Year 11 Biology

Mini Guide

Breaking down the Claim
Researching
Writing

INFECTIOUS DISEASES
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The Aims of Your Research
Step 1 Find a scientific journal article
Step 2 Do some background research
Step 3 Find some secondary data

Step 1: Find a Scientific Journal Article
Find a journal article on which to base your research question (it must include data).
1. Break down the claim.
   a. Follow the Prepare to Search steps below
2. Find an article that matches the claim (i.e. an infectious disease that has been reduced by some kind of technology).
3. Make sure this article has some kind of data that you can use (numbers!)
4. Form your research question (using the article).

Prepare to Search

1. Break down the claim
Investigate the following claim:
   • Infectious diseases have been reduced by technological advances.

2. Brainstorm the claim
Brainstorm definitions of the key terms within your claim. See the Research Guide for some suggestions.

3. Question the key elements
   Complete background reading to get a feel of your topic. Here is where you become familiar with the key concepts so you can easily identify them to determine if an article or report will be useful for study. Start with your textbook.
   Broad example questions:
   a) What are infectious diseases?

   b) What causes infectious diseases?
   • Pathogens
   • Cellular pathogens
   • Non-cellular pathogens

   c) How are infectious diseases transmitted?
   • Direct contact
   • Vectors: organisms carrying the disease-causing pathogen
   • Contaminated objects
   • Contaminated water
d) How can the spread of pathogens be controlled/reduced? What technological advances have been made to reduce the occurrence/risk of infectious diseases?

- Vaccines
- Antibiotics
- Antivirals
- Antifungal medications
- Sterilisation methods
- Personal hygiene
- Care with food preparation
- Proper disposal of sewage and garbage
- Chemical control of vectors
- Chemical treatment of clothes, surfaces and water
- Pasteurisation of milk
- Public education programs
- Quarantine laws
- The use of drugs such as antibiotics

e) Which methods are used for prevention and which are used for treatment?

4. Brainstorm or note-take
Represent your ideas and the key concepts from your background reading in a graphic form.

5. Use these ideas and questions to guide your research
The key is to start broad and narrow your focus as you research.

Finding your Article

Broad Background Reading
Start with reading a suggested background reading article from the Research Guide.
* It is crucial you have a solid, broad understanding of the topic before you start to look for specific research.

**Suggested background reading**

Article 1: Four of the most lethal infectious diseases of our time and how we’re overcoming them: https://theconversation.com/four-of-the-most-lethal-infectious-diseases-of-our-time-and-how-were-overcoming-them-78101


Narrow Research
Once you have an idea about the disease you would like to investigate, start your targeted research using databases such as Gale, EBSCO Discovery Service, State Library OneSearch, and Google Scholar.

Make use of Boolean Operators to help narrow or broaden your search query.
- Helpful tips for using Boolean Operators are on page 6 of this guide.
Step 2: Do Background Research
So, you have found and read your research article you now need to do some reading to become an expert in this specific field.

1. Follow the Trail
   Search for your topic or key words on Google and within online periodicals such as The Conversation and New Scientist.

   REFLECT: Can I find any information that supports what I have previously read?
     - If NO: Try using different search terms or broaden your search. Try using the search terms in another search engine or website.
     - If YES: Good. You’re on the right track. Take notes about the topic. What are the key areas, theories, or principles? Record the reference information – you may want to come back to this later or use it in your rationale. Use this information to guide your next phase of research.

2. Spotlight
   Have you found what seems to be a really helpful article?

   Can you mine the reference list?
     - Mining the reference list means looking up the sources the article refers to. Are they useful for your research? Do they provide data or links to data?

   Can you follow the claim upstream?
     - Can you follow hyperlinks included in the article?

   Can you triangulate the claim?
     - Can you find another source that supports or refutes the claims made in the article?

3. Saturation
   Continue with your search until you have found enough information to support your claim. You know when to stop when you have reached knowledge saturation. You have everything you need and you’re only finding information that repeats what you already have.
Step 3: Find Secondary Data
This data can be used to corroborate (back up) the data in your article. This data can be found in Datasets but only in other journal articles.

Datasets
Before you get to the datasets, you must know what you are looking for or have an idea of the terminology, pathogens, chemical or biological abbreviations, or phenomena you are looking for. Most datasets are very academic and use very technical language.

- It might be wise to first look for data through Google Images and follow the trail.
- Find a graph or table of data that is related to your topic and locate the source of information.
- Use the dataset links on the Research Guide as a starting point.
- The WHO database will give you data on mortality rates for a range of infectious diseases.

