

# Subtleties of scientific communication: Precision, synonym, “Material and Methods” and “biomaterials”

Alberto **CONSOLARO\***

## Abstract

The “Material and Methods” section has not been uniformly used by all journals and institutions. In addition to that, “Materials and Methods” or “Material and Method” have been mistakenly employed. The term “material”, in its singular form, is a collective noun of intrinsic plurality. It also functions as a qualifying adjective for solid, liquid or gaseous substances that occupy space as an aggregate of particles that has mass.

“Methods” must be used in its plural form because no collective term is able to cover all procedures employed in a research, which often includes more than one single investigation method, for instance, reading, tests, calculations, trials and illustrations. The terms used for products known as “materials” or “biomaterials” are inappropriate for the meaning they convey in the Portuguese language. For this reason, they must be adapted. Or the language must change, which is perfectly possible given its dynamic nature! This article presents the basis for discussions on the theme.

**Keywords:** Material. Materials. Material and Methods. Methodology. Biocompatibility. Biomaterials.

**How to cite this article:** Consolaro A. Subtleties of scientific communication: Precision, synonym, “Material and Methods” and “biomaterials”. *Dental Press Implantol.* 2013 July-Sept;7(3):32-9.

» The author informs he has no associative, commercial, intellectual property or financial interests representing a conflict of interest in products and companies described in this article.

## Contact address:

**Alberto Consolaro**  
consolaro@uol.com.br

Submitted: February 19, 2013  
Revised and accepted: March 04, 2013

\* Full professor, Department of Pathology, School of Dentistry – University of São Paulo/Bauru and Postgraduate Department, School of Dentistry – University of São Paulo/Ribeirão Preto.

### Accurate terminology is very important for three reasons

Communication must be accurate. Every word has one or more than one specific meaning, and must be strictly chosen as an operator chooses a scalpel in surgery. Scientific communication must be even more accurate in order to avoid potential blanks or doubts. Word accuracy must be achieved for three reasons:

**1<sup>st</sup>** —The four branches of contemporary human heredity are: A) Genetics; B) Epigenetics: the study of changes in Genetics caused by environmental interference that does not result in mutation; C) patterns of behavior promoting social learning as a result of attitude, habit or reaction that induce others to acquire the characteristics of a group or family, and D) symbology: language symbols such as writing, speech and other icons shared by different generations and that are part of world heritage.

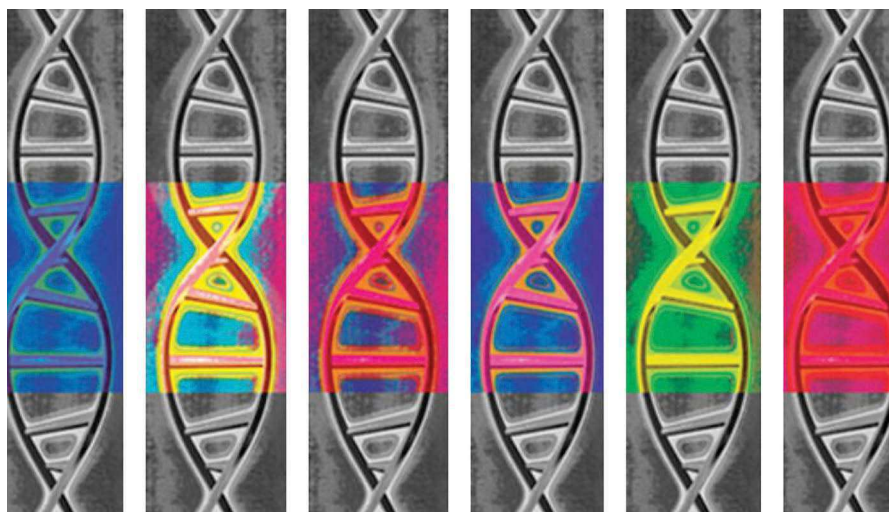
These four branches establish a dialogue between different generations, which implies that a codified world is left for future generations. Symbology is exclusively human.

