Influences from Latin on Chemical Terminology

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Latin forms the basis of many European languages such as French, Italian, and Spanish and was used for centuries as the main "lingua franca" of the Roman world, spreading with the expansion of the Roman Empire *(1)* and later, the Catholic Church *(2)*. Latin has also influenced the English language *(3)*; in fact, many everyday English words have a Latin origin. Examples include: *introduction*, *penultimate*, *minus*, *mile*, *contradict*, *omnipotent*, *professor*, *vice president* and *senate*, to name just a few. It is obvious that there would be many scientific and chemical words that have a Latin derivation. There would be two main reasons for this: first, in the western world, Latin was used as the language of scholarship well into the 17th century: the last great English-speaking scientist who used Latin was Isaac Newton in his *Principia Mathematica* in 1687 *(3)*; second, early Western chemists in the 18th and 19th century, usually had a classical education, steeped in Latin and Greek, so that when it came to describing a new scientific or chemical term, they resorted to their knowledge of Latin and Greek to coin the new word.

A recent article in this *Journal* discussed the influences of ancient Greek on chemical terminology *(4)*. This article traces the influence of Latin on words commonly used in chemistry.

Understanding the Meaning of Latin-Derived Words

To understand the meaning of Latin-derived words it is first necessary to look at Latin prefixes and suffixes: these are components of words which are put at the start (prefix) or at the end (suffix) of a word. Familiarity with these word components, also called morphemes, allows for easy formation and understanding of Latin-derived words. Table 1 shows an alphabetical list of Latin prefixes commonly found in chemical terminology, while Table 2 lists Latin suffixes routinely used *(5– 7)*. Examples are given for each case and knowledge of these Latin prefixes and suffixes allows for easier understanding of the exact meaning of these words. Additional examples are *superscript* and *subscript*, so essential in chemical formulas, and *in situ*, meaning in the original situation, literally "in place".

Latin-Derived Names for Chemical Elements

Several papers addressing the naming of the elements have appeared in this *Journal* over the years *(8– 17)*. Two articles in particular *(13 17,)* explore the origin of these elemental names and many are shown to have either Greek or Latin derivation. A recent paper in this *Journal (4)* summarized the 36 elements whose name derives from the ancient Greek language or Greek mythology. Table 3 lists the elements whose names are derived from Latin, in order of increasing atomic number. Further information regarding the naming of these elements can be obtained from additional sources *(18, 19)*.

Table 1. Latin-Derived Prefixes Commonly Used in Chemical Terminology

Latin Prefix	Meaning in English	Example
Ab-	Away from, off	Absorption
Ad-	Toward, to	Adhesion
Ambi-	Both, on both sides	Ambivalent
Bi-	Twice, twofold	Bimolecular
Co-	Together, with	Covalent
De-	From, down from	Desorption
Dis-	Apart, away from	Discharge
Equi-	Equal	Equimolar
Ex- (ef- or e-)	Out of, off	Effluent
In-	In, into	Induction
In-	Not	Insoluble
Infra-	Below	Infrared
Inter-	Between	Intermolecular
Intra-	Within	Intramolecular
Multi-	Many	Multivalent
Non-	Not	Nonaqueous
Post-	After	Postcolumn
Prae-	Before	Pre-electrolysis
Re-	Back, again	Reduce
Sesqui-	And a half more	Sesquioxide
Super-	Above, over, more than	Superconductor
Trans-	Across	Transmutation
Ultra-	Beyond	Ultraviolet

Table 2. Latin-Derived Suffixes Commonly Used in Chemical Terminology

English Suffix	Latin Ending or Word	Meaning in English	Example
-able	-abilis	Capable of	Reduceable
-ant	-ant	Corresponding to	Reductant
-cide	caedere	To kill	Herbicide
-cule	-culus	Small	Molecule
-eous	-eus	Pertaining to	Aqueous
-ion	-io	Action	Fission
-ory	-orium	Place	Laboratory

As can be seen from Table 3, there are 18 elements with Latin-derived names. Eight of these are derived from Latinized place names and one for the planet Earth; three deal with the colors found in their emission spectra; the rest refer to properties and Latin names for materials in which they were found.

