Making Sense of Medical Research

Are you interested in learning more about scientific and medical research, perhaps for personal reasons, but don't know where to access accurate and reliable information?

In this article we outline some different sources of information, highlighting some of the advantages and disadvantages of each. As a research organisation, our benchmark source for information about research is academic journals. Journals have been in existence for over 300 years, and form the principal global knowledgebase of academic study, but they have historically been difficult to access. To illustrate why the information published in academic journals is so highly-regarded, we will detail the process of publishing original scientific research, explaining how critical appraisal through peer review is a key component in this rigorous system, and provide signposting for accessing them as a member of the public. We will also give a brief overview of other sources of information about medical research, and how accurate they are likely to be.

Contents

Summary

In today's information-rich environment, it can be challenging to navigate the multitude of resources, and differentiate between those that are reliable and those that are unreliable. This article provides a comprehensive guide to accessing and appraising different sources of information about medical research. We discuss several types of resources, from news media and social media to academic publications, and highlight their advantages and disadvantages.

Academic journals are well established as the gold standard source of information about scientific research, published in the form of scientific papers, including original research articles about new studies, along with literature reviews and systematic reviews, which review the available evidence in an area of research. This article explores the rigorous publishing process, where peer review (by fellow experts in the research field) plays a critical role in ensuring scientific rigour and relevance of a study before publication. The ways in which academic journals measure the impact of research and ensure articles can be searched for are summarised, and we discuss their accessibility, outlining the ways members of the public can access some content without a subscription. Additionally, we discuss potential issues with published research, such as publication bias (where positive results are more likely to be published than negative results), data transparency, and reproducibility challenges.

Existing alongside the formal academic literature there is a wide variety of other sources of information ranging from trustworthy and accurate to unreliable. We provide practical guidance for navigating these resources, especially for non-experts, by recommending suitable starting points and giving a framework for interpreting the content.

Overview of Information Sources

News Media

Produced by professional journalists and freelance creators across a variety of output platforms including print and digital.

Medium: Print & Digital
Authorship: Professional journalists & freelancers. Contributors are often named
Peer Review: No, but some editorial oversight
Indexed in specialist databases: No
Accessibility: Good – in general no subscription is required
Best for: Audiences seeking timely summary information

Social Media

Rapidly disseminated informal content in written or video format, often with discussion/comments. Can be used by scientists to promote and discuss their work, and also by individuals creating sensational or emotionally-charged content. Content varies widely in accuracy, can be edited or removed by the author at any time, and generally has a short lifespan.

Medium: Digital
Authorship: Individuals or organisations. Authors' names and affiliations may or may not be disclosed
Peer Review: No
Indexed in specialist databases: No
Accessibility: Good – in general no subscription is required
Best for: Audiences seeking informal information that they will verify from other sources, with scope for discussion and input

Blog Articles

A regularly-updated website with informal posts written by an individual or group, potentially making scientific information accessible to a non-specialist audience, promoting greater engagement, understanding, and discussion. The content is not subject to peer-review and varies widely in accuracy, author expertise and bias, and can be changed or deleted without notice.

Medium: Digital
Authorship: Individuals or organisations. Authors' names and affiliations may or may not be disclosed
Peer Review: No
Indexed in specialist databases: No
Accessibility: Good – in general no subscription is required
Best for: Audiences seeking informal information that they will verify from other sources

Grey Literature

Documents produced at all levels of government, NGO, charities, and business organisations in print and electronic formats. They are often protected by intellectual property rights, and their status as official documents means that they may be collected and preserved by library holdings or institutional repositories. They are controlled by the organisation that produced them rather than commercial publishers. Examples include, government reports, working papers and white papers, and policy documents.

Medium: Digital and/or print
Authorship: Individuals or organisations. Authors' names and affiliations may or may not be disclosed
Peer Review: Varies
Indexed in specialist databases: No
Accessibility: Moderate - often openly accessible but may not be searchable on specialist databases or obvious where to find the documents
Best for: An introduction to the work carried out by different organisations

Textbooks

Printed or digital works, often providing broad and deep coverage of an area of knowledge with a focus on explanation and understanding. Once printed, hard copies cannot be changed or updated, so there is a risk of increasing obsolescence until an update is issued.