The more accurate and simple language symbols are, the more they will be understood in the future!

Changes in DNA as a result of body adaptation are slow, they occur every 100 years, approximately. Likewise, men cannot adapt and improve the storage capacity of their brains, which would alter the size of the organ and, as a result, hinder pregnancy and delivery.

Unable to make changes in the DNA or the size of the brain, men learned to pass on information to future generations by registering it as language symbols. To this end, they have developed high quality transgenerational information storage systems in the form of words and symbols.

**2<sup>nd</sup>** — Each word has its meaning and, at the same time, is a key or password that, whenever entered in a database, computer or device, will retrieve all information on a specific theme stored by current and previous generations. One wrong letter and the search will be changed, imperfect or incomplete.



**Figure 1** - Changes in DNA as a result of adaptation to the environment are slow. In order to provide information to future generations, men created new means of transmission or “the four branches of heredity”.

Using inappropriate words to retrieve stored information may find totally mistaken data.

The more accurate keywords are, the better databases — our current libraries — can be used. In other words, the more accurate a keyword is, the more complete and quick the search, the job, the device and the time spent will be.

**3<sup>rd</sup>** — Not long ago, using different words as reference to the same phenomenon or object was smart and erudite. However, this is currently seen as obsolete and inappropriate. In addition to hindering comprehension and accuracy, it broadens the number of key or passwords entered in databases to retrieve information previously or currently stored.

Retrieval of previously or currently stored information about a specific subject was also known as bibliographic research. It used to be carried out in a set of books known as index or reference work in which new publications were monthly or annually registered. An exhausting, but necessary job currently optimized by computers!

Analog or physical libraries used to have shelves full of outstanding reference works such as Current Contents, Index Medicus Literature, Index Dental Literature and Biological Abstracts, real databases that used to be manually used. The more reference works a library collected, the more information it stored in comparison to other libraries. In general, it would be the most important and the best library!

**Synonymy**, a collective term comprising different words for the same event, is still used in the first paragraphs of books about diseases, chemical substances or physical phenomena. Some diseases, substances and phenomena are known by 20 to 50 different terms. A web that hinders information retrieval, an intellectual and involuntary trap!

The scientific community should raise awareness about synonymy so as to decrease or eliminate it to the full extent of human knowledge: it is helpless and useless. Extensive synonymy is confusing, hinders comprehension and information retrieval. Exaggerated synonymy may be a sign of pseudo-erudition.

### “Material and methods” or “Materials and methods” or “Material and method”?

Terminological care must be taken when mentioning the different types of matter or “material” applied to the human body with different purposes, including material used to ease and speed up bone repair.

According to the dictionary, “**material**” means:

**Material:** (*adjective*) 1. Relating to or made of matter; 2. Physical rather than spiritual; 3. Rough, rude, dull; 4. Solid, heavy; 5. Practical, useful, objective; 6. Consisting of matter.

It also means:

**Material:** (*masculine noun*) 7. Something that is related to matter; 8. A set of objects, tools, machinery and parts that a finished work, construction, etc. may be based on or derived from; 9. Apparatus; 10. A substance from which something is made.

As for “**matter**”, the definition is as follows:

**Matter:** (*feminine substantive*) 1. Solid, liquid or gaseous substances that occupy space; 2. An aggregate of particles that has mass; 3. A material substance of a particular kind.

The academy hardly ever has time for subtle details such as perfectly appropriate terminology. For some philosophers, subtleness is home for the sacred and the evil,

gods and devils: Thus, for good measure, let us be careful! This philosophical message is often seen as unpleasant, but it suggests that: the wrong or right points of a hypothesis or theory may be a minor detail embedded in an inappropriate name or term.

