

# THE DIFFERENT TYPES OF SCIENTIFIC LITERATURE

Scientists communicate the results of their research to other scientists primarily through the **scientific literature**, which therefore constitutes a permanent repository of scientific knowledge and a record of progress in scientific enquiry.

Different types of scientific literature exist, normally referred to as the primary, secondary, tertiary and grey literature.

The **PRIMARY LITERATURE** refers to accounts of research carried out personally by an individual scientist or as collaboration by a group of scientists, which is published in a **peer-reviewed scientific journal**. These accounts, commonly called '**papers**', are written in the particular format specified by the journal to which it is submitted for publication. Normally journals require a paper to consist of a title, abstract, keywords, introduction, material & methods, results, discussion, acknowledgements and references. Papers are submitted to the journal editor who then asks a number of recognised experts in the area of study addressed by the paper (called '**referees**') to give an opinion on whether the work reported presents new scientific information, and to report on the merits and deficiencies of the work. On the basis of the referees' reports, the editor may accept the paper as it was submitted, or may require minor revision from the authors, or may require major revision, or the paper may be refused outright. This formal reviewing process is known as '**peer review**'. There are different types of journal that range from international to regional to local and there are also systems that grade the importance of journals on the basis of how often papers carried by the journal are cited in other scientific papers (called the '**impact factor**').

Most primary literature is published in scholarly journals, but some research is published as monographs, theses or dissertations, conference papers and reports. In the world of science, the contribution of an individual scientist to the advancement of knowledge is usually gauged partly on the number of publications that the scientist has contributed to, especially those published in international peer-reviewed journals with high impact factors.

The **SECONDARY LITERATURE** consists of publications that rely on primary sources for information. Here it is not a requirement for the authors to have done the work themselves, since the purpose of the publication is to summarise and synthesize knowledge in a specific area for other scientists who already have an understanding of the topic; however, the authors of secondary publications would normally have worked and published primary literature in the area they are writing about. The secondary literature includes review journals, monographic books and textbooks, handbooks and manuals. Although normally written in a scientific style, secondary publications are not organised in the same way that primary publications are; however, it is a universal requirement that they are fully **referenced** and that most of these references are to the primary literature. Scientists use the secondary literature to gain an overview of research areas that are close to or relevant to their own, or to familiarise themselves with existing research in new topics on which they plan to start working.

The **TERTIARY LITERATURE** consists of published works that are based on primary or secondary sources and that are aimed at scientists who work in different areas from the subject matter of the publication, or towards an interested but lay audience. Such publications are normally written in a popular rather than a scientific style and while such publications may include a short **bibliography**, they do not usually include references to the primary literature. Examples of the

tertiary literature include science magazines, newsletters, science articles in newspapers, introductory textbooks and encyclopaedias.

The **GREY LITERATURE** refers to sources of scientific information that are not published and distributed in the usual manner and which therefore may be difficult to obtain. Gray literature includes theses and dissertations, technical reports with a limited distribution, journals published by special interest groups that have a limited distribution, abstracts of conference papers and conference proceedings that are only made available to conference participants, Environmental Impact Statements, some types of Government documents, working papers, and some types of online documents. Note that being classified as 'gray literature' in no way implies that the publication has little scientific merit, since some types of grey literature are rigorously peer reviewed and count as primary literature; 'grey' refers more to the limited distribution and difficulty of accessing the publication than to its content.

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It is important to note that the form that a publication takes no guide to its classification as primary, secondary or tertiary literature. For example, books may belong to any of these three categories. A **monograph** that presents new ideas as a result of scientific research that has been reviewed by a number of referees (usually called 'readers' in the case of a book), will count as primary literature (in effect, a very long scientific paper), whereas an **encyclopaedia** or **science magazine** article, even if written by a Nobel laureate, is still tertiary literature.

Another example is the case of **conference proceedings**. Papers presented at international, regional or national conferences, workshops or symposia are considered as primary literature if they are peer-reviewed and published, either as a book of conference proceedings, or as a special issue of a scientific journal. On the other hand, abstracts of papers presented at a conference, or the papers themselves, which have not been peer-reviewed, do not count as primary literature even if they are published in book form. An in-between case is that of conferences where the papers presented are published as peer-reviewed '**extended abstracts**' (in effect, long summaries of the work that may be formatted in the same way as a journal paper). Normally, such papers present work that is in an advanced stage but not yet complete to an audience of peers for comment and criticism. Most such work is later published in full form in primary scientific journals.

The situation is further complicated by the **Internet**. Scientific information available on the Internet ranges from absolute rubbish to high quality. There are very authoritative looking sites that present completely wrong information, sometimes deliberately, whereas at the other end of the spectrum, there are primary peer-reviewed scientific journals that are **published online** (normally, but not always, with at least a limited print edition as well). Professional looking websites are no guarantee of quality information. Users of the Internet should very carefully evaluate the source, quality and accuracy of any information that they plan to use. (See 'Evaluating WWW resources' on the 'Tips and Links' webpage of the Department of Biology website at: [http://home.um.edu.mt/biology/12\\_links.html](http://home.um.edu.mt/biology/12_links.html) ).