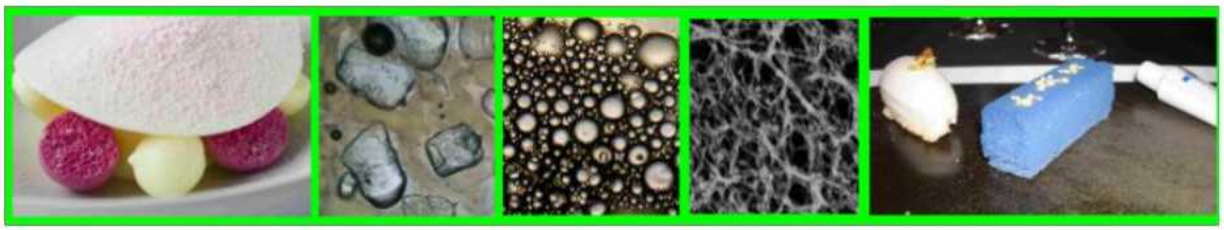

Inrae-AgroParisTech
International Centre for Molecular and Physical Gastronomy

International Journal of Molecular and Physical Gastronomy

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Title of the work
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2023, 12, 1-5

Published online: 22 October 2023, https://icmpg.hub.inrae.fr/international-activities-of-the-international-centre-of-molecular-gastronomy/international-journal-of-molecular-and-physical-gastronomy/1-news/editorials/editorials

International Journal of Molecular and Physical Gastronomy
*(*Molecular Gastronomy*)*
Editorial

Shall we get rid of adjectives and adverbs in scientific writing? Not always.

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Abstract
The scientific method is based on a quantitative, precise and rigourous description of the phenomena. When are adjectives and adverbs legitimate in scientific writing ?

Keywords
scientific writing, adjectives, adverbs, quantitative information

As I finish evaluating a scientific manuscript for a journal other than this one, I notice once again that the main mistake done by the authors is the excessive use of imprecise adjectives and adverbs, and the question I ask myself is: should words of this kind be banned entirely from scientific texts? Should they be systematically replaced by the answer to the question "How much?". Indeed, I am not alone in thinking so, as it was frequently proposed, in particular the fifth rule given by Weinberger *et al.* (2015).

Let us start by looking at some examples: an adjective like "large" means nothing because what is large in relation to an ant can be small in relation to Mount Everest; "hot" means nothing because is it hot in relation to the 37 °C of the human body, or in relation to 0 K? "Very hot?": it gets worse. "Important": a reading of scientific articles shows that this is very often the sign of an argument of authority, of "communication", which has no place in an objective presentation of experimental or theoretical results. "Complex?": this is often (except for complexity theories, for example) the sign of the author's lack of understanding or a way to tell the readers that the scientist who studies the matter is particularly good.
Wouldn't it be a good idea to give our friends who write manuscripts the essential advice of hunting down these types of words, adjectives and adverbs, in order to replace them with the answer to the question "How many?", which is the question on which the natural sciences are based? And shouldn't we be looking for the

Table 1. Proportion of adjectives and adverbs from some scientific texts, distributed in categories (in %). The last line was about an article published in this journal.

Author	characterizing	imprecise	quantitative	rhetorical
Faraday (1823)	18	33	45	5
Einstein (1905)	52	17	22	9
Perrin (1909)	25	37	24	16
De Gennes (1968)	68	7	20	5
De Gennes (2002)	42	30	12	15
Lehn (2017)	46	17	26	11
This vo Kientza (2022)	61	17	9	13

presence of such words as soon as a manuscript is received by a journal, so that we can immediately ask authors to replace them with precise, quantitative information?

After all, the natural sciences are based on the following process:

- identifying a phenomenon;
- quantitatively characterising the relevant aspects of this phenomenon;
- combining quantitative data into equations;
- building up a theory by combining the equations and introducing new (obviously quantitative) concepts;
- searching for consequences of this theory which can be tested;
- experimentally testing the theoretical predictions;
- and so on *ad infinitum*.

In this movement, the quantitative is everything, and it is through numbers that we can decide between competing hypotheses. So the question is, should we be radical and do away with all the adjectives and adverbs? Of course, when we describe the results, for example, a curve, we may want to say that there is an initial "slow" growth, followed by a "fast" growth. But these two adjectives should alert us: wouldn't we be more precise if we immediately added by how much the first growth is slow, and by how much the second is fast? Could we not immediately look for a law of variation or a quantification of this speed? And, in any case, the "discussion" should look at this, even if the description of the results has already done so.

