programmes

# Contents

## For Teachers

- 03 **RBC Guide**
- 04 **Using RBC Packs**
- 06 **Why RBCs and EAL support**

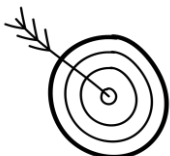
## Model Answers

- 10 **Resource One: What is a hormone?**
- 12 **Resource Two: An introduction to Neurobiology**
- 15 **Resource Three: Sex hormones and brain development**
- 17 **Resource Four: Your brain during puberty**
- 19 **Final Reflection Activity**

# For Teachers

## RBC Guide

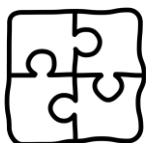
### Learner Aims



The Research-Based Curriculum is resources based on cutting-edge research, tailored for KS3, KS4 or KS5. The resources:

- *Support student attainment and progression*
- *Promote intellectual curiosity in students of all prior attainment*
- *Build understanding for more accessible 'stretch' beyond the curriculum*
- *Develop core academic skills that aid progression, including critical thinking, metacognition, and written and verbal communication*
- *Encourage students to see these subjects as engaging, worthwhile and inspiring for continued study*

### Content



The RBC packs contain four chapters (resources) suitable for Key stage 3 study. The resources span a range of exciting and interdisciplinary topics related to STEM (Science, Technology, Engineering and Maths), Social Sciences or Arts & Humanities. Each pack includes roughly 6 hours of teaching and practical, student-led activity content.

Each RBC pack contains 1) Four resources that function as subject 'lessons'; 2) Activities at the end of each resource for students to test their learning; 3) Further Reading links related to the subject; 4) Final Reflection Activity as the final assignment; and 5) Teacher Guide and model activity answers (this document).

# For Teachers

## Using RBC packs

### Suggested School Use



Teachers can use these resources flexibly. Students can complete the resources individually or in groups, in or out of the classroom. These packs help teachers:

- *Use research-based learning to engage whole classes, not just as a 'stretch' for the most able*
- *Support more students earlier in high academic achievement*
- *Improve all-school enrichment strategies by providing opportunities and resources*
- *Increase motivation and subject interest*

To do this, we encourage the 'supported use' approach. In other words, teachers provide some guidance and support to students in their independent use of the RBC packs.

### Delivery Options



To ensure all students can benefit from these materials, we recommend they are delivered with 'supported use.'

Supported Use means this resource is designed to be used partially with teacher introduction or instruction. While not marked, each chapter and the final reflection activity are set up so a teacher can help ease the students into the subject area or use the resource in class.

More ideas for using these packs in your school:

#### 1. Research Challenge

The resources can ignite curiosity about new topics and encourage independent research. Schools could hold a research challenge across a class or year group to submit a work based on the resources. Pupils could submit individually or in small groups, with a final celebration event.

# For Teachers

## Using RBC packs

### Delivery Options [cont.]



#### 2. “STEM”, “Social Sciences” or “Arts & Humanities” Morning/ Day

We know class time can be tight, so some schools ‘launch’ these packs and have students start them as part of a special subject day. This can be great for all-staff engagement too.

#### 3. After School Club

The resources can be completed in small groups (4-8 pupils) across weekly lunch clubs or after-school clubs. Groups can reflect on their learning by presenting a talk or poster on the subject matter at the end of the course.

#### 4. Classroom Debate/ Discussion if a written Final Reflection Activity isn’t possible

Resource packs can function as ‘transition’ projects over the summer, serving as an introduction to the next level of study between KS3 and KS4, or KS4 and KS5. Students could present their reflections on the experience in a journal.

### Origin and Evaluation



The RBC programme builds on the University Learning in Schools programme (ULiS), which was successfully delivered and evaluated through the London Schools Excellence Fund in 2015. The project was designed in a collaboration between Achievement for All and The Brilliant Club, the latter of which is the sister organisation of AccessEd. ULiS resulted in the design and dissemination of 15 schemes of work based on PhD research for teachers and pupils at Key Stage 3.

LKMCo evaluated the project. Overall, pupils made higher-than-expected progress and felt more engaged with the subject content.