Medium: Digital and/or print
Authorship: One or more. Authors' names and affiliations are disclosed
Peer Review: At editorial level
Indexed in specialist databases: Textbooks may indexed in Scopus, Web of Science Book Citation Index, or Google Scholar, although only the latter is publicly-accessible.
Accessibility: Moderate – some are available through libraries, others need to be purchased and they can be expensive.
Best for: Audiences seeking to learn about a field of knowledge in depth

Academic Publications

Highly specialised documents in a variety of formats for sharing scientists' original research work and reviews of collective research with other scientists, published in specialist journals. Once published, these articles cannot be changed, but corrections or retractions may be published later.

Medium: Digital and/or print
Authorship: One or more. Authors' names and affiliations are disclosed
Peer Review: Yes
Indexed in specialist databases: Yes, including PubMed, Google Scholar, Web of Science, depending on subject
Accessibility: Moderate – although there are some 'open access' journals, and public libraries provide access to others (details below), many specialist journals require a costly subscription to access their content
Best for: : Expert scientific audiences seeking specialist information – read on to find out more

Academic Publications and Peer Review

So, in a world where information is readily accessible from numerous sources to anyone with an internet connection, why are academic publications still regarded as the benchmark repository for verified scientific information?

The Academic Journal

The world's first academic journal, Philosophical Transactions, was launched in March 1665 and there are now many thousands of different journals spanning all areas of research. Some publish work across a range of disciplines (e.g. Nature), whereas others are highly specialised (e.g. BMC Gastroenterology publishes work restricted to the fields of gastroenterology and hepatology). Journals were originally all hard-copy and are now published in digital and printed formats at regular intervals, often weekly or monthly, .

There is a long history of hierarchy among scientific journals, with some journals regarded as a more prestigious outlet for research than others. This is now formalised in a numerical 'Impact Factor' that is calculated for each journal, providing a measure of how often the work published in that journal is referred to ('cited') in subsequent publications. In general, work is frequently cited when it is of high importance and substantially advances knowledge in the field. For example, Nature is one of the most prestigious and widely-read journals and has an impact factor of 50.5, while many other more specialist journals have impact factors in single figures. Scientists will submit their findings to a journal that they feel is the correct outlet for the subject of their work and will initially aim to publish their work in the journal with the highest impact factor that they think might accept their work. Journals with higher impact factors are more selective about the work they publish – for example Nature publishes 8-10% of the submitted manuscripts, many of which will already have been through a presubmission enquiry process, meaning that the true acceptance rate is less than 8%.

The Scientific 'paper' – making original research public

Although the format varies, journals typically publish original research articles, reviews, and sometimes other styles of article (collectively referred to as 'papers'):

- Original research articles: The most common type of scientific paper, these are the articles where novel discoveries are made public for the first time. Most science is done by collecting data to generate or test a hypothesis (a proposed explanation for a phenomenon), and it is important that the study is designed in a way that cause-and-effect relationships can be established reliably. See an example of an original research article, where the powerful benefits of Herceptin (Trastuzumab) in treating breast cancer were first published during the HERA clinical trial.

- Literature Review articles: An important type of paper written by one or more experts in a field, providing thought leadership, discussion and a summary of the 'state of the art' in a particular research area. The author(s) will explore the broader context of the published works, and may need to impartially address contradictory findings by different researchers, making this type of article a useful source of information. Articles of this type might be proposed by the author(s), by a journal editor, or by an organisation. For example, this review discusses the recruitment and retention of participants in randomised controlled trials.

- Systematic Reviews and meta-analyses: Systematic reviews are a rigorous summary and assessment of all empirical primary studies answering a specific clinical question using the PICOT framework: Patient, Intervention/Issue, Comparator, Outcome(s), Time. Cochrane produce an excellent, accessible series of reviews – see the Cochrane Library.

Systematic reviews employ a specific method to provide a reliable summary of evidence on a particular topic:

1. Defining a focused research question
2. Establishing inclusion and exclusion criteria to determine which studies are included in the search
3. Performing a comprehensive literature review
4. Critically appraising the quality of the studies
5. Extracting data from the studies
6. Synthesis of the results
7. Interpretation of the findings

Meta-analysis may also be used to statistically collate and quantitatively analyse existing published data from multiple original research articles researching the same question, helping to establish an overall answer to a research question, in order to inform evidence-based practice and sometimes resolve apparently contradictory research outcomes.

See an example of a review here.

