



## Justice and injustice in chemistry: aspirin and other drugs

### **Education in Chemistry**

Sustainability in chemistry 2021

**Goal 1: end poverty in all its forms everywhere**

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**Develop your learners' critical thinking and research skills by reflecting on the science and societal views surrounding drugs and their development.**

### Teaching notes

This resource can be used to accompany practical work on the synthesis of aspirin, included in many 16–18 courses across the UK and Ireland. It will stimulate students to think about science in society and develop critical thinking skills, important throughout their study and in their future careers.

The resource is split into two tasks which can be carried out over two whole or part lessons.

- Task 1 includes a free writing task (see description and instructions on page 2) and introductory information, including a video on medicinal drugs (approx five minutes), before learners are put into small groups to discuss their ideas.
- Task 2 is a research and discussion task. In small groups, learners share out the topics to research. The research task could be set as homework with the members of the groups coming back together in the second lesson to use the evidence from their collective research to answer questions.

When setting the research task, highlight to your students the importance of being aware of bias. A website by a leading drug manufacturer will give a different perspective to a university research department, a rehabilitation centre or a campaign group. They should also be encouraged to evaluate the reliability of the information they find and record their sources.

The topics discussed in this resource will help develop your learners' critical thinking skills and are a perfect springboard for development into a critical analysis essay, eg for the Extended Project Qualification (EPQ).

### Acknowledgement

This activity has been inspired by the work of D. Morales-Doyle, *Cult. Stud. Sci. Educ.*, 2020, **15**, 639 (DOI: 10.1007/s11422-019-09932-z).

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## Task 1: introduction and free writing

### Part 1

Work individually to reflect on the following questions and **free write** some of your ideas.

1. Think about the ways in which people (people you know, schools, government and the media) talk about heroin and other addictive street drugs. Who is usually blamed for the problems associated with these drugs? Why (and how) are these people/groups blamed?
2. Think about how aspirin and other pharmaceutical drugs are talked about by those same groups. Who usually gets the credit for their success? Why (and how) are these people/groups praised?
3. Think about how your answers compare to each other. Do the questions about blame and praise and cost and reward matter in debates about the successes and failures of drug synthesis in chemistry?

**Free writing** is a technique where you write without stopping for a set amount of time. When free writing, spelling, grammar and punctuation can be ignored and the aim is to write down anything that comes to you, without going back and correcting it.

Follow these steps:

1. Clear your mind. Forget the rules. Relax.
2. Set a time limit for yourself, eg ten minutes.
3. Start writing and don't stop until the time ends.

### Part 2

Now, as a small group, draw on your collective experiences to co-write your initial thoughts on the questions you answered in part 1.

The history of drug development tells the story of chemistry as a site of both social and scientific progress and success, as well as social, economic and **epistemic harm**. Medicinal drugs synthesised by chemists have undoubtedly made millions of people's lives better. However, the chemical structures of many of these drugs originate in the knowledge of indigenous groups who used plants medicinally, rather than in high-tech laboratories. Furthermore, the process of designing and synthesising new drugs is not always a harmless scientific endeavour: many drugs have had harmful unexpected side effects (eg thalidomide), or turned out to be highly addictive.

Watch this [video](http://www.periodicvideos.com/videos/mv_morphine.htm) ([http://www.periodicvideos.com/videos/mv\\_morphine.htm](http://www.periodicvideos.com/videos/mv_morphine.htm)) in which organic chemist Rob Stockman discusses painkillers, such as morphine and heroin.

**Epistemic harm** occurs when a person is not taken seriously as a knower, reasoner and thinker. This might mean that the individual's knowledge and ways of knowing are not taken to be as legitimate as the knowledge of another person (usually in a dominant group). Or it might mean that their knowledge is taken and used by another person and the original knower is not considered worthy of intellectual or financial credit. A group can also suffer from epistemic harm when their ways of knowing are delegitimised (eg they are told their knowledge is 'not scientific'), or their knowledge is stolen by another group.

## Task 2: research and discussion task

As a small group, divide up the following research tasks:

<p><b>Research the history of aspirin.</b></p> <ul style="list-style-type: none"><li>• How is it found in nature (what is the chemical structure)?</li><li>• How was it used by indigenous groups?</li><li>• How was aspirin (as we know it today) derived from the original version in willow bark (show the chemical synthesis)?</li><li>• Who is credited with scientific successes associated with aspirin?</li><li>• What is the global aspirin industry worth (and to whom)?</li></ul>	<p><b>Research the history of a 'miracle' drug of your choice derived from plants.</b></p> <ul style="list-style-type: none"><li>• How is it found in nature (what is the chemical structure)?</li><li>• Who/which groups discovered it? Do all sources agree about who should be credited with the discovery?</li><li>• How did chemists contribute their knowledge to make this drug available on a global scale?</li><li>• What is the global industry for this drug worth (and to whom)?</li></ul>
<p><b>Research the history of an 'illegal' drug of your choice.</b></p> <ul style="list-style-type: none"><li>• Is it found in nature and, if so, how? What is the chemical structure?</li><li>• Who/which groups discovered it? How are these individuals/groups portrayed in relation to this drug?</li><li>• (How) did chemists contribute their knowledge to make this drug available on a global scale? What was this drug designed for?</li><li>• Which groups are associated with the use of this illegal drug and how are they portrayed?</li></ul>	<p><b>Research the opioid crisis in the US.</b></p> <ul style="list-style-type: none"><li>• What are the chemical structures of commercially available opioids?</li><li>• What are the causes of the opioid crisis according to different sources?</li><li>• What is the global opioid industry worth?</li><li>• What are the costs of the opioid crisis (social and financial)? Who pays them?</li><li>• Why is there currently legal action being taken against pharmaceutical companies? How is this legal action being portrayed in the media?</li></ul>

Come back together as a small group. Use evidence from your collective knowledge and research to answer the following questions.

1. How and in what ways are drug synthesis and pharmaceuticals an important tool for tackling local and global poverty?
2. How and in what ways have drug synthesis and pharmaceuticals been causes of local and global poverty?
3. How and in what ways have chemists and the pharmaceutical industry exploited and/or harmed marginalised groups, including indigenous groups, colonised peoples and those in poverty?
4. How might/should we think, talk and act differently in terms of drug synthesis as we aim for social, economic, and epistemic justice?

Return to your original free writing tasks. How have your ideas changed, developed or stayed the same?