

Symposium on Inorganic Nomenclature.*

Introductory Remarks

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I'm sure that most of you know that all of the planning and arrangements for this symposium were made by Dr. George W. Schaeffer, Director of the Department of Chemistry of Saint Louis University, and his secretary, Mrs. Fay Hardy, in the few months following the Boston meeting in April. Because of ill health he had to give up all of his activities in June, but was apparently improving until his heart gave out the middle of August. This symposium is therefore a very real tribute to him.

From another point of view, this is a particularly appropriate time for an inorganic nomenclature symposium because the 1957 Paris International Union of Pure and Applied Chemistry (IUPAC) Rules for Nomenclature of Inorganic Chemistry were published in 1959 by Butterworth's Scientific Publications in London. These rules are the first official inorganic rules since 1940 and are a complete revision and expansion of the 1940 rules and the tentative rules drawn up in Stockholm in 1953. Although they are called "definitive rules," fortunately "definitive" does *not* mean that they are not to be reconsidered, changed, or added to. These rules were carefully studied by the appropriate committees of the National Research Council and the American Chemical Society for publication with the committees' comments in the *Journal of the American Chemical Society* [82, 5517 (1960)] along with the IUPAC organic and biochemical rules and "Manual of Physico-Chemical Symbols and Terminology." Reprints combining all of these or reprints of the inorganic rules alone can be obtained from Chemical Abstracts Service.

The only symposium in the United States dealing entirely with inorganic nomenclature was held in 1941 before the Division of Physical and Inorganic Chemistry. Two other symposia dealing in part with inorganic nomenclature were held in 1947 and 1951, under the Divisions of Chemical Education and Chemical Literature, respectively. The present symposium is therefore the first nomenclature symposium under the Division of Inorganic Chemistry, and we are delighted to have the Division of Chemical Literature as co-sponsor.

The historical separation of chemistry into organic and inorganic, dating back to the concept of a "vital force"

considered essential for the synthesis of organic compounds, naturally led to the development of separate systems of nomenclature. The earliest successful attempt at systematization, by de Morveau, Lavoisier, Berthollet, and Fourcroy in 1787, was largely in the inorganic field, and their system still forms the basis of our naming of acids, bases, oxides, and salts. Some of the earliest systematic organic names, such as benzoyl chloride and ethyl iodide, followed this pattern of two-word names. However, the more complete systematization of organic nomenclature in the Geneva Rules in 1892 and later in the International Union Rules often exerted a strong influence on the more slowly developing inorganic nomenclature, as in names like "disilicoethane" for Si_2H_6 (because its formula is analogous to that of ethane). This inorganic lag was due partly, at least, to the mistaken idea that inorganic compounds seemed to be much simpler than organic compounds and to the slower development of methods for determining the structures of inorganic compounds. It is only within comparatively recent years that the complexity of inorganic compounds has been more fully realized, together with the fact that it is not possible, in general, to predict a structure from a formula. As a consequence, the complexities of naming inorganic compounds have increased, as will be brought out in most of the following papers.

Some general questions then arise: Just how much information about structure should we attempt to give in a name? Should ring systems like those of the metaphosphates be clearly distinguished from linear structures? When should crystal structure be indicated, if ever? Type of bonding (ionic, covalent, sigma, pi)? Differences in coordination numbers of central atoms, as in the fluorophosphates?

The International Union Commission has wisely not attempted too much, but has aimed to formulate inorganic rules "of the most general utility" leading to names that are unique for the particular compounds and convey at least the empirical formulas and also, if possible, the structural features. In other words, their system is "based on the composition and most obvious properties of substances, avoiding as far as possible theoretical matters which are liable to change."