# For Teachers

## Why RBCs and EAL support

### Target Pupils



Using an RBC coursebook to provide EAL support benefits your school and the individual students.

#### 1. Increased academic achievement

When students feel supported and are helped to understand and use the language of topics that support their curriculum learning, they are more likely to achieve at the expected level (or above). EAL students with appropriate support often do well alongside monolingual students in school due to their perseverance and higher-level abstract thinking skills from speaking more than one language.

#### 2. Higher self-esteem

A consequence of feeling supported and properly included in lessons is higher self-esteem and self-confidence for the student.

#### 3. Helping to eliminate inequality

RBC coursebooks support teachers in tackling achievement gaps and building life chances. EAL resources which support classroom learning help students to have equal opportunities and achieve well.

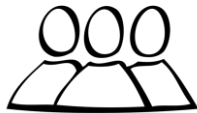
#### 4. Stronger learning environments

Bilingual and multilingual students often have strong working memories and attention spans (see Adescope, Lavin, & Thompson, 2010). This helps build a robust learning environment and encouragement amongst the rest of the class. Students in diverse groups have an enhanced ability to think creatively and to use higher-order cognitive thinking skills.

# For Teachers

## Why RBCs and EAL support

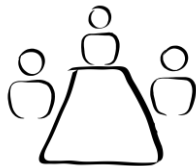
### Target Pupils [cont.]



#### 5. Different perspectives

Students with different language skills bring diverse cultural experiences to the classroom, supporting all students to understand other perspectives better. Additional learning resources can help all students feel valued in the classroom, with diversity of all kinds being celebrated.

### Meeting the needs of EAL learners



Various strategies can be used to meet the differing needs of EAL learners and help them achieve at and above age-related expectations. Below are some suggestions on how to use these packs with EAL learners.

#### 1. Classroom organisation

- Place EAL learners in pairs or groups with supporting pupils who are language role models. This is important for developing language and understanding new subject-related words.
- Make available and encourage learners to use age-appropriate bilingual and English dictionaries and thesauruses for clear definitions, pronunciation, and translation.

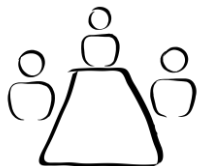
#### 2. Differentiation

- Repeatedly check understanding of the topic, learning aims and objectives and what to do in a task.
- Provide learners with subject-specific vocabulary and structures, and check understanding of the language involved in carrying out activities.

# For Teachers

## Why RBCs and EAL support

### Meeting the needs of EAL learners [cont.]



- Provide learners with instructions they are likely to encounter in their subject and ask them to translate them into their language. For example, common instructions in Science could include: what do we want to find out, what equipment do we need, how can we show our results, what is the conclusion, etc.
- Encourage EAL learners to research new words and create their vocabulary lists using the bilingual word list templates provided for each chapter in the Student packs.
- Provide model answers, gap-fills, or speaking and writing frames for students to complete with or without word banks for extra support.

### Support and stretch responses



Look out for stickers throughout this coursebook which indicate different model answer responses to cater for varied student levels and attainment. These include:

- **Support** – Responses and techniques for students who might require further support.
- **Stretch** – Responses and techniques for students to be further challenged and stretched in the activities they do and responses that they give.

### Tips for delivering activities and model answers



Throughout this coursebook, you will see stickers with 'tips' for engaging students and strategies to support them in answering questions and completing activities. Stickers include:

- **Use visual aids** - Visual learning can be helpful for EAL students struggling to process the spoken language. Use labelled images and videos to illustrate the answers, so everyone understands the references.



# For Teachers

## Why RBCs and EAL support

**Tips for delivering activities and model answers [cont.]**



- **Try as group work** - Group work can increase student engagement and allow EAL learners to practice speaking in a less intimidating context. This will enable learners to learn from one another.
- **Students use their first language** – Using first language can be a valuable foundation to build on – it allows students to compare words and sentence structures and understand more quickly. Particularly with new subject content, this can help students relax and engage with concepts at a higher level.
- **Give additional thinking time** – Allow extra time or space for processing new or more complex topics where required.

