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### Translating German, French, and Italian Chemical Literature

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## TRANSLATING GERMAN, FRENCH, AND ITALIAN CHEMICAL LITERATURE

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The object of this paper\* is to outline briefly some of the major problems facing the translator of foreign chemical texts, and to offer a few practical suggestions for solving them. The intention is not to lay down any ironclad rules which will apply in all cases, but rather to recommend a few simple mental techniques calculated to facilitate the work of the chemist who may be called upon to translate from the foreign literature.

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### ¶ COGNATES :

**Recognition.** The ability to recognize English cognates of foreign technical terms greatly facilitates the translation of technical material for anyone who is faced with a foreign text in his own field of specialization. Chemists who write in German, French, and Italian—the only languages which will be considered here—are not only professional colleagues whose minds are likely to work along the same scientific lines as that of American chemists, but they are also to some extent terminological brothers under the skin. This is more or less true of all fields of science, where specialized terminology has been evolved in one country and just as quickly adopted in another. Technical terminology generally keeps pace with scientific discovery, and as the results of individual and original research become known so do the new terms used to describe this research. Of course, by the time they reach us many of these terms have already been anglicized. Familiarity with a few basic principles enabling one to spot cognates automatically, as it were, will obviate the need for much time-consuming word hunting in the many instances where the English cognates can be detected at a glance. The examples given below are not always applicable, and there are a number of linguistic pitfalls to be avoided—cases where apparent cognates can turn out to be “false friends.”

Perhaps the most useful aid in recognizing cognates is a knowledge of the vowel and consonant changes which tend to recur frequently. The following enumeration of such changes makes no pretense at completeness, and although the cases illustrated will not be applicable always, they will be helpful in most instances.

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The consonants **b**, and **f**, **v**, or **w** are sometimes interchangeable. Thus, the German word *Silber* is cognate to silver. *Wismuth*, on the other hand, is bismuth. In German, the letter **b** will often reveal an English cognate when changed to **f**, as in *halb* meaning half.

In Italian, the letters **c**, **ch**, or **cc** will often hide a cognate. Thus, *caolino* is kaolin, *eccipiente* is excipient, and *chinino* is quinine. In German, the letters **ch** will frequently become **qu**, as in *Chinaldin* (quinaldine) and *Chinol* (quinol). In French, **ch** is also sometimes equivalent to **qu**, as in *chinoline* (quinoline).

The letter **k** does not exist in Italian, except in a handful of foreign words—mostly proper names. For example, one of the standard Italian dictionaries,<sup>(5)</sup> somewhat like the French “Larousse,” contains roughly 120,000 entries, but only about 50 of these appear under the letter **k**. Since **ch** in Italian is generally pronounced **k**, such Italian words as *chilometro* and *chilogramma* are cognate to the English words kilometer and kilogram.

Therefore, when confronted with a word containing the letters **ch**, one should mentally allow for the possibility that there is an English cognate where these letters will have changed to **qu** or **k**. As often as not, however, the English will also be written with **ch**, but then there is no problem because the cognate is overt and not hidden.

The combination **cl** or **cr** in Italian will often stand for **chl** or **chr** in English, as in *cloro* (chlorine) and *cromo* (chromium).

Conversely, English words written with a **c** will often be cognate to German words written with a **k**, as in *kolloidal* (colloidal), *Koks* (coke) and *kalorisch* (caloric). German words ending in **cht** are generally cognate to English words ending in **ght**, as in *Licht* (light) and *Fracht* (freight).

The thing to remember, therefore, is that the letters **c**, **ch**, **qu**, **k**, and **gh** are to a large extent interchangeable, and when confronted with a word containing any of these consonants one should be mentally prepared for the change.

With regard to the letter **d**, in cognate words it corresponds to German **t** or **th**, as in *Tochter* (daughter) and *Tod* (death). This latter example shows that, conversely, German **d** is sometimes cognate to English **th**, as also in *Bruder* (brother).