In many specific cases there would seem to be a place for more than one type of name: in addition to the simple name provided for in the rules, there might be one or more names for special purposes, as for indicating structure under given conditions or for emphasizing some particular

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** Editor's remark: Papers from this symposium were first received July 27, 1962. Subsequently, through Miss Janet Scott's efforts and the efforts of many reviewers, these important papers were thoroughly reviewed, rewritten, revised, and brought up-to-date.

portion of the molecule. Thus "phosphorus pentachloride" suffices for PCl_5 or P_2Cl_{10} for most purposes, but for designating the structure of the crystalline form, $[\text{PCl}_4]^+[\text{PCl}_6]^-$, "tetrachlorophosphonium(V) hexachlorophosphate(V)" is more accurate and more informative.

Furthermore, there are whole areas (such as isopoly and heteropoly acids) hardly touched on in the IUPAC Rules. Thus, while they are a much-needed start in the right direction, a great deal more remains to be done, as you shall see.

Procedures in the Development of Chemical Nomenclature*

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Language lives. As with all living things language is constantly changing for better or for worse. Because science must be exact and because scientific research is continuously turning up much new information, there is perhaps more need for growth in scientific language than in any other kind. In chemistry this need is extra strong because chemists need to discuss effectively hundreds of thousands of chemical compounds, including probably almost 100,000 new ones each year. Most of the newly prepared compounds are characterized by increasing complexity.

Individual investigators are continuously confronted with the need for good names for substances or phenomena on which new light has been thrown. In the earlier days names were coined with few or no guiding rules or other considerations with standardizing purpose. It is perhaps altogether natural that discoverers should have developed a feeling that they have the right to name their own children. This feeling of right or privilege is, no doubt, justified so long as it does not interfere with progress or what might be called the general good. In the earlier days there was a good deal more insistence on the exercise of this right than is true now, and this also is natural. The need for system has become overwhelmingly apparent with the growing quantity and complexity of information.

Editors, confronted with recording problems, have had a good deal of influence on nomenclature development and other efforts for good usage. They have had many struggles against rugged individualism. Abstract journal editors, confronted with the heaviest recording task, have had the advantage of not having to deal directly with individuals.

Nomenclature development has been both national and international. Since science is international, it is good to be able to say that there has been increasing emphasis on international efforts. The existence of the many national languages has been a handicap in the international efforts, but not an insurmountable one except for details.

Within nations the scientific societies, for chemistry at least, have long had standing nomenclature committees. On these committees the editors of the publications of the

scientific societies have almost always been represented and so awareness of needs and general problems as well as good opportunity for applying rules worked out has been in the picture.

At first, the tendency was for one general committee, with various branches of chemistry represented on it, to undertake to solve nomenclature problems. Eventually, it was realized that there should be separate working committees consisting of groups of specialists for special fields or problems. Gradually, the role of the general society committee came to be one of stimulation, organization, general guidance, testing of proposals, and dissemination of information. I mean by these words that the general committees, while solving some problems of a more or less general nature themselves, have seen to it that specific problems received attention, have helped in the organization of working committees of specialists, have endeavored to help such committees, have made sure that the recommendations of the groups of specialists would fit in with the general nomenclature picture, and then have encouraged good usage by gaining official approval of the rules and by special efforts to get the information into the hands of users. They have gone further by pointing out bad usage to individuals, by urging good usage in key positions, as in those held by editors and teachers, and often by seeking international approval of rules standardized within a nation.

In the United States the American Chemical Society's Committee on Nomenclature, Spelling, and Pronunciation, organized in 1911 (there was an ACS Committee on Nomenclature and Notation as early as 1886), undertook perhaps too long to work alone. During the 1940's the need for special committees was met largely by the appointment of nomenclature committees within many of the divisions of the American Chemical Society. The Committee on Nomenclature of the Division of Organic Chemistry, under the leadership of Howard S. Nutting, became especially active and gradually built up special working committees for the organic field under its guidance. Now subcommittees of the divisional committees work out most of the rules on special subjects within the fields of the respective divisions.

When there has been overlapping interest, ACS divisions have not hesitated to appoint joint working committees. This has worked to good advantage.

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