Try as group work

Use visual aids

Students use their first language

Give additional thinking time

### Further resources



For more resources, visit:

- [https://www.learningvillage.net/more\\_info](https://www.learningvillage.net/more_info)
- <https://www.bell-foundation.org.uk/>

### Questions

For more information, contact: [hello@access-ed.ngo](mailto:hello@access-ed.ngo).

# Resource One

## Model Answers

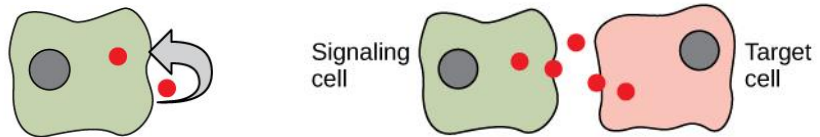
### Answers

Use visual aids



1. 1 – **Paracrine**  
2 – **Endocrine**  
3 – **Autocrine**
2. From slowest to fastest: **endocrine, paracrine, autocrine.**

*Offer students additional support when responding to questions 1 and 2 by using the visual aids below:*



*Autocrine (left) vs paracrine signalling (right).*

3. Target cells and tissues express receptors that are specific to each hormone.
4. 1 - **Pituitary gland**  
2 - **Thyroid gland**  
3 - **Adrenal glands**  
4 – **Ovaries**  
5 – **Testes**  
6 - **Pineal gland**  
7 - **Parathyroid glands**  
8 - **Pancreas**

# Resource One

## Model Answers

### Answers



Give  
additional  
thinking time

Stretch students further after the completion of Resource One by asking the following questions :

- Can you name hormones produced by each endocrine gland?
- What do these hormones do to the body?

**Tip:** Further reading is needed to answer these questions. Refer to materials 2 and 3 in the Further Reading section of Resource One.

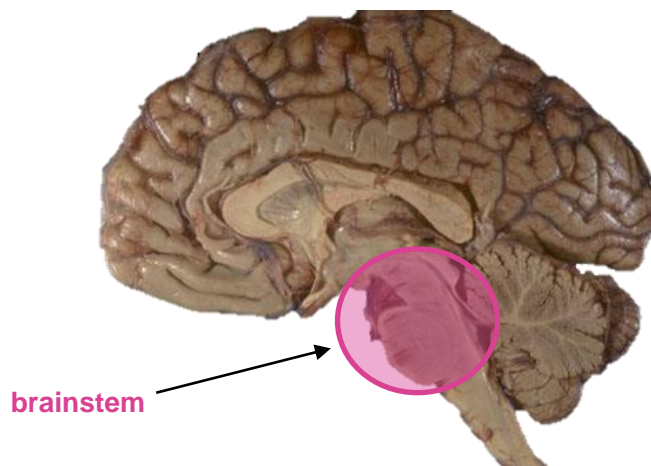
See example answers below:

- The pituitary gland releases a range of hormones, such as growth hormone (required for bone growth) and other hormones that tell other endocrine glands to release their own hormones. For example, the thyroid stimulating hormone released by the pituitary tells the thyroid gland to release thyroid hormone.
- The thyroid gland releases thyroid hormone, which controls metabolism (i.e., how fast your body turns food into energy).
- The adrenal glands release adrenaline, which is released under stress and the fight or flight response.
- The ovaries release estrogen, which is required for egg maturation and reproduction.
- The testes release testosterone, which is required for sperm maturation and reproduction.
- The pineal gland releases melatonin, which regulates sleep.
- The parathyroid gland releases a parathyroid hormone, which regulates calcium levels and bone health.

# Resource **Two**

## Model Answers

- Answers**
1. After being released from the signalling cell, hormones and biochemicals travel in the bloodstream/ circulatory system until they reach the brain. When in the brain, they bind specific receptors on target cells, which initiates a response from the target cell.
  2. The **brainstem** - It controls all automatic bodily functions, i.e. the things we do not have to think about.
  3. Refer to the pink circle to identify where the brainstem is situated.



Give additional thinking time

4. The hypothalamus receives messages from other parts of the brain in the form of electrical signals and messages from the rest of the body in the form of hormones and biochemicals. After putting the messages together, the hypothalamus decides on a response. Usually, this response involves telling the pituitary gland to produce and release more hormones, which will act on other body parts.