When faced with a foreign word containing the letter **f**, especially in Italian, the English cognate (if there is one) will immediately come to mind if the **f** is mentally changed to **ph**, as in *fenolo* (phenol), *asfalto* (asphalt), and a less obvious example, because it contains a double consonantal change, *canfora* (camphor). In cognate words, English **f** may also correspond to German **v**, which is understandable if one remembers that in German the letter **v** is pronounced **f**. Here are two examples: *Vater* (father), *vorwärts* (forward).

A single or double **g** in Italian will often give a clue to the English cognate when the **g** or **gg** is changed to **j** or **dj**, as in *getto* (jet) and *aggiustare* (adjust).

Although the letter **h** does exist in Italian, it exists only as an expedient in writing to differentiate between two words which are identical in pronunciation but dissimilar in meaning (as between *anno*, year, and *hanno*, they have), or else as part of a consonantal group such as **ch** or **cch**.

In Italian, the letter **h** has no consonantal standing of its own. When it occurs by itself, other than in such cases as just illustrated, it is as part of a foreign word, proper name, or place name. The standard Italian dictionary mentioned earlier lists only about 80 words under the letter **h**. This therefore presents a problem since a large number of Italian words will be recognized as cognates only if an **h** is mentally added. First of all, there are all the words containing such radicals as **hydro** and **hypo**, which in Italian will appear as *idro* and *ipo*. For example, rather than reach for the dictionary, supply an **h** in such words as *alcool* (alcohol), *idrato* (hydrate), *iposulfato* (hyposulfate), *aldeide* (aldehyde), *idrolisi* (hydrolysis).

The last four examples conveniently bring us to the vowel **i**. In Italian, this vowel can probably hide more cognates than any other single letter. Since Italian does not have the letter **y** at all, countless Italian words with **i** are direct cognates to English words written with **y**. The example of *idrolisi* (hydrolysis) is especially revealing because both the first and second **i** change to **y**. The same is true of *idrossile* (hydroxyl). Here are two more examples of this change: *acetile* (acetyl), *amile* (amyl). Therefore, when an Italian word with an **i**, either at the beginning or in the middle of the word, is suspected of being a cognate, the assumption can often be turned to certainty by mentally substituting a **y** or **hy** for the **i**.

The letter **j** in English presents no problem in French to which it is cognate. Nor does it present a problem in Italian for the very good reason that it simply does not exist in that language. In German, however, the **j** is sometimes cognate to our **y** or **i**, as in *Jahr* (year), *Jodid* (iodide) and *Jon* (ion).

The letter **k** was discussed above in connection with **c**, **ch**, and **qu**, and the letter **l** is generally cognate in the foreign. **M** and **n**, however, are sometimes interchangeable when preceding **f** and **ph**. We have seen that the English cognate of the Italian word *canfora* is camphor. The same is true of French where, for example, the word *confort* is cognate to comfort.

The vowel **o**, notably in French and Italian, may be cognate to **u**, as in *fonction* (function) and *pompa* (pump).

In German, **pf** is cognate to English **p**, as in *Hopfen* (hops) and *Tropfen* (drops).

Since the letters **q** and **qu** have already been discussed and since the consonant **r** generally presents no problem, we now come to the letters **s**, **t**, and **z** which do.

In Italian, the double **ss** is almost always cognate to our **x**, as in *complesso* (complex), *ossido* (oxide), and *reflusso* (reflux). When it precedes **p**, the Italian **s** also becomes **x**, as in *espansione* (expansion). In German and French words containing the letter **s**, the **s** generally remains unchanged in the English cognates.

The letter **t** in Italian can also be an annoying but, as we shall see, transparent screen behind which a perfectly good English cognate will lurk, especially when one **t** combines forces with another. Take the word *ottano* (octane), or the words *elettrico* (electric), *effetto* (effect), *contatto* (contact). As is evident, the double **tt** becomes **ct**. Here is one case where it becomes **pt**: *settico* (septic).