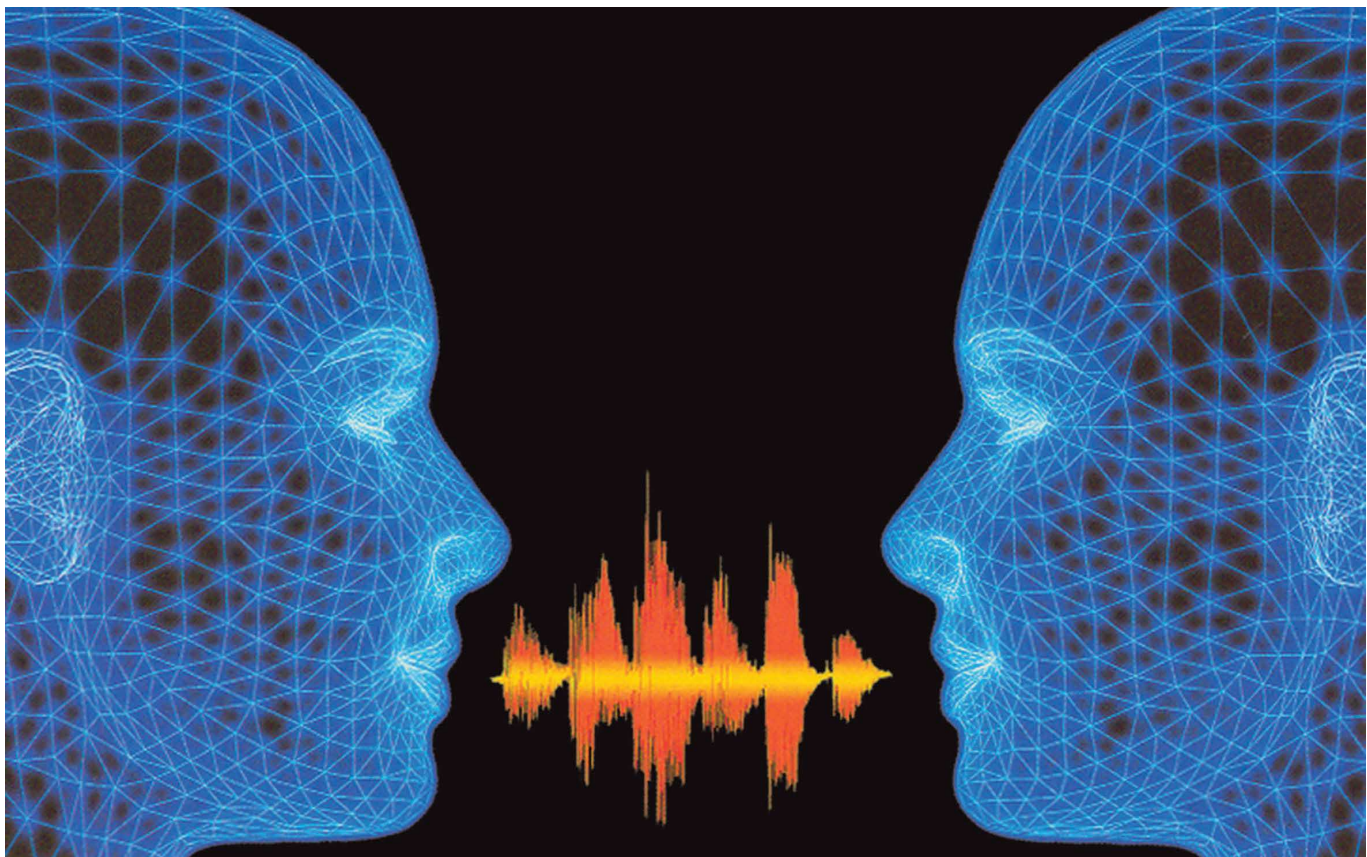
In the academy, one of the most frequently asked questions is: *Should the term “material” be used in its singular or plural form?*

“Material” may have two different connotations: an individual — functioning as a qualifying *adjective*; and a collective — a noun referring to a set of objects. A collective *noun*, even if in its singular form, refers to a group of creatures that belong to the same species.