- Case Studies: Common through business and law, a case study is a research approach to generate an in-depth understanding of a complex issue in its real-life setting in order to illustrate the broader lessons that can be learned. They can yield powerful insights into many important aspects of health and healthcare delivery. This example looks at ways to facilitate the recruitment of minority ethnic people into research.
- Case series: medical papers on the experience of clinicians with an interesting or unusual individual patient case. They can provide interesting information for rare cases but do not tend to be generalisable to the overall population.
- Comment/Opinion/Perspective: Usually short articles in the style of an editorial which can be written by editors or researchers, perhaps commenting on an individual study to provide additional context for the journal's readers.

Original Research Articles

In medical research, the process of publishing an original research paper begins when the research team believe that they have completed a body of work to a standard that it is ready to be publicised and shared. Choosing the right time to publish requires the investigators to balance the need for scientific rigor with the time pressure of publishing before a competitor does so first (yes, science is competitive too!). They then submit a written manuscript to the journal, along with the data they have collected and analysed.

Until this point, for reasons of intellectual property the research team may not have discussed their work with anyone outside their team.

The journal will specify the general format and length of the article, with many following a similar structure in this order:

1. Title and list of authors

   The title describes the content of the manuscript, and a common format is "Drug X: A New Approach to Treating Y". The list of authors details everyone who contributed to the project. There are different conventions in different disciplines, but in medical research the first named author generally contributed the most to the study, with the remaining order determined by the level of contribution made by each person. The last named author is often the senior or supervising author and is usually someone with a respected research track record. Some journals now ask for a summary of what each author contributed, to reduce the temptation to add the names of well-known (but non-contributing) senior researchers to improve the credibility of the work!

2. Abstract

   Simply, a short synopsis of the content of the manuscript, although the focus may be on the headline 'positive' results from the work with lack of space (or author bias!) meaning that 'negative' results may be given less emphasis. The abstract will be included in the specialist database records, and is available to read for free even if the remainder of the article requires a paid subscription to access. Although the abstract should provide a fair overview of the work, it will sometimes tend towards summarising the more positive results, and provide less emphasis on any negative or inconclusive results.

3. Introduction

   This is where the authors set out what is already known about the subject of their work, and details what question(s) they are addressing in their study in the context of that existing knowledge. They will cite (reference) existing published papers to verify the facts they provide and the statements they make in the introduction, and may also address contradictions in the existing knowledgebase.

4. Methods

   In this section of the manuscript the authors describe exactly how the study was carried out, with sufficient detail to enable other competent scientists to repeat their methodology. The authors will cite published papers where a method or technique they used was first described or used. This will often be the most technical part of the paper, and may be difficult to understand by anyone other than an expert in the same field of research. Before the advent of significant computer processing in research, the methods used could be described in conventional written prose. However, computer programs and code are too large/complex to be written out, so this part of the methodological information is made available online for other researchers to download separately from the article.

5. Results

   Here, the authors describe their findings, presenting and analysing the data in a variety of formats to suit the data. This might include tables of values, graphs and charts, and different types of images. This section of the paper only presents the 'what' and not the 'why'.

6. Conclusion

   The conclusion is where the authors explain their findings in the context of current knowledge, and how their work has advanced our knowledge and understanding of their research subject. They will refer to other published works that might be consistent with their findings, or that might be contradictory, and explain why this might be. There are many possible reasons for contradictory results, including experimental design, and the authors may suggest further research that would either extend their findings or resolve conflicting results.

7. References

   A list of all the sources of external information quoted in the manuscript, including published papers. Only reliable sources of information, such as other academic publications or published grey literature, are quoted in the reference list.

The Peer Review Process – critical appraisal by experts in the field

Once the draft manuscript has been completed and submitted to the journal, the journal editor will assess the applicability of the work to the journal's subject area, and its likely significance in the field of study. Many manuscripts are rejected at this early stage if the journal does not deem them to be appropriate or sufficiently impactful. If the subject material is acceptable, the journal editor will circulate the manuscript to a small number of expert independent reviewers. This presents a challenge for some subject areas, as many scientific disciplines are by their nature highly specialised and there may only be a handful of people worldwide with the necessary expertise to critique the work. There is also the risk that in very specialist fields, one or more reviewers could be a direct competitor (or a collaborator) of the submitting research team – the journal will ask the reviewers to report any commercial or professional conflicts of interest to mitigate this risk.