# Resource **Two**

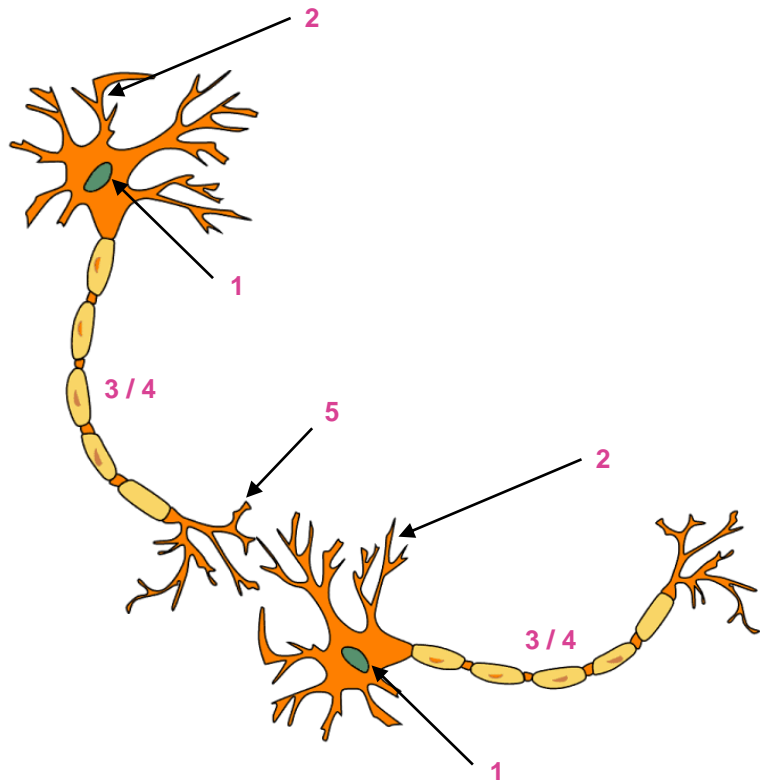
## Model Answers

### Answers

5. Diagram should include:
  1. Cell body with nucleus
  2. Extensions, labelled dendrites/ dendritic spines
  3. One long extension, labelled axon
  4. Axon may have a myelin sheath
  5. Terminal branches of the axon

Students use their first language

Cells should be connected in such a way that the terminal branches of the axon are next to a dendrite. See an example below:



# Resource Two

## Model Answers

### Answers



Stretch students further after Resource Two by asking: What is the difference between the posterior and anterior pituitary?

**Tip:** Further reading is needed to answer this question. Refer to materials 2 in the Further Reading section of Resource Two.

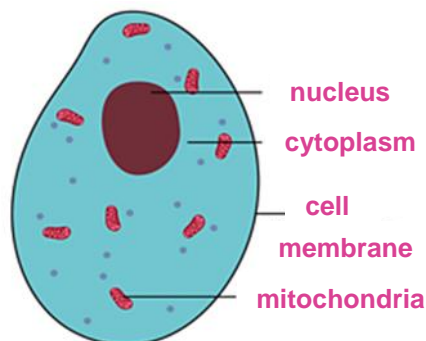
Give additional thinking time



The anterior pituitary makes its own hormones. The posterior pituitary does not make its own hormones. The hypothalamus produces and sends hormones to the posterior pituitary, which are released from there.

Support students after Resource Two by asking them to create a poem or song that explains how neurons differ from other animal cells that they have learnt about in your schoolwork.

**Tip:** Encourage students to highlight/ make notes of the text on pages 17 and 18 of the coursebook to identify neuronal features for the song or poem. Use an animal cell as a visual aid at the bottom.



# Resource **Three**

## Model Answers

### Answers

1. Students can be creative and expressive as they wish here. Any of the following forms are considered correct:
  - New cell growth/ neurogenesis
  - Increasing dendritic spines/ spinogenesis
  - Forming more connections between neurons/ synaptogenesis
  - Cell death/ apoptosis
  - Removal of connections between cells/ pruning
2. Endocrine
3. Any answer backed up by sufficient evidence from Resources Three, and further reading is acceptable as this is still a hugely debated topic in this field of science. See example answers below:
  - The female brain develops in the presence of estrogen because the ovaries begin to release estrogen during puberty, and development is still taking place during puberty.
  - The female brain develops in the absence of estrogen because the organisational period is typically described as the period straight after birth, and the ovaries are not active yet. Therefore, there is no estrogen present as the brain develops.