With that in mind, I had some fun examining the adjectives and adverbs that survive in articles published by a few scientists of the past or present: Michael Faraday, Jean Perrin, Albert Einstein, Pierre-Gilles de Gennes, Jean-Marie Lehn and myself (rest assured: I'm not comparing myself to these remarkable scientists). Very often, the adjectives or adverbs used are "necessarily" used, in the sense that they specify objects, characterise them, and are not subjective assessments. For example, a "sealed" glass tube, "new hydrates", "heavy bodies", "electromagnetic waves". Or they may be quantitative characterisations: a "finite" number, a value "greater" than a precise value, the "average" energy, etc.

Admittedly, our predecessors were not perfect, and some of them let themselves go by using adjectives that were insufficiently precise ("light

yellow gas", "instantaneous value", "studied extensively", etc.), but sometimes the adjectives are authoritative, especially in the older texts (Faraday, Einstein, Perrin), which are more bombastic, which is typical of their time; finally, sometimes the words are rhetorical, with the aim of better establishing the importance of the results ("interesting results").
The appendix lists the adjectives and adverbs systematically recorded, in the order in which they appear in five texts, and Table 1 gives the proportions calculated (on small samples).
What conclusions can we draw? Firstly, that we cannot ban adjectives and adverbs from scientific texts: from Table1, one can calculate that the majority of them are needed. Secondly that all the adjectives written in these publications have a purpose. For sure, some imprecise adjectives can usefully be replaced by the answer to the question "How many?", and here is perhaps a piece of advice that we can remind authors and reviewers about: check that adjectives and adverbs are necessary, in manuscripts submitted to the *International Journal of Molecular and Physical Gastronomy* or to any other journal.

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Kulchat S, Chaur MN, Lehn JM. 2017. Kinetic Selectivity and Thermodynamic Features of Competitive Imine Formation in Dynamic Covalent Chemistry, *Chemistry the European Journal*, 23, 11108 – 11118.

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Received :
20 August 2023

Accepted :
19 October 2023

Published :
22 October 2023

Editor:
Roisin Burke, Technological University Dublin, Ireland.

Reviewers :
1. Mark Traynor, Auburn University, Alabama, USA

2. Anonymous

Cite as:
This vo Kientza. 2023. Shall we get rid of imprecise adjectives and adverbs in scientific writing? Not always, *International Journal of Molecular and Physical Gastronomy*, 12, 1-5.

Annex:

In what follows, for some pages of each text selected, adjectives and adverbs are given in the order in which they appear. The list only concerns the beginning of the texts (a more complete work can be done later, assuming that it is of interest). Note that the last text is by an author who is not of the same scientific quality as the authors of the previous texts, but the analysis gives an impression of the editing work carried out by the editors and reporters of this journal.

1. Faraday M. 1823. On fluid chlorine, *Philosophical Transactions of the Royal Society*, 13 (2), 160-165:
well known, usually, low temperature, pure dry gas, late cold weather, short paper, interesting results, sealed glass tube, upper und, hermetically close, bright yellow atmosphere, faint yellow colour, heavy bright yellow fluid, apparent tendency, pale fluid, bent tube, more complete decomposition, weak solution, a little muriatic acid, two new hydrates, entirely separated, vertically, immediate deposit, perfectly dry tube, sulfuric acid, pure chlorine, liquid state, very limpid, excessively volatile, common pressure, immediately flew off, atmospheric pressure, true composition, exactly like...

2. Einstein A. 1905. Concerning an heuristic point of view toward the emission and transformation of light, *Annalen der Physik/American Journal of Physics* (May 1965), 33(5), 367-374 :
profound formal distinction, theoretical concepts, ponderable bodies, empty space, very large, yet finite, spatial functions, finite number, sufficient, complete determination, continuous spatial function, purely electromagnetic phenomena, present conception, arbitrarily, small parts, purely optital, instantaneous values
complete experimental confirmation, related phenomena, increasing space, finite number, useful, completely reflecting, conservative forces, widely separated, bound electrons, free molecules, conservative interactions, definite period, dynamic equilibrium, identical, kinetic energy, average kinetic energy, universal gas constant, absolute temperaure, potential energy, average value greater or less, average energy, similar argument, wider range, greater energy, fundamental constant, large values, evident, exactly, useful, different frequencies, single variable, well confirmed, monochromatic radiation…