Boolean Operators are your friend
Remember to use these useful Boolean phrases when searching. These can take your search results from the millions to the hundreds (or less)

- “ ” : searches for the exact phrase, or else some search engines will split the phrase up into single word components.
- * : the database (won’t usually work with Google) will return and highlight any word that begins with the root/stem of the word truncated by the asterisk.
  - E.g. admin* with return results such as administrator, administration, administer, administered.
- And: combines search terms so that each search result contains all of the terms.
- Or: combines search terms so that each search result contains at least one of the terms. Put brackets around the words to group the options.
  - E.g. (disease OR illness)
    (“strong force” OR “nuclear force”)
- Not: excludes terms so that each search result does not contain any of the terms that follow it.

Not sure what search terms to use?
Use the answers gathered from your background reading and key words from your task sheet. Also, use the key terms on the Research Guide.

Important Tips
- Read from the outside-in. Don’t waste your time reading through a lengthy study if it isn’t relevant. Just read the Abstract – It will be summary of the entire paper, including Aim, method, results, conclusions.
- Keep a record of your notes and references as you go.
  - Sign up to Diigo – annotate and save online
- Remember to be flexible in your searching.
  - If you are struggling to find information, change your article.
  - If you are struggling to write enough words, change your article or find more corroborating data.
Incorporating and using evidence

**MAKING A CLAIM/DRAWING A CONCLUSION (RESEARCH REPORT)**

*A statement or conclusion that addresses the research question and links to the claim.*

**Sentence Starters**
- This study shows that ____________ because ____________.
- ____________; therefore, ____________.
- The evidence suggests that ____________.
- If ____________ then ____________.
- ____________ is supported by the evidence in the study by __________ et al. (20__).

**Counter claim:**
- Another study by __________ et al. (20__), however, reported that __________.
- While ____________, it can be seen that ____________.

**A statement or conclusion that answers the original question/problem.**

**Sentence Starters**
- This evidence suggested that ____________ (identify what happened) when ____________ (identify the action).
- A comparison was made between ____________ and ____________ by ____________ (identify the action/process/method).
- The effect of ____________ on ____________ is ____________.

**EVIDENCE**

*The scientific data that answers the research question:*

*Data are observations or measurements OR results from an experiment.*

*Numbers and data table information.*

*Research findings, principles and theories.*

**Sentence Starters**
- In the data ____________.
- The evidence indicates ____________.
- ____________ (statement or claim) is clearly supported by ____________ (evidence).
- Based on ____________, it is apparent ____________.
- It is hypothesised ____________ based upon ____________.
- According to (specific person), ____________.
- In fact, (specific person) states ____________.
- Further evidence that supports this was reported in a study by ____________ who suggests ____________.

**REASONING**

*Explains why the evidence answers the research question, providing a logical connection between the evidence and claim. A justification that connects the evidence to the research question.*

**Sentence Starters**
- Based on the evidence, it can be concluded ____________ because ____________.
- Since ____________, that means ____________.
- The ____________ is determined by ____________ (include appropriate scientific principles).
- ____________ (scientific explanation for a phenomena), which is why ____________ (the phenomena happens).
Rationale

A scientific rationale provides a reason, based on your background research, that a particular research question is chosen. A rationale is simply your justification of the topic you chose. It explains why the research was performed in the first place. It is the very reason why you conducted the research.

You may ask yourself the following questions in order to compose the rationale:
(Think broadly first then bring the issue into focus.)

- What is the issue all about? Why is it important?
- Why is there a need to conduct the study?
- How should the issue be resolved?

You need to show how you got from your claim to your specific research question. Show the in-between steps. Use background research to show the links between each step.

Research Rationale

- Your rationale provides a reason, based on supporting scientific evidence, that your particular question was chosen.

Define and explain the different elements of the claim. Then, identify and describe key research and/or theories surrounding the claim. You must then establish your research question based on the claim and identify what the implications will be if your question proves to be correct.