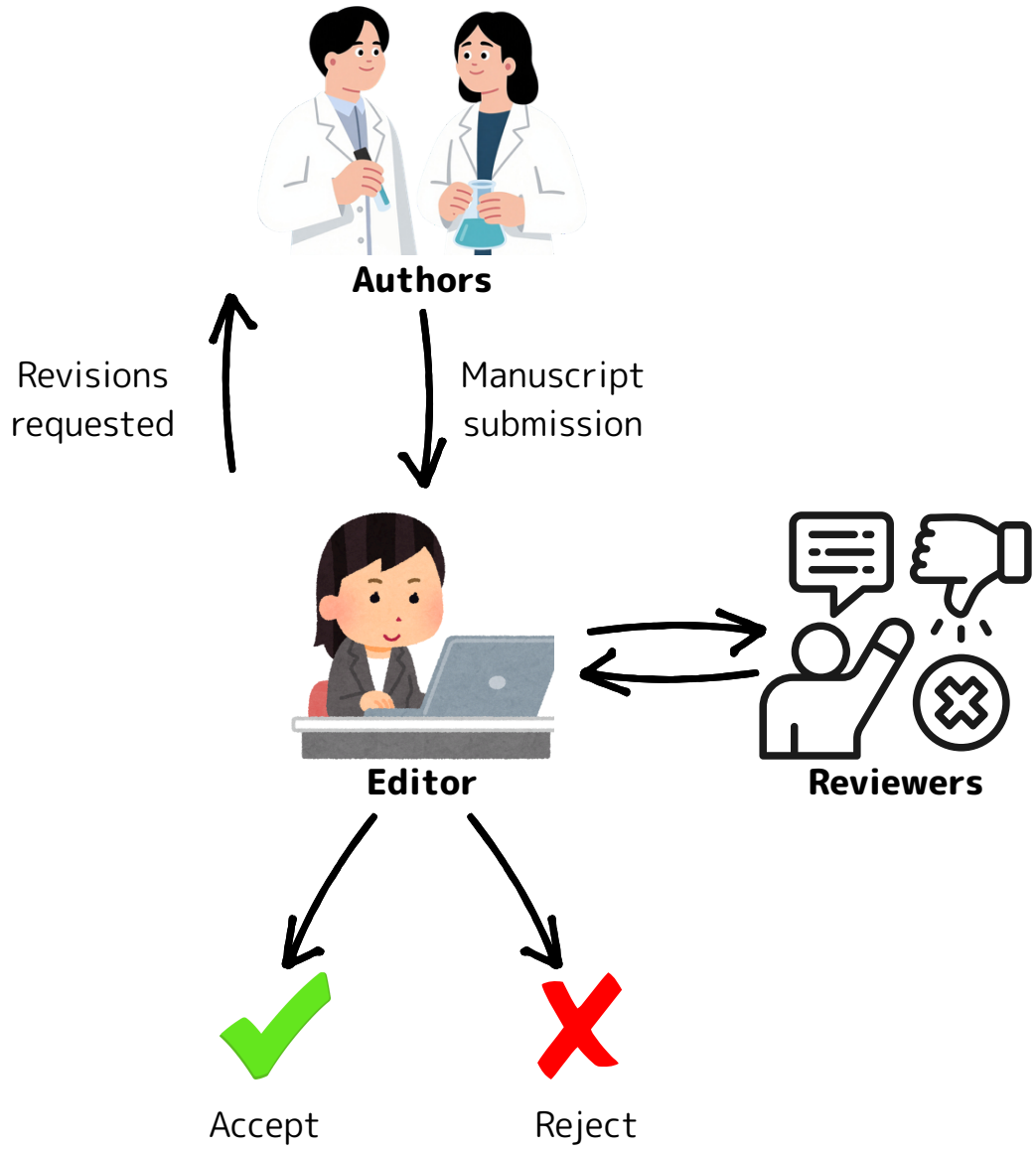
The editor will provide the reviewers with guidelines on reviewing the manuscript, but in essence the reviewers' role is to ensure that the work has been performed with scientific rigor, and that the work is novel and relevant. They will also appraise how well the authors have assessed the current state of knowledge, and the context in which their work sits. The reviewers will then respond to the journal editor with their feedback, after which there are four possible outcomes:

1. The manuscript is accepted for publication without the need for any changes.
2. The manuscript is accepted in principle once the authors have made revisions to the manuscript in response to the reviewers' comments.
3. The decision is deferred, pending the submission of a revised version after performing further experiments or technical work. The revised manuscript is then returned to some or all of the reviewers for a second round of review, following which it will either be accepted, rejected, or further revisions

requested.