Since the letter **h** in Italian is merely an auxiliary and does not have any standing of its own, it is reasonable to expect that English words with **th** will, when we meet them in Italian, have lost the **h** en route. Such Italian words will read like perfect English if the **h** is restored in its familiar place behind the **t**, as in *catodo* (cathode) and *metano* (methane), or, for those who prefer a somewhat more challenging mental exercise, here is an example of another double change: *etile* (ethyl), in which the **t** becomes **th** and the **i** becomes **y**.

The last example of vocalic and consonantal changes in Italian is the Italian name of a chemical compound which requires seven letter changes before it becomes recognizable in English, namely *esaossicicloesane*. By restoring the two missing **h**'s, changing all the **s**'s to **x** and all the **i**'s to **y**, we finally get **hexaoxyyclohexane**, or of course, hexahydroxyyclohexane.

In French and German, the letters **t** and **th** are a help rather than a hindrance in recognizing cognates, except that occasionally one will find an extra **h** after the **t** as a form of antiquated spelling in German, as in *Theil* for *Teil* (part).

The letter **z** is the last of the changes selected for illustration. Here, the difficulty is in connection with the **z** in German, which may become **c** or **s** in the English cognate, as in *Kalzium* (calcium) and *Zucker* (sugar).

## ¶ FALSE FRIENDS :

Now a word of caution which should dampen anyone's excessive enthusiasm for cognate-hunting. There are many words, especially in the Romance languages, the spelling of which so closely resembles that of certain English words that one may be tempted to translate them literally. Although similar in form, these words are frequently different in meaning, and the chances are against any passage being correctly translatable by simply substituting the apparent—but false—cognate. This is an important pitfall to avoid, and such "false friends," as professional translators call them, should never be taken at face value.

This problem is particularly acute when translating from French. A considerable number of French words have found a secure place in the English language in almost unchanged form. However, the meaning of some of these words has evolved along different lines, so that a word which crossed the English Channel at the end of the eleventh century, let us say, and had the same meaning on both sides of the water at that time, may have a different meaning today.

The phrase, "*cette expérience a été d'intérêt*," contains two false friends. It does not necessarily mean "this experience was of interest," although in some contexts it may. In technical, and especially in chemical texts, it means, "this experiment was useful" or "this experiment was of value," or even "this was a significant experiment." Another example: "*Cette réaction a pratiquement donné du cuivre*" does not indicate that the "reaction practically yielded copper," but rather that it yielded copper "in practice," or more smoothly rendered, "this reaction **actually** yielded copper."

Another French word which should not always be translated literally, especially in technical texts, is the word *important*. In addition to its obvious abstract meaning of "important," it also has the concrete meaning of large or **substantial**, as in this example: "*Nous avons obtenu une quantité importante de l'acide*," which should correctly be translated as, "we obtained a **substantial** quantity of the acid." Here are two more French words which should be carefully interpreted on the basis of the context: *une lecture* is not "a lecture," but a **reading**. *Sans doute* may mean "without doubt," but more often it means just the opposite, namely, **probably** or **perhaps**. You can readily see how a translation of the phrase, "*ne me dérangez pas!*" would be somewhat lacking in accuracy were it rendered as "do not derange me!" Translating from French presents many such pitfalls.

An example of a false friend in Italian is the expression, *temperatura ambiente*, which should not be translated as "ambient temperature," needless to say, but as "**room** temperature."

You will also encounter a number of false friends in German, although less frequently so. A few examples which may be regularly found in technical texts have been selected. The expression, *Technische Hochschule*, does not, all appearances to the contrary, mean "technical high school." It stands for "institute of technology" or "polytechnic institute." In German, a *Hochschule* is a **university**. Another false friend German is one which all of us have warmly embraced at one time or another. I am referring to the word *eventuell*. Neither in its adjectival nor in its adverbial form does it mean "eventual" or "eventually." In German, this word denotes contingency in the sense of our own noun "eventuality." According to Webster, the corresponding English adjective and adverb originally had the same meaning, but this meaning is now obsolete. In German, the word *eventuell* can variously mean, "if necessary," "in certain cases," or just "perhaps." Let me illustrate: "*Diese Ergebnisse werden eventuell veröffentlicht werden*" does not mean that the "results will eventually be published," but rather that they **may be** published or that they will "perhaps" be published.