3. Perrin J. 1909. Mouvement brownien et réalité moléculaire, *Annales de chimie et de physique*, 8(43), 5-114:
masse fluide, immobiles, objet plus dense, exactement, sphérique, lente, petit, mouvement perpétuel, seconde espèce, familières, bonnes, simple emploi du microscope, vieille conception statique, difficile, milieu liquide, mouvement régulier, parfaitement irrégulier, aucunement, mouvement brownien, objectifs achromatiques, animalcules vivants, plus vivement, rendre visible, projection difficile, résultat acceptable, arc électrique, la plus grande partie, rayons calorifiques non lumineux, observation directe, fort grossissement,horizontalement, réflexion totale, verre dépoli, écran ordinaire, émulsion appropriée, difficilement perceptible, éclairage latéral, moins gros, visibles, au premier abord paradoxale, des gros grains, agitation moins grande, très suffisante, caractères essentiels, désirable, étude expérimentale, parfaitement sphériques, obscurité rigoureuse, cause extérieure, beaucoup, analogue, petites différences, apparente explication, esprits réfléchis, propriété fondamentale, phénomène insignifiant…

4. De Gennes PG. 1968. Calcul de la distortion d'une structure cholestérique par un champ magnétique, *Solid State Communications*, 6, 163 – 165:
champ magnétique nul, structure hélicoidale, champ magnétique, période spatiale, valeur critique (avec valeur), alignement complet, systèmes cholestériques, ondes lumineuses, champ magnétique, champ fort, équilibre

thermodynamique, conditions idéales (caractérisé), vecteur unitaire, constantes élastiques, susceptibilité magnétique, axe hélicoïdal, énergie libre, longueur caractéristique, intégrale première, période spatiale, unités réduites, intégrales elliptiques, champ nul, diverge logarithmiquement, champ critique, configuration nématique, axe hélicoïdal, configurations côniques, analyse détaillée, énergie libre, plus basse en énergie, cas intermédiaires, équilibre thermodynamique, structures cholestérique, champs magnétiques relativement faibles, difficultés techniques évidentes...

5. De Gennes PG. 2002. A simple picture for structural glasses, *C. R. Physique* ,3, 1263–1268:
simple structure, structural glasses, mosaic structures, possible role, slightly more compact, free volume, low density matrix, free volume, localement hétérogène, naturel, régions compactes, coordination icosahédrique, modèle classique, volume libre, densité un peu plus basse, hypothèse centrale, assez bien définie, matrice amorphe, propriétés statiques, chaleur spécifique, amazing, flat glass, splendid pigments, recent achievements, optical fibers, important distinction, strong liquids, well defined, fragiles liquids, apparent activation energy, covalent bonding, typical barrier, most recent observation, structural grasses, fundamental heterogeneity, purely qualitative, local clusters, crystallographic literature, ionic transport, glassy matrix, fast orientational relaxation, long time, nicely narrow, similar information, different molecules, same molecule, simple relaxation, more complex mode, coherent light scattering, small wave vector, anomalous, molecular glasses, small angle peak, matches exactly, characteristic length, large, critical behavior…

6. Kulchat S, Chaur MN, Lehn JM. 2017. Kinetic Selectivity and Thermodynamic Features of Competitive Imine Formation in Dynamic Covalent Chemistry, *Chemistry the European Journal*, 23, 11108 – 11118:
dynamic covalent chemistry, reversible actions, complementary functional groups, molecular constituents, carbonyl groups, amino groups, prominent role, related compounds acylhdrazones, extensively studied, bioactive molecules, materials science, adaptive chemistry, widely implemented (mais références données), primarines amines, nucleophiles, more stable amines, recent times, different aldehydes, simple two component reactions, different amino derivatives, mixed DCLs, relative reaction rates, a mixture of different imines, final composition, reactions are slow, it is difficult, present investigation, very slow reaction, relative fraction, relative amounts, initial stages, simple second-order kinetics, easy comparison, very slow, extensively studied, low equilibrium constants, organic solvents, individual amine, equimolar, weakly acidic, kinetically favored, formed quickly (mais valeur donnée), react efficiently

7. This vo Kientza H. 2022. Using the disperse system formalism, DSF, to determine the first two classes of complex suspensions, *International Journal of Molecular and Physical Gastronomy*, 2, 1-8:
disperse system formalisms, complex suspensions, physical and chemical systems, particularly useful, colloidal systems, complex gels, first classes, increasing number, solid phase, monophasic liquid phase, ubiquitous, more or less concentrated, deformable particles, frequently, respectively, same order of magnitude, directly inside, random dispersion...