As a collective noun, the term material stands for a set of things used for a particular purpose. A herd stands for a group of elephants that are kept together, while a bunch stands for a group of keys held together. Likewise, the products and objects used for a specific purpose in a research must be referred to by the collective noun “*material*”.

The use of “material” in its plural form is limited: When referring to more than one set of things; several herds or bunches. For this reason, it is generally accepted that the plural form of “material” as a noun is not used!

Chapters and headings that describe the scientific methodology employed in a research published in the form of an article are entitled “Material and Methods”



**Figure 2** - Language symbols are one of the four branches of men’s ability in transmitting something.



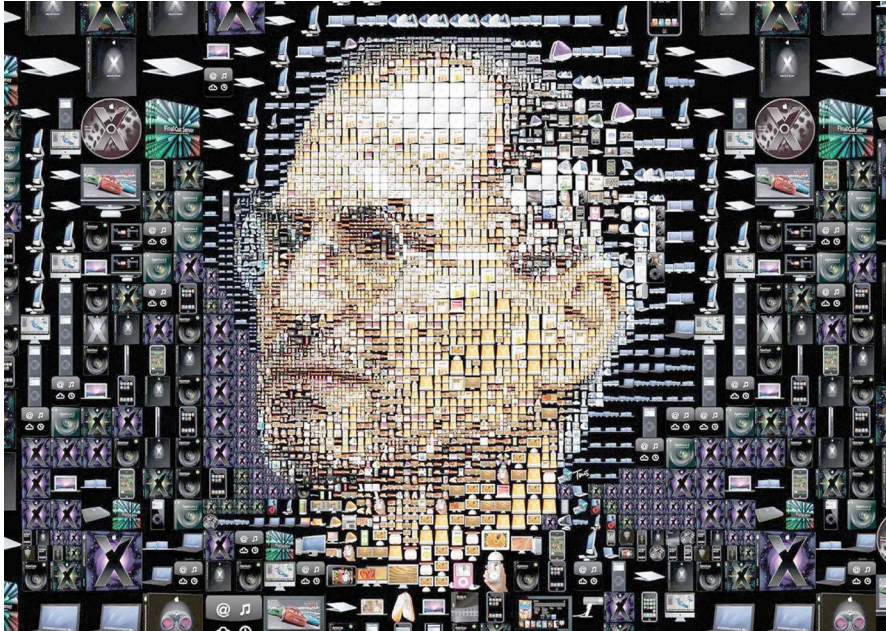
**Figure 3** - In order to quickly register and pass information on, different languages have been created and employed in databases and libraries.

in case of studies conducted with several objects, tools, products and parts which, as a whole, must be referred to as "material" in its singular form. For instance: A shop sells building material. In other words, it sells a variety of products, tools and supplies for construction purposes.

In a dissertation or article, the chapter entitled "Material and Methods" refers to the whole set of objects and products used. Conversely, no collective noun is used in reference to a set of methods, often employed

in association with more than one method. Researches are usually carried out by means of imaginologic, statistical, surgical, microscopic and photographic methods, which hinders the use of "Material and Method" in its singular form. The path that employs several methods to achieve a desirable result is known as methodology.

That is the reason behind the use of "Material and Methods", although the term "Materials and Methods" have been used and recommended by the guidelines of several institutions



**Figure 4 -** Contemporary man uses symbology to be immortalized for future generations, as it is the case of Steve Jobs, co-founder of Apple.

and journals. Subtleness is generally related to refinement and absolute accuracy. Some studies, institutions and journals allow or recommend the use of “Patients and Methods” for considering that research subjects have a spirit or a soul and, for this reason, “Material and Methods” would be too impersonal for humans. Should that be the case, this chapter should have been entitled “Patients, material and methods”, given that a set of objects, products and other tools are used to conduct the study. To be more precise, given that research subjects are not always ill, the term “People, material and

methods” should be used instead. However, the term “Material and Methods” is generally used in modern sciences, even when the study sample comprises people.