4. The manuscript is rejected due to technical deficiencies or because the authors' claim is not fully supported by the data, sometimes with an invitation to resubmit once all the concerns have been addressed. In most cases of rejection, authors will need to seek an alternative journal to begin the submission process again.

Following the outcomes above, the authors have the opportunity to appeal if they feel that their work has been misunderstood or misinterpreted, and parts of the cycle may be repeated.



The peer review process for academic journals

Publication – sharing new discoveries with the World

Once the manuscript has been accepted, it will be published online and often in print, becoming a building block in the global knowledgebase of scientific knowledge. The work will be indexed on specialist databases, allowing other scientists to find and read the work.

Databases – a critical component in indexing and searching research

Once published, an important stage in the lifecycle of a scientific publication is that it is recorded in a number of aggregator databases, allowing researchers to find the information they need to learn what is known, and to help them design future studies. One such database is PubMed, which is a free resource for biomedical and life sciences literature maintained by the National Center for Biotechnology Information (NCBI) in the U.S. It contains more than 38 million citations and abstracts. Another long-standing database is Web of Science which began as a citation index, linking similar papers on a subject, and where the number of citations provides a measure of the influence of each published paper (similar to the journal impact factors mentioned earlier). Google Scholar is an open access database that also provides citation data - for example this paper published in 2005 reporting the outcome of a trial testing Trastuzumab in a specific group of breast cancer patients has been cited in over 6900 other publications to date.

Publishing Negative Results

As we have said above, the vast majority of published scientific articles are positive and novel – that is to say the study 'worked'. This information is assimilated into the various databases and forms the basis of our knowledge and understanding.

What about initially promising results that cannot subsequently be reproduced, or that do not fit a hypothesis? There is a risk that such studies could be rejected from publication, leading to a bias of positive studies in the literature (in turn affecting future systematic reviews and meta-analyses). If these negative studies are not added to the knowledgebase, there is a risk that other scientists will waste valuable resources independently trying to test the same hypotheses. This raises ethical questions if their work involves animals or human patients participating in risky studies, or spending funds raised through taxes or donations. This study is a good example of a published negative result, showing that adding immune therapy to post-operative chemotherapy in a specific type of breast cancer did not demonstrate an improvement in recurrence. Because this work has been published, there is no risk of other investigators testing the same idea.

A big step forward as a result of the 'AllTrials' campaign it is a statutory requirement from 10 April 2026 for all medicinal clinical trials in the UK to register and publish a summary of results within 12 months of the end of the trial.

Can there be problems with the published research?

Science pays a vital role in knowledge-based economic development, and scientists and their employers strive to rapidly publish findings of high impact. While this 'Publish or Perish' pressure could lead scientists to publish their work before it is fully validated, or in very rare cases to publish false findings, there are many ways that the scientific community can check and validate published work. One challenge caused by the increase in computer data processing and analysis in science is that the conventional written communication of scientific methods is no longer adequate to record the entirety of the information gathered and the way it is handled for a study. There are now various repositories where the source data and computer code are shared by researchers.

This allows the following:

- reproducible research (or 'Research that can be checked') – where the original data and computer code are made available for others to reproduce the analysis. This primarily concerns the integrity and transparency of the data analysis of the investigation.
- replicable research (or 'Research that can be replicated') - the independent investigation of a scientific hypothesis with newly collected data, new experimental setups, new investigators, and possibly new analytic approaches.

Online journal clubs such as PubPeer also provide a platform for post-publication discussion of articles where any indications of errors or fraud can be challenged (and responded to by the authors of the article).

In very rare cases, published papers that are found to contain intentional or unintentional unsound science can be retracted. Because of the trust placed in the scientific community, these rare cases of 'poor' research can be headline news. The highest profile retraction to date in the UK is probably the controversial 1998 publication by Andrew Wakefield and colleagues in The Lancet, investigating childhood developmental disorders and vaccinations. The paper implied a link between the measles, mumps, and rubella (MMR) vaccine and a "new syndrome" of autism and bowel disease. At the peak of the media controversy caused by the publication, first-dosage MMR vaccine uptake at 24 months in most of the UK reached its lowest rate of 81% in 2003–4. The Wakefield paper was retracted in 2004 after the General Medical Council (GMC) found that Wakefield had falsified his results and he was also found to have received hundreds of thousands of pounds from lawyers who were building class-action lawsuits against vaccine companies. Despite multiple studies since showing no link between the MMR vaccine and autism, vaccination rates did not recover to 90% until 2011, due to the long-lasting adverse effects on public perceptions of the safety of the MMR vaccine.

