Letters

Periodic Table and the Formation of Inert Gas Molecules

The discovery of noble gas compounds has been an unusually interesting event in science—particularly in its impact on the conceptual framework of chemistry and its implications for the nature of the chemical bond. Because of this, another viewpoint on the theoretical aspects of the problem, different from that offered by the recent survey of the Noble Gas Compound Conference (*1*), may be useful.

There is widespread agreement among physical scientists in general that complete understanding of noble gas molecules is contained in solutions to Schroedinger's equation; but the pictures, models, and concepts in terms of which chemistry is organized and described do not contain all of the detailed information derivable from Schroedinger's equation. This is especially true of the periodic table itself and it has been the incompleteness of this table which has discouraged intensive investigations into the possible formation of inert gas compounds.

The speculations of Pauling and Pimentel (*2*) were made as minor parts of work on rather different topics; they were not quantitative, and they did not resolve the contradictory prediction of the periodic table. Neither paper stimulated further experimental or theoretical efforts on noble gas chemistry. None of the current empirical or simple semi-empirical molecular theories are capable of bridging the gap between the periodic table and molecular formation with noble gases. They have the further disturbing property of being uncritical in the sense that they predict molecular formation between almost any pair of atoms.

To explain the formation of noble gas molecules, the usual isolated electron picture must be augmented by including effects due to the instantaneous influence of one electron on another. The more complete theory, of course, encompasses the results of the simpler models. It is of paramount importance that the more complete theory is not a restatement of Schroedinger's equation but is one in which the new features may be calculated directly and discussed in a simple manner. As pointed out in the conference survey, the interest created by noble gas chemistry has also drawn attention to the fact that, for certain cases, such as XeF_6, two of the most popular simple electron structure models predict conflicting geometries. However, it is definitely not "clear that additional refinement can bring either approach into agreement with the experimental observations as they are ultimately established. Nevertheless, many chemists will prefer concepts that come closer to reality with fewer ad hoc adjustments." A more likely and hopeful conclusion is that one existing model will prove superior or that a third equally practical model for predicting geometries will emerge with the same or fewer ad hoc parameters.

The long-range significance of the discovery of inert gas molecules may well be that of providing an entering wedge for a new attack on inorganic chemistry. It has forced the introduction of concepts not generally employed in chemistry and afforded a sharper criterion for the range of applicability of existing chemical electronic structure models. In the past, quantum theory has not played an equal role with experiment in the development of new chemistry, as has been the case in physics. Perhaps the advent of inert gas molecules will give stimulus to a more balanced participation of theory and experiment (*3*).

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References and Notes

1. H. H. Hyman, *Science* **141**, 61 (1963).
2. L. Pauling, *J. Am. Chem. Soc.* **55**, 1895 (1933); G. C. Pimentel, *J. Chem. Phys.* **19**, 446 (1951).
3. Predictions of this nature have been the subject of a recent editorial by S. A. Goudsmit, *Phys. Rev. Letters*, **10** (15 May 1963).

Experimentation in Citizen Reaction?

I read with interest the letter of Richard C. Neavel [*Science* **140**, 856 (24 May 1963)] indicating his concern over having his "widow's mite" end up in the wrong column (he wrote to Senator Joseph Clark opposing his bill on animal experimentation and received a reply thanking him for his support).

Several years ago, while residing in the state of Maryland, I wrote to one of its senators regarding my opposition to an antivivisection bill which was being considered for the District of Columbia. Several days later I received an acknowledgment thanking me for indicating my support for the measure. In the following mail, I received another letter which just as graciously thanked me for indicating my opposition.

I couldn't resist stapling the two together and returning them to the senator.

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Popular Scientific Publications

Throckmorton's review of the Moore/*Life* "Evolution" [*Science* **139**, 899 (8 March 1963)] calls attention to an increasingly prevalent practice in the publication of popular scientific books.

I suspect that this book *was* "written by two people" with precisely the characteristics stated: Miss Moore, who has given adequate evidence in previous books that she "is competent and writes for intelligent and interested readers," and a committee similar to the one alleged to have designed the giraffe—members of the *Life* editorial staff. I would be very surprised if Miss Moore had any idea of what would be included in the "pictorial studies," let alone have approved them.

Increasingly, major and presumably responsible American publishers are illustrating popular scientific books by the "Sears, Roebuck" technique of sending to picture agencies for job lots of "scientific" illustrations. These seem to be selected by the art editor or his assistants for their pictorial and decorative qualities, with no regard for their appositeness as text illustrations. The captions or accompanying text—quite extensive in the *Life* publications

—seem to be accepted without question from the picture agencies, or dashed off by members of the junior editorial staff who may have had a freshman course in science or who may recall a little science from their high school days.

Isaac Asimov's *Intelligent Man's Guide to Science*, for example, was embellished by sheafs of photographs placed with no reference to the text, and with captions that seemed in some cases to be the result of a layman's misreading misinformation. *Life* generally goes to more trouble than this, with the results Throckmorton describes.

Ideally, perhaps, an author should insist on a contract which gives him the right to approve every detail of *his* book. This is not very practical, however, either for the publisher—who has had bitter experiences with hair-splitters who insist on adding footnotes to footnotes or changing 20th century back to 19th century style—or for the writer. Supermarket illustrations are easier for the publisher to get and use than struggling with the author over the rights to pictures that may illustrate well enough but be copyrighted by a competitor.

If reviewers took extra pains to separate the sins of the author from those of his publisher when it is reasonably evident who is to blame, perhaps publishers would eventually mend their ways.

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Keeping up with Current Research: Science Information Exchange

The Science Information Exchange (formerly Bio-Sciences Information Exchange) was originally established in 1950 to help federal research directors and administrators quickly exchange up-to-date information on their current research activities. This service has expanded so that it now serves the entire scientific community. A staff of more than 30 scientists and specialists in life and physical sciences review, classify, and index the resumés of more than 50,000 projects that are annually registered in the Exchange. To cover the many multi-disciplinary relationships, now so evident in modern research, more than 18,000 reference points are used.

In order to provide comprehensive services to the scientific community, the Exchange receives resumés of current research projects on a voluntary basis from all available sources. Notice of new work comes to hand long before it may appear in normal publication channels, and any research scientist or engineer, who is associated with a research institution, foundation, or laboratory may request and receive, without charge, up-to-date information on who is currently working on a specified topic, problem, or project. Research resumés are accepted and released only under the condition that they will not be used for publication or publication reference without the express permission of the principal investigator.

The Exchange is especially organized to provide reference on detailed technical points. It also provides information covering broader fields and topics of basic and applied research, but it should be borne in mind that broad subject fields are difficult to define, especially in terms of their related and interdisciplinary aspects, and usually result in very large and unwieldy numbers of project records. For instance, all cancer research now in the S.I.E. files would include about 6500 records.

At present, the Exchange collection is fairly comprehensive in the life sciences including almost 90 percent of all the basic and applied research sponsored or conducted by the Federal agencies. In addition, more than 100 non-government foundations, universities, and state and city governments actively cooperate in furnishing records of their programs, and an annual growth rate of about 20 percent is being maintained.

Registration of basic and applied research in physical sciences began this year and is now being developed as fast as current research records can be identified and secured. In such areas as chemistry, materials, electronics, and earth sciences, useful information can be obtained already, even if not complete or comprehensive at this point. However, if the Exchange can furnish even a few records of new research not yet known to the scientist or engineer, it will be an increasingly useful service to the scientific community.

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