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Table 3. Etymologies of Chemical Elements with Latin-Derived Names

Element Information				
Atomic Number	Symbol	Name	Latin Word	Etymological Meaning
6	C	Carbon	Carbo	Coal, charcoal
9	F	Fluorine	Fluere	To flow, fluorspar used as a flux in metallurgy
13	Al	Aluminum	Alumen	Alum, the aluminum salt
14	Si	Silicon	Silex	Flint, a Si-containing mineral
20	Ca	Calcium	Calx, calcis; calcinare	Chalk ($CaCO_3$), lime; Incinerate chalk to lime
21	Sc	Scandium	Scandia	Scandinavia, only found there and discovered by a Swede, L. F. Nilson in 1879
29	Cu	Copper	Cuprum	Mined in Cyprium, Cyprus, by the Romans
31	Ga	Gallium	Gallia	Gaul, modern France, discovered by Frenchman Lecoq de Boisbaudran in 1875
37	Rb	Rubidium	Rubidus	Deepest red, after its reddish-violet flame color
44	Ru	Ruthenium	Ruthenia	Russia, discovered by the Russian Karl Klaus in 1844
49	In	Indium	Indicum	Indigo, named after the blue spectral line in its spectrum
52	Te	Tellurium	Tellus	Earth, named after our planet
55	Cs	Cesium	Caesius	Bluish gray, named after the bright blue lines in its emission spectrum
67	Ho	Holmium	Holmia	Stockholm, hometown of P. T. Cleve who discovered the element in 1878
71	Lu	Lutetium	Lutetia	Paris, named by the French chemist G. Urbain, who codiscovered it in 1907
72	Hf	Hafnium	Hafnia	Copenhagen, named after the place of discovery in 1923 by D. Coster and G. von Hevesy
75	Re	Rhenium	Rhenus	Rhine, after the German chemists, W. Noddack, I. Tacke, and O. Berg who discovered it in 1925
88	Ra	Radium	Radius	Ray, referring to its radioactivity

An interesting case is the naming of Gallium. It was named by its discoverer, Paul Emile Lecoq de Boisbaudran after the Latin name for Gaul, essentially modern France, his native land. It was later claimed, however, that he had also named the element after himself, because "le coq" in French means "the rooster" and the Latin for "rooster" is "gallus". However Lecoq controverts this in an article he wrote describing gallium and his methods of discovering it *(20)*.

Regarding the name of the element Cs, it should be noted that the international spelling of the name, standardized by IUPAC *(21)*, is actually Caesium, as it should be, considering the Latin word from which it comes, and not Cesium, although this spelling variant, predominant in American English, has been accepted by IUPAC since 1993 *(22)*.

Latin influences can also be seen in the symbols used for elements whose English name is not reflected in the symbol for that element. There are nine such elements and the information is shown in Table 4.

Naming of Chemical Compounds: Classes and Types

Although the naming of chemical compounds and complexes is mainly based on the ancient Greek numerals *(4)*, it is informative to look at some of the Latin numerals and their associated words that are used in chemical terminology. Table 5 summarizes the most important Latin numerals and ordinals, with an example of their use.

As seen in that table, many words used in chemical terminology are based on Latin numerals. *Primary* and *secondary* alcohols, *tertiary* amines and *quaternary* ammonium compounds are just some examples of classes of compounds based on Latin ordinals. An interesting example is *nonane*, C_9H_{20}, the ninth member of the homologues series of alkanes, named after the Latin ordinal for nine. Most of the other members in that series are named after Greek numbers *(4)*. Nonane is an exception in that series.

Other classes of compounds based on Latin prefixes are *semiconductors* and *superconductors*, *nonelectrolytes* and *multidentate* (many teeth) *ligands*. The latter word comes from the Latin verb *ligare*, "to bind". The term *insulator*, literally means "making something into an island" (*insula*), and clearly describes its nonconducting properties.

The word *patricide* means "father killer" (*pater* means father), while *regicide* means "king killer" (*rex* means king), so a word like *herbicide* (*herba* means vegetation) means weed killer and *germicide* is that which kills germs.

A *sesquioxide* is an oxide containing three atoms of oxygen with two atoms of another element, in line with the Latin meaning of the prefix *sesqui* shown in Table 1. For example, Al_2O_3 is a *sesquioxide*. Another example is Fe_2O_3. The name also applies to compounds containing other negative ions in the same ratio with metal ions: chromium *sesquisulphate* $Cr_2(SO_4)_3$, and ethyl aluminum *sesquichloride*, $(C_2H_5)_2AlCl \cdot Cl_2Al(C_2H_5)$, a catalyst used in the Ziegler–Natta polymerization process for the synthesis of vinyl and diene polymers *(23)*.