The words *neben* and *durch* are two more examples which should not be taken at face value. Although *neben* can mean **next to**, it is often preferable to translate it as **in addition to**. The word *durch* may have to be translated as **through** in some contexts, but in others it is more properly rendered as **by** or **by means of**. Thus, *durch Erhitzen* is not "through heating," but **by heating**. *Carbonsäure* is another case in point. It is properly rendered as **carboxylic acid**, not "carbonic acid," which in German is *Kohlensäure*.

## ¶ PREFIXES AND SUFFIXES :

A less elusive subject is that of prefixes and suffixes. I have selected a few typical ones in German, French, and Italian, and shall indicate their English equivalents, which may sometimes be cognate, but just as frequently not.

In German, the prefix *unter-* often becomes **hypo-**, **sub-**, or **infra-**, in addition to the more obvious **under-**, as in the following examples: *unter-*

*phosphorig* (hypophosphoric), *Untereinheit* (subunit), and *unterbelichten* (underexpose). The antonymic prefix *über-* can become *per-*, *super-* (or *supra-*), *hyper-*, and *ultra-* in addition to *over-*. Sometimes, it must be rendered by the word, *excess*: *Überoxyd* (peroxide), *über-basisch* (superbasic), *überelastisch* (hyperelastic), *Übermikrometer* (ultramicro-meter), *überlaufen* (overflow or flow over), *Überhitze* (excess heat).

A useful rule to remember is that, generally but by no means always, *über* in chemical compounds is *per-* and in verbs *over-*. Conversely, *unter-* is *hypo-* in chemical compounds and *under-* in verbs.

The French and Italian prefixes corresponding to those mentioned are fairly easy to identify and need not be discussed. The same is true of the Romance-language suffixes *-able*, *-ible*, and *-uble* (in French) and *-abile*, *-ibile*, and *-ivile* (in Italian). These correspond to the German suffix *-bar*, which, in English, is generally *-able*, *-ible*, or *-uble*. For example, German *haltbar* equals French *stable* and Italian *stabile* (English: *stable*).

The corresponding nouns—that is, those which in English end in *-ity* (e. g., *stability*)—as a rule have the following endings in the other three languages: German, *-keit* (as in, *Beständigkeit*); French, *-ité* (as in, *stabilité*); and Italian, *-ita* (as in, *stabilità*).

A chemical suffix which may be difficult to equate is *-ure* in French and *-uro* in Italian. These suffixes denote a salt and are rendered as *-ide* in English—e.g., *chlorure* or *cloruro* is chloride.

In the introduction to his invaluable "French-English Dictionary for Chemists",<sup>(3)</sup> Austin M. Patterson mentions some very helpful hints for the translation of organic compounds from French, where the prefix or suffix is the key to the correct translation. They are quoted here, with his kind permission, because as a rule they also apply to Italian.

1. Translate *oxy-* by *hydroxy-* when it designates hydroxyl, as is commonly the case in organic names. When *oxy-* designates the ketonic group (CO) it is preferably translated *oxo-* or *keto-*.

2. Translate names of compounds the chief function of which is alcoholic or phenolic so that the name ends in *-ol*; as, glycerol, resorcinol, mannitol, pinacol (not pinacone).

3. When the French ending *-ol* does not indicate hydroxyl it should be translated *-ole* (as, anisole, indole), or in the case of a few hydrocarbons *-ene* (as *benzol*, benzene; *toluol*, toluene; *styrol*, styrene).

4. The ending *-ine* or *-in* should be translated *-ine* in the case of basic substances and *-in* elsewhere; as, aniline, glycine, palmitin, albumin. Exceptions are *benzine* (meaning benzene) and the names of alcohols and phenols [see <sup>(3)</sup>].