### Using the term “**biomaterial/biomaterials**”.

In our current society, we cannot change some basic concepts and violate our mother tongue by creating dialects with meanings that are restricted to a field of study — for instance, a specialty.

If "material" is a collective noun, how should we deal with the term "biomaterial/biomaterials"? When products aiming at improving bone repair are referred to as "**biomaterial**" by surgical suppliers, they make reference to an adjective that, according to the dictionary, stands for a product or object: Relating to matter; physical rather than spiritual; rough, rude, dull; solid or heavy; practical, useful, objective.

Although it may seem too different from what we are used to, the term "**matter**" should replace the term "material" used in the form of an adjective. As we have previously mentioned, "matter" stands for solid, liquid or gaseous substances that occupy space, an aggregate of particles that has mass or a material substance of a particular kind.

As for "**bio**", functioning as an element of word formation, it comes from the Greek: indicating or involving life. For instance: biological, biography, etc.

As for "**life**", it stands for the sequence of physical and mental experiences that make up the existence of animals and plants, which distinguishes them from dead organisms or raw matter. An organismic state characterized by capacity for metabolism, growth, reaction to stimuli, and reproduction. Life means existence. It also means an organismic state or condition that lasts from birth to death.

When the term "biomaterial" is used in Implantodontics, it probably makes reference to a matter-related product. When the term "material" is used as a collective noun, it functions as an adjective that qualifies

something relating to matter. In this case, adding the term "bio" is meaningless, given that the product is no longer alive. Thus, it is suggested that the following be used instead: Bone repair matter or products with bioaffinity, or simply "matter" or "bioaffinity products" or further suggested terminology capable of identifying these products with greater accuracy.

**Bioaffinity** is a term widely used in Chemistry in reference to the property of a specific attraction between a biomolecule and other molecule, biological or not. As for **biocompatibility**, it does not compete with bioaffinity, given that it refers to the condition of being compatible with a living organism by not being injurious to adjacent tissues or harmful to the organism as a whole. Biocompatibility has a broad scope, given that it aims at maintaining an organism as a whole.

### **Final Considerations: The correct is "Material and Methods"**

The "Material and Methods" section of scientific papers, thesis and dissertations has not been uniformly used by all journals and institutions. Many doubts arise as a result of the inappropriate use of "Materials and Methods" and the recent improper correction "Material and Method".

The term "material", in its singular form, stands for a collective noun of intrinsic plurality. It represents a set of parts, apparatus, tools, objects and products used in research, and, for this reason, must always be used in its singular form.

Conversely, “methods” must be used in its plural form because no collective term is able to cover all procedures employed in a research, which often includes more than one single investigation method, for instance, reading, tests, calculations, trials and illustrations.

“Material” must not be used in reference to a product, given that its singular form functions as an adjective relating to matter: Solid, liquid or gaseous substances that occupy space as an aggregate of particles that has mass.

Widely used, the term “material” functions as a collective noun or a qualifying adjective employed to name or qualify something in its singular form.

Correcting such terminological distortions requires persistence. Perhaps the dynamic nature of language may embrace the meanings of terms that have been inappropriately used. Another feasible alternative would be to replace “material” by “matter” whenever the former stands for a singular concrete noun.

## REFERENCES

1. Consolaro A. Queremos saber! Bauru: Idea; 2013.
2. Ferreira ABH. Aurélio Século XXI: o dicionário da Língua Portuguesa. 3ª ed. Curitiba: Positivo; 2010.
3. Jablonka E, Lamb MJ. Evolução em quatro dimensões : DNA, comportamento e a história da vida. São Paulo: Companhia das Letras; 2010.
4. Skinner HA. The origin of medical terms. Baltimore: Williams & Wilkins; 1961.
5. Villar MS, Houaiss A. Dicionário Houaiss da Língua Portuguesa. Rio de Janeiro: Objetiva; 2009.