Using Etymologies of Latin Word Derivations To Enhance Chemistry Teaching and Learning

General Words Used in Introductory Chemistry

Numerous words that form part of our everyday chemical nomenclature are derived from Latin. In *introductory* ("leading

Table 4. Latin-Derived Suffixes Commonly Used in Chemical Terminology

Atomic Number	Symbol	English Name	Latin Name	Explanation
11	Na	Sodium	Natrium	Latin name for natron, a hydrated sodium carbonate salt, found in Egypt
19	K	Potassium	Kalium	Latinized name of the arabic word "alkali", meaning calcined ashes
26	Fe	Iron	Ferrum	
47	Ag	Silver	Argentum	
50	Sn	Tin	Stannum	Originally referred to an alloy of Ag and Pb; came to mean tin only in the 4th century B.C.E.
51	Sb	Antimony	Stibium	Name proposed by Berzelius
79	Au	Gold	Aurum	
80	Hg	Mercury	Hydrargyrum	Latinized Greek meaning "silver water" or "liquid silver"
82	Pb	Lead	Plumbum	

Table 5. Latin Numerals and Ordinals

Numeral	Ordinal in Latin (English)	Example
Unus (1)	Primus (first)	Univalent, primary
Duo (2)	Secundus (second)	Duality, secondary
Tres (3)	Tertius (third)	Tertiary
Quattuor (4)	Quartus (fourth)	Quadrivalent, quaternary
Novem (9)	Nonus (ninth)	Nonane
Decem (10)	Decimus (tenth)	Decimal
Centum (100)	Centesimus (hundredth)	Centimeter
Mille (1000)	Millesimus (thousandth)	Milligram

into") chemistry courses, one has the *mole*, which comes from the Latin word *moles*, meaning "mass", and *molecule*, which is the diminutive form of moles, signifying "a very small mass". The term *valency* is derived from the word *valentia* meaning "strength" and hence "covalent" means two atoms exerting a strong influence on an electron pair in a bond.

The word "equilibrium" is derived from *aequus* ("equal") and *libra* ("balance") and perfectly describes a stable state of a system, as illustrated by the two arms of an old-fashioned chemical balance being level during a weighing process. The words *equal* and *equation* are also related to *aequus*, while *aequatio* means "making equal". "Equivalent" (*aequivalens*) indicates "having equal power".

The term *constant* comes from the verb *constare* meaning "to stand firm", indicating that the particular value must be the same under different conditions.

The terms *metal* and *metallic* come from *metallum* ("metal") and *metallicus* ("having the qualities of a metal"), respectively. An orbital derives from *orbita*, meaning a "circuit". The terms *solubility*, *solvent*, *solvation*, *solution*, *soluble*, and *insoluble* (note the prefix *in-*, meaning "not") are all derived from the verb *solvere* ("to loosen or dissolve"). The word "salt" comes from the Latin word *sal*, and hence *saline* and *desalination*. "Miscible" and "mixture" are derived from *miscere*, meaning "to mix".

Further introductory chemistry words are *nuclear* (*nucleus* means a kernel, or the inside of a thing), *configuration* (*configere* means to fasten together), *co-ordination* (from *ordinare* to arrange), *activity* (*activus* means active), *distribution* (*distribuere*, to divide), *complex* (*complexus* means combination), *crystal* (*crystallus* means crystal) and others.

Latin-derived words dealing with introductory practical work are "laboratory", consisting of *labor*, "work" and the suffix

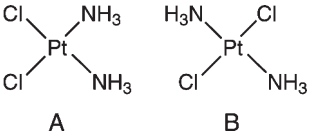

Figure 1. Isomeric structures of (A) *cis*- and (B) *trans*-$Pt(NH_3)_2Cl_2$.

-orium, "place"; *acid* (*acidus* means sour); *balance* (*bilanx*, having two scales); *aqueous* and *nonaqueous* (*aqua*, water); *desiccator* (*siccare*, to dry); *neutralize* (*neuter*, neither one nor the other; i.e., neither acid nor base); *reduction* (*re-*, again or back, and *ductare*, to lead; i.e., leading back the electrons, to cause a lower nuclear charge), and *precipitate*, which derives from "*praecipitare*", meaning "to fall headlong, to rush down".

Inorganic Chemistry Terms Derived from Latin

Some inorganic compounds or complexes are often named using either the terms *cis-* ("on this side of") or *trans-* ("across") as prefixes *(24)*. For example, the *cis-* and *trans-* isomers of Pt-$(NH_3)_2(Cl_2)$ are shown in Figure 1; using this notation, it is possible to easily distinguish between the two isomers, which have different properties.

In the cis isomer, named *cis*-diamminedichloroplatinum-(II), identical ligands occupy adjacent corners of a square, while in the trans isomer, named *trans*-diamminedichloroplatinum-(II), the identical ligands are across from each other. It is interesting to note that the cis isomer, called cisplatin, is an effective anticancer drug, whereas the trans isomer is physiologically inactive *(24)*.