5. The form *amido-* should be so translated only when it denotes combination with an acid group. Usually it is to be translated *amino-*; as, *acide amidopropionique*, aminopropionic acid; *amidophénol*, aminophenol. The same holds for imido-, anilido-, etc.

6. In such combining forms as bromo-, cyano-, chloro-, nitro-, etc., when they denote substituting radicals, the connective *o* is to be used invariably; as *chlorobenzène* or *chlorbenzène*, chlorobenzene; *acide chloracétique*, chloroacetic acid. This usage is by no means universal, but those

who cannot reconcile themselves to such spellings as "bromoacetic" should at least avoid the German forms bromphenol, acetphenitidine, etc., by using the connective *o* before consonants. (French literature does not contain so many of these objectionable forms as does the German.)

7. The French ending *-ane* should be translated *-ane* if it is the name of a hydrocarbon (or parent heterocyclic compound) which is fully saturated; otherwise, *-an*. Examples: methane, menthane, tolan, furan, pentosan.

8. Names of acids ending in *-carbonique* are translated *-carboxylic*, not *-carbonic*.

## ¶ INVERSIONS :

We now come to the question of inversions, which are characteristic of French and Italian, and which may present somewhat of a problem. Although in German the adjective generally precedes the noun, as is usually the case in English, this is not true of French and Italian where, as a rule, the adjective follows. Here are some examples: *une solution concentrée* (a concentrated solution), *acide nitrique* (nitric acid), *nel campo speciale* (in the special field), *carbonato sodico* (sodium carbonate), etc.

From where the English translator sits, French and Italian invert the words in chemical compounds, occasionally connecting them with the preposition *of*—i. e., *di* in Italian and *de* in French. By reading them in inverted sequence, and forgetting about the preposition, the English equivalent immediately becomes apparent. For example, *bromure de calcium* (calcium bromide), *acide de tartre* (tartaric acid), *acetato di alluminio* (aluminum acetate), *bagno di olio* (oil bath), etc. In certain cases, however, the cognate is not as easily detected, even after the inversion has been mentally made. Thus, *acide chlorhydrique* (hydrochloric acid), *aldeide formica* (formaldehyde). By locating the *hydro* radical—or, as a colleague once put it, "looking for the hidden water"—in the foreign name of the compound, one will often be able to translate it at a glance.

The fact that the French and Italians call sodium chloride *chlorure de sodium* and *cloruro di sodio* explains why one will occasionally find equations where NaCl appears as ClNa. This is true of so many compounds that some chemical equations in French and Italian often look as if someone just jumbled all the chemical symbols.

Another thing worth remembering is that when an adjective following two or more nouns is in the plural, it applies to all the nouns and, in English, should therefore precede all the nouns, not just the last. For example, "*à une température et une pression élevées*" means "at a high temperature and pressure." Likewise, "*acido nitrico, sulfurico e idrofluorico concentrati*" means "concentrated nitric, sulfuric, and hydrofluoric acids."

Such inversions as generally occur in French and Italian may occasionally also occur in German, especially in a composite word designating a chemical compound in which the basic element is at the end. When translated, the elements must be inverted, as in *Kohlenwasserstoff* (hydrocarbon), *Tetrachlorkohlenstoff* (carbon tetrachloride), *Schwefekohlenstoff* (carbon disulfide), *Chlorwasserstoff* (hydrogen chloride), etc.



Inversions such as the above also extend to dates. When, in a foreign text, you see 6.2.52, what is meant is February 6, 1952, not June 2, 1952.

## ¶ ACCENTS :

Accents in French and Italian, as well as in other languages, often have more than a phonetic function. In German, the umlaut is not an accent but a diacritical mark which changes the vowel over which it appears. Certain words will have different meanings depending on whether they are written with or without accent or umlaut. Here are a few examples.