Sample Rationale THIS IS A MODEL ONLY– IT DOES NOT ANSWER YOUR CLAIM

Brown (2010) in the X-Men Mail recently claimed that ‘human evolution is still occurring’. The article discussed broadly the link between cultural practice and humans but did not detail a specific example of a scientific case study where cultural practice was driving this supposed evolution. Consequently, with initial research, a broad research question ‘does cultural practice drive human evolution’ was developed based on the initial claim. This was further refined to specifically consider human geneculture coevolution. A summary of this refinement and the specific research question is detailed below. The Homo sapien population has grown from an estimated 5 million people in the pre-Neolithic era to an estimated 7.4 billion in 2016 (Biraben, 2003; Population Reference Bureau, 2016). The exponential growth observed in the last 50 000 years can be linked to a variety of cultural factors that have enabled a greater portion of humans to reach reproductive age and live longer lives (Cochran & Harpending, 2009). Consequently, in this larger population, higher levels of gene flow and variation occur between individuals (microevolution) and the likelihood of macro evolutionary change is increased. This can be attributed to an increased range of favourable, advantageous genetic combinations arising in a population whilst smaller populations may be more likely to experience a high degree of genetic drift. However large-scale scans using patterns of linkage disequilibrium to detect recent selection (i.e. in the last 10, 000 years) suggest that many genes may have evolved in response to agriculture (Richerson et al., 2010).

Coevolution is the process used to describe cases where species influence each other during their evolution. Human gene-culture coevolution can be observed in technological advancements such as agriculture. With the concept being that if ‘the cultural inheritance of an environment-modifying human activity persists for long enough to generate a stable selection pressure; it will be able to co-direct human evolution’ (Gerbault, 2011). The cultural process of managing wild cattle into herded livestock, and consequently domestication, has its oldest evidence dated at 10 500 BP (Helmer, 2005). Thus, this environment-modifying activity could have co-directed the evolution of lactase persistence in humans. Therefore, this essay proposes the following research question: ‘Is the prevalence of hypolactasia (lactose intolerance) in Finland linked to the practice of domesticating cattle for dairy purposes?’
Below is an example of a student’s work. Below that is an example of how a teacher has re-stated the exact same information but in a more concise manner. This has improved the response not diminished it.

**Student’s work**
One of the important benefits of fire is in forestry, where fires often aid in the regeneration of forests. A proposition was made by Smith et al. (2009) that indicated that the frequency of brushfires was correlated with the number of melaleuca trees saplings in the area. These saplings are important as they provide eucalyptus oil which is the second largest horticultural sector in Australia. The eucalyptus oil industry is a significant contributor to the Australian export market.  

**Re-stated**
Forests benefit from the regenerating effects of fire. Smith et al. (2009) indicated that brushfire frequency was correlated with melaleuca sapling density. These saplings produce eucalyptus oil. The eucalyptus oil industry is the second largest horticultural sector in Australia and contributes significantly to our export market.

Selecting words carefully and omitting any unnecessary words can eliminate wordiness. Here are some examples of common changes:

<table>
<thead>
<tr>
<th>Wordy</th>
<th>Concise</th>
</tr>
</thead>
<tbody>
<tr>
<td>One of the problems</td>
<td>One problem</td>
</tr>
<tr>
<td>In only a very small number of cases</td>
<td>Occasionally, rarely</td>
</tr>
<tr>
<td>An additional piece of evidence that helps to support this hypothesis</td>
<td>Further evidence supporting this hypothesis</td>
</tr>
<tr>
<td>In spite of the fact that knowledge at this point is far from complete</td>
<td>Although present knowledge is incomplete</td>
</tr>
<tr>
<td>It is also worth pointing out that</td>
<td>Omit</td>
</tr>
<tr>
<td>Before concluding, another point is that</td>
<td>Omit</td>
</tr>
<tr>
<td>It is interesting to note that</td>
<td>Omit</td>
</tr>
</tbody>
</table>
Word Choice

Words to help say what things are made of:
Consists of  
Is composed of  
Is made up of  
Is comprised of  
Is constructed of (with)

Words to help compare things:
Less/more  
The same as  
On the other hand  
The least  
Whereas  
The same number as  
The most  
Unlike  
In contrast  
Like/ likewise  
Dissimilar  
However  
Similarly  
Although  
The equivalent of  
Equally /equal to  
Alternatively  
Identical  
Matching  
Different  
Parallel

Words and ways to help talk about cause and effect (or actions and results):
Because (of)  
Produces/ is produced  
Accounts for  
As a result (of)  
Forms  
Is formed  
On account of  
Consequently  
Creates/ is created  
Due to  
Leads to  
Results in  
Owing to  
Causes  
Brings about  
When  
Makes  
Gives rise to

Words to help talk about unexpected outcomes:
Even though  
However  
But  
Yet  
Although  
Nevertheless,  
In spite of  
On the contrary