Try as group work

# Resource Three

## Model Answers

### Answers

4. Both lead to the development of secondary sexual characteristics (development of breasts and widening of hips in girls, development of facial hair and a deeper voice in boys).

- Testosterone** - Regulates sex drive, bone mass, muscle mass, and the production of sperm.
- Estrogen** - Regulates sex drive, the menstrual cycle, pregnancy, bone mass, and supports heart and liver function.



*Support students after completing Resource Three by asking them to explain what the term “sexually dimorphic” means in their own words.*

A condition or feature that is different between individuals of a different sex in the same species.

Anything can be sexually dimorphic, from appearance to behaviour. As long as there is a clear difference between a male and a female of the same species, it is sexually dimorphic.



*Stretch students after completing Resource Three by asking: Can you think of any sexual dimorphisms in nature?*

See example answers below:

- Lions** - Males have a mane, and females do not.
- Ducks** - Males have a green head and neck, and females are brown all over.
- In **many mammals**, males are generally much larger than females.
- Spiders** - Females are larger than males.

Try as group work



# Resource Four

## Model Answers

### Answers

Try as group work

Students use their first language

1. Encourage group discussion; there's no answer here as it's down to individual experience.
2. The results suggest that older children are more likely to report mixed emotions in themselves and others than younger children. This means that older children better understand mixed emotions and are more likely to experience mixed emotions. The differences between age groups are probably related to the hormonal changes associated with puberty.

3. The 11-12-year-olds know how others might feel but do not necessarily feel it themselves.

4. **Reward:** A sense of accomplishment, strength, etc. **Risk:** Injury from falling. This is an example of positive risk-taking because the reward outweighs the risk (injury from falling is unlikely if using safety equipment).

**Reward:** Having fun/ not having to pay for a taxi, etc. **Risk:** Crashing and seriously injuring or killing yourself or someone else. This is an example of negative risk-taking because the risk outweighs the reward (the fun only lasts for the drive, but injuring or killing someone else or yourself can be life-changing).

**Reward:** Having fun. **Risk:** Falling out of the roller coaster/ being sick. This is an example of positive risk-taking (roller coasters are generally very safe and operated by trained staff members).

**Reward:** Understanding the work/ gaining intelligence. **Risk:** Classmates making fun of you/ the teacher not helping. This is an example of positive risk-taking (teachers will always help, and if classmates make fun of you, it's probably because they do not understand it themselves!).

# Resource Four

## Model Answers

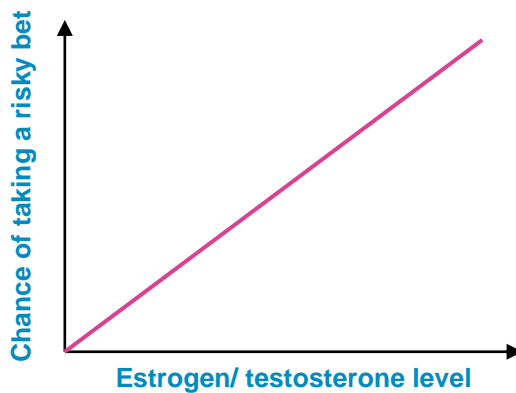
**Answers**

**Reward:** Getting a good grade. **Risk:** Getting caught. This is an example of negative risk-taking (getting caught cheating will get you in a lot more trouble than getting a bad grade!).

Give additional thinking time

- Both graphs will look the same. Look for a graph title and labelled axes.

Effect of estrogen/ testosterone level in girls aged 11-13 on taking risky bets



Support students after completing Resource Four by explaining the difference between the dependent and independent variables.

- The dependent variable (the thing you measure) goes on the y-axis.
- The independent variable (the thing that changes) goes on the x-axis.



Stretch students after completing Resource Four by asking how they think the results from question 5 would change if the study had compared 11-13-year-olds with 65-70-year-olds.