In German, the verb *fordern* means **to demand** or **to claim**; with the umlaut—i.e., *fördern*—it is an entirely different word meaning either **to promote** or **to convey**. In French, the noun *cote* means **quota** or **quotation**; with the circumflex accent—i.e., *côte*—it means **slope**, **coast** or **rib**; if in addition to the circumflex accent over the *o* there is also an acute accent over the *e*—i. e., *côté*—the word means **side**. The word *ou* without an accent is the conjunction **or**, and with an accent—i. e.,—*où*, it is the adverb **where**. In Italian, the letter *e* without an accent means **and**; with a grave accent—i. e.,—*è*, it is the verbal form of “to be” and means **is**.

## ¶ THE DECIMAL POINT :

The decimal point in almost all foreign languages is not a period but a comma. When a German, French, or Italian chemist writes that he added 18,050 grams to a solution in a test tube, he does not mean that “eighteen thousand and fifty” grams were added, but that 18.050 were added; conversely, where we use a comma to set off every thousand group in a figure, the foreign language will generally use a period. Thus, 18.050 grams is not eighteen grams and fifty milligrams, but 18,050 grams. Sometimes, the custom is to use no punctuation at all to set off each thousand group, but merely to leave a space: 18 050. In some German texts one may find a raised period to indicate the division—i.e., 18<sup>0</sup>50.

## ¶ THE PERCENTAGE SIGN :

The percentage sign in the foreign is generally the same as in English—i. e., % or, as acceptable variants, *per* 100, *pour cent*, *per cento* or even *o/o*. None of these present any particular problem, but what does are such signs as ‰ and ‰‰ to indicate **per mill**. In such cases, it is often desirable to convert into **per cent**. For example, *Abbiamo usato soluzioni al 1‰ e al 1‰‰ (or 1 ‰‰) dei sali*, should preferably be rendered as “We have used 1% and 0.1% solutions of the salts.” Therefore, 1‰‰ should be converted to 0.1% and 1‰‰‰ to 0.01%.

## ¶ ABBREVIATIONS :

We now come to the problem of foreign abbreviations, and a considerable problem it is, because the abbreviations used are sometimes of the author's own invention (in which case, the best we can hope for is that the context will indicate what they represent), and they may be of a local

nature (either limited to a fairly small geographical area, or to a rather restricted field or industry).

When abbreviations consist of several capital letters, one should mentally be prepared to invert the letters, as this may occasionally provide a clue. Thus *D M L*—i.e., *dose minima letale*—is MLD (minimum lethal dose); *S.N.C.*—i.e., (*système nerveux central*) is C.N.S. (central nervous system); etc. Foreign authors do not appear to adhere to any uniform or standard set of abbreviations for weights and measures. French and Italian texts present the most flagrant evidence of this lack of uniformity. Thus, to indicate cubic centimeters (cc.), we may find such a variety of abbreviations as *cm*<sup>3</sup>, *ccm.*, *cc.m.*, *cm. cube* (or *cm. cubico*), *%m*<sup>3</sup>, and occasionally even *cc.* The varieties of abbreviations for milligram (mg.) reflect an even more fertile imagination. At one time or another I have encountered: *mm.g.*, *mm.G.*, *mmg.*, *mmG.*, *mmgr.*, *mmGr.*, *mm/G.*, *G/mm* (which should indicate "grams per millimeter," but not always does), and even *0/00 g.* Where there are several possibilities, the context will have to be relied upon to determine the correct meaning of the abbreviation. An interesting set of abbreviations, found in German, is *Jato* for *Jahrestonnen* (tons per year); *Moto* for *Monatstonnen* (tons per month); and *Tato* for *Tagestonnen* (tons per day).

This completes my brief outline of the problems involved in technical translation. It is very incomplete, even as an outline. But the best I could hope to do was to present some of the highlights, and to offer a few practical suggestions.<sup>(2)</sup>

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## NEWS BRIGHTENERS :

London, March 23 (Reuters). — The *Sunday Times* today reports this conversation between a visiting American and a teacher at straight-backed Eton :

*American* : Do you allow your boys to smoke ?

*Teacher* : I'm afraid not.

*American* : Can they drink ?

*Teacher* : Good gracious, no !

*American* : What about dates ?

*Teacher* : Certainly, as long as they don't eat too many.