Physical Chemistry Terms Derived from Latin

In spectroscopy there are numerous Latin-derived words: a *spectrum* in Latin means "an appearance" or "image of a thing" and the *visible* (*visus*, meaning sight) spectrum indicates the portion of radiation that can be seen with the naked eye. The sensitivity limits of the human eye extend from violet light ($\lambda = 400$ nm, 4×10^{-7} m or wavenumber 25 000 cm^{-1}) through the rainbow colors to red light ($\lambda = 800$ nm, 8×10^{-7} m or wavenumber 12 500 cm^{-1}) *(25)*.

Infrared radiation is the portion of the spectrum *below* the red, referring to the wavenumber range of 12 500−33 cm^{-1}, which is *below* that for red light. The name suggests a lower wavenumber, hence lower energy than red light. Similarly, *ultraviolet* light is the portion of the spectrum *above* violet, exceeding the wavenumber of violet, and therefore more energetic than violet radiation.

Table 6. Some Selected Latin-Derived Words from Instrumental Analytical Chemistry

Latin-Derived English Word	Latin Word and Meaning
Detector	Detector, an uncoverer
Dispersion	Dispersio, a scattering
Flame	Flamma, a flame
Fluorescence	Fluor, a flowing
Membrane	Membrana, a thin skin
Mobility	Mobilis, movable
Polarity, polarization	Polus, a pole
Potential	Potentia, power
Pulse	Pulsus, a beating
Refractive index	Refractum, broken up; and index, from indicare, to point
Selectivity	Selectio, selection
Transformer	Transformare, to change in shape

The terms *vibrational*, *rotational*, *quantum* ("how great"), and *emission* all derive from Latin words. Two additional terms, *absorbance* (*ab-* and *sorbere*, "to suck in") and *transmission* ("to send through"), make sense when the Latin meaning is understood.

The term *adsorption* in surface chemistry signifies the deposition of gas molecules on the surface of a solid to form either a monolayer or multilayers *(26)* and represents a tendency of gas molecules to go toward (*ad-*) the surface. *Desorption* indicates removal (*de-*) of the molecules from the surface.

The nuclear terms *fusion* and *fission* can be distinguished by understanding the Latin words from which they are derived: *fusio* means "a melting" and hence fusion indicates the combining of the nuclei of atoms under intense heat to release nuclear energy; the word *fissio* means "a cleaving" and hence fission indicates the splitting of a nucleus of a heavy atom into nuclei of lighter atoms and the resultant release of energy.

In a reaction mechanism, the last step is termed the terminal step, reflecting the word *terminus,* ("limit or end"). Finally, the term *radioactivity* is purely Latin, based on *radius*, "ray", and *activus*, "active".

Analytical Instrumental Chemistry Terms Derived from Latin

Numerous Latin-derived terms are used here. Table 6 summarizes some selected terms with the words from which they derive.

Organic Chemistry Terms Derived from Latin

Many organic acids and alcohols have trivial names derived from the Latin language. Table 7 summarizes some of these, together with their original meaning. In many cases, the compound was named after the Latin word of the material from which it was first isolated and identified.

Certain techniques used in organic chemistry also derive from the Latin: *saponification* (*sapo*, "soap"), *distillation* (*destillare*, "to trickle down"), *extraction* (*ex-* and *trahere*, "to draw or drag"), and *reflux* (*re-* and *fluere*, "to flow back").

Finally, a *racemic* mixture derives its name from *racemus*, meaning a bunch of grapes, and indicates a 50:50 mixture of (+) and (−) isomers, which produce no net optical rotation in a polarimeter because the rotations produced by the individual isomers exactly cancel. The first known racemic mixture was "racemic acid" that Pasteur found to be a mixture of the two enantiomeric isomers of tartaric acid *(27)*, an acid that occurs naturally in grapes.

Table 7. Latin-Derived Trivial Names of Certain Organic Compounds

Trivial Name	Latin Word and Meaning
Acetic acid	Acitum, vinegar
Citric acid	Citrus, lemon
Oleic acid	Oleum, olive oil or oil
Lactic Acid	Lac, milk
Cerotic acid	Cerotum, wax plaster, beeswax
Palmitic acid	Palmetum, a palm groove
Myristic acid	*Myristica fragrans*, nutmeg
Cetyl alcohol	Cetus, whale

Conclusion

This article has shown that there are many Latin-derived words used in chemistry, and that an elementary knowledge of Latin prefixes and suffixes, together with a few selected Latin words, can lead to a better understanding of the exact meaning of these words. Learning the connection between the roots of Latin-derived words and the chemical meaning of these terms allows students to master these chemical concepts easier *(28− 32)*.

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