**Tip:** Refer to Figure 8 in Resource Four.

If risk-taking is associated with estrogen and testosterone levels, risk-taking behaviour will decrease with age.

# Final Reflection Activity

## Further Guidance

### Individual activity

- Ensure the movie/ book/ song picked is familiar to all – or at least a majority – students. Consider taking the time to show snippets of the movie/ song in class, and encourage students to think about how they feel as an audience and how the character in the movie/ book/ song feels. Examples:
  - ❑ Flash the sloth laughing from Zootopia. Judy Hopps feels annoyed, but the audience finds it funny. Watch: <https://www.youtube.com/watch?v=4aUC1VZQE1E>
  - ❑ Olaf's "Samantha" scene from Frozen 2. Olaf might feel scared, but the audience finds it funny. Watch: <https://www.youtube.com/watch?v=93wzjJmIVfE>
  - ❑ Simba finds love and seemingly forgets his friends, Timone and Pumba, in the Lion King. Timone and Pumba feel annoyed because they have lost their friend, but the audience is happy. Watch: <https://www.youtube.com/watch?v=25QyCxVkJwQ>
  - ❑ Or use the Little Mermaid scene used in the study! Watch: <https://www.youtube.com/watch?v=NytHPQoV1Cs>
- It's important to gather data from various age groups and sexes. Make sure students record the age and sex of their participants. After students have collected data, split the age groups into 5-10, 11-15, 16-20, and 21+ (or any other reasonable group splits).
- Record all data in an accessible open database. For example, Excel (circulated to the class by email, printouts, or OneDrive) or a dedicated whiteboard in class.
- It's important to gather data from enough people. Small sample sizes will not be representative of a larger population and may skew the final results. Aim to have at least 10 participants for each age group, with a roughly even split between the sexes. Ensure this is attainable by asking students to collect data from at least two people of different ages.

# Final Reflection Activity

## Further Guidance

### Individual activity [cont.]

- Encourage students to make their own comparisons for their activity, meaning that not all students will need all data. For example:
  - Student A could compare boys and girls aged 11-15 (requiring data for 11-15 years old only),
  - Student B could compare all age groups for boys alone (requiring data for boys only),
  - Student C could compare all age groups of boys and girls (requiring all data).
- Ensure students understand how to calculate the mean:

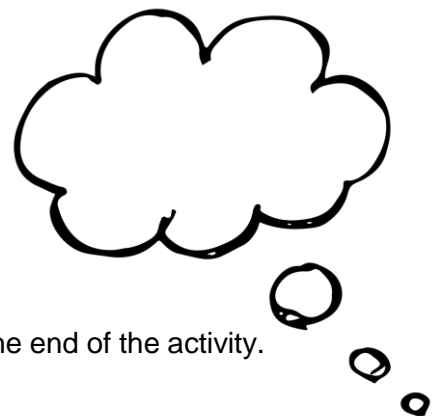
$$\text{Mean} = \frac{\text{sum of all data points}}{\text{number of data points}}$$

- Remember that the data is never wrong! Fit the conclusions around the data; it may differ from what they read in the coursebook – that’s just science!

### Group activity

**“Why your brains are amazing”** is subjective, so allow for a variety of reasoning across posters. Specifically, students should consider that they can change (under the control of estrogen and testosterone). Therefore, encourage students to think about the following:

- How do estrogen and testosterone access the brain?
- The effects of estrogen and testosterone on the brain, such as neurogenesis, apoptosis, etc.
- What do their brains, as adolescents, do better than adult brains, such as learning?



Consider asking the groups to present their posters at the end of the activity.



**[www.access-ed.ngo/coursebooks-partner/university-of-readings](http://www.access-ed.ngo/coursebooks-partner/university-of-readings)**



**[www.access-ed.ngo](http://www.access-ed.ngo)**



**[@\\_AccessEd](https://twitter.com/_AccessEd)**



**[hello@access-ed.ngo](mailto:hello@access-ed.ngo)**



**Kemp House, 160 City Road  
London, EC1V 2NX**



**AccessEd is a charity registered in  
England and Wales (#1186355)**