How do I navigate these different information resources?

Academic publications

Research is by nature highly specialised, and researchers use a vocabulary that can be difficult to penetrate to a non-expert. Some research articles are written with the expectation that the reader already possesses a considerable understanding of the field. This means that understanding research in any subject can require a gradual process of learning the vocabulary and concepts before you can understand the detail. Depending on the research area, you may find that reading original research articles for the first time is slow and frustrating as you encounter new vocabulary and concepts. Literature reviews usually provide a higher-level summary than original research articles and are likely to be easier to understand.

Before diving into the detail of academic papers, a good starting point can be a trusted website that is written by experts for the general public, such as the Cancer Research UK website which provides an introduction to the past and current research on different types of cancer. From here you might follow a link to a page about research led by a particular scientist or research group, which will in turn list their publications. Following the link to their publications will provide a connection to all the prior work that was cited – by reading these publications you can build your understanding of what is known about a subject.

A hurdle you will encounter is that many academic journals are only accessible to subscribers. Fortunately, some journals are 'open access' which you can access directly online without a subscription. Open Access Journals and The Directory of Open Access Journals (DOAJ) are good places to search for open access journals in any subject. At the time or writing there are 4,327 open access journal publishing medical subjects in English on DOAJ.

Some examples of relevant open access medical journals include:

- PLOS Journals: All 21 PLOS (Public Library Of Science) journals are open-access. They are published by a non-profit organisation and cover life science, health science and sustainability science.
- BMJ Open: BMJ (British Medical Journal) Open is an online, open access journal, dedicated to publishing medical research from all disciplines and therapeutic areas.
- JAMA Network Open: JAMA (Journal of the American Medical Association) Network Open is an international, peer-reviewed, open access, general medical journal that publishes research on clinical care, innovation in health care, health policy, and global health across all health disciplines and countries for clinicians, investigators, and policy makers.
- BMC Medicine is the flagship medical journal of the BMC (BioMed Central) series. An open access, transparent, peer-reviewed general medical journal, BMC Medicine publishes outstanding and influential research in all areas of clinical practice, translational medicine, medical and health advances, public health, global health, policy, and general topics of interest to the biomedical and sociomedical professional communities.

Some other journals, for example The Lancet series of journals, include some fully open-access journals, and some hybrid journals where certain articles are open access.

Another excellent resource is Access to Research - a service that provides free, walk-in access to more than 30 million academic articles in public libraries across the UK. This service will enable you to access journals that would otherwise require a subscription through your local public library.

Finally, many universities require their research staff to upload their research publications to the university's research portal/repository. This provides another resource for accessing publications, and to learn more about individual researchers and their work. For example:

- Glasgow University - Enlighten
- St Andrews University – Research repository
- Oxford University – Research archive
- University of Strathclyde - KnowledgeBase Research Information Portal

Other sources

Outside the structure of academic publishing, here are some some pointers to help you navigate the complex diversity of sources of information about medical research:

1. Regardless of your prior knowledge, the detail you seek, or your preferred source of information, you should always obtain facts and information from more than one independent source. This applies just as much to a professional scientist as a member of the public. In comparing different sources of information, it is important to be clear that the information is indeed independent, and not simply the same information being repeated by different people. See if you can find other work that discusses or explains what you have read. Sometimes this reveals whether there is general agreement or not with the facts you have found.
2. Is the person who is providing the information named, or is the work anonymous? People who are happy to put their name to a piece of information are more likely to ensure that it is accurate.
3. When comparing information from different sources, look to see if the person who wrote the article is able to back up what they say. For example, do they explain where the information they present has come from, or do they say something like 'it is well known' without providing a source?

Information from a named, credible source is more likely to be accurate than information from an unknown source.

4. For every source of information, check to see if there is potential for bias or a conflict of interest. For example, consider the affiliation and interests of the author. Is the writer/author an employee of a pharmaceutical company, or perhaps an investigative journalist, or even a conspiracy theorist!
5. Finally, think like a good scientist - always interpret everything with a questioning, open mindset and be willing to revise your personal beliefs based on new evidence.