orbital may be compared with the postulate that Avogadro made, that the molecules in solids are one-quarter or one-half as big, or perhaps twice as big, as the molecules in gases. Avogadro was led to this incorrect postulate by the success of his gas-volume postulate. I have been led to apply ideas about valence to metals by the success of valence theory in organic chemistry and ordinary inorganic chemistry.

I do not know whether the system of metallic valences that I have formulated, and the postulate of the metallic orbital too, will have the same fate as Avogadro's assumption about molecular volumes of solids. Perhaps someone will think of a completely new way of handling the problem of the structure of metals and alloys. Perhaps the idea of valence should not be extended from the compounds of organic chemistry and ordinary inorganic chemistry to metals and intermetallic compounds. Nevertheless, I feel that there is still reason to attempt to apply the old methods of argument that have been used by chemists especially, including Avogadro, during the past 200 years, in an effort to discover laws of nature by induction from a great mass of experimental and observational information.

Avogadro was a great man. He was a thinker—a man who tried to understand the world.

Although he seems to have departed from the faith in being willing to split molecules in solids, I think that Avogadro really believed in molecules. In 1839 he gave a clear discussion of isomerism in terms of molecular structure. He described two isomers as substances which present different arrangements of the atoms out of which their molecules are formed. It is unfortunate that he was not led by considerations of this sort to ask what the forces are that hold the atoms together.

A description that he gave of a molecule in 1849 seems almost modern. He wrote: "It seems to me that one can think of the combination of several atoms of different kinds only as their union into a single molecule, in which one can no longer distinguish the parts of the volume that belong to the individual atoms. The atmospheres of imponderable bodies that surround the atoms in the separated state, and that hold them at a certain distance from one another, and thus determine the volume, should interpenetrate and become combined, in such a way as to form only a single atmosphere for the entire molecule, surrounding the individual atoms, and bringing them rather closer together than are the resultant molecules themselves, and thus determining the molecular volume of compounds." This sounds much like a modern description of a molecule, with imponderable bodies replaced by electron clouds.

I do not know whether Avogadro would be happy in the modern world, or unhappy. Chemists know too much now; perhaps we should say that physicists have discovered too much. It is hard for a chemist now to find a part of chemistry where hypotheses, chemical hypotheses, can be made. I almost feel that Schrödinger did the chemist a disservice when he developed the wave equation. But biology still offers a great opportunity for theoretical discovery, for the development of new hypotheses. Perhaps Avogadro, if he were living now, would be trying to think of a new Avogadro's hypothesis, a hypothesis relating to the gene, perhaps, to enzymes, to viruses, to the nature of life.

We are fortunate in having the example of Avogadro and the hypothesis that he made in 1811, to show us clearly how great is the value of hypothesis in science.

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A. J. Carlson

The death of A. J. Carlson on Sunday morning, 2 September 1956, in Chicago, was not a surprise to anyone who knew of his illness but was a shock to everyone acquainted with him. A man so strong in body and soul, so permanent in his influence, so timeless in his outlook, partook sufficiently of the stuff of immortality to seem to belie a vulnerability to disease and death.

Appropriate though the appellation "Ajax" may have seemed, I somehow never much fancied it. Perhaps it was because Homer's Ajax, the embodiment of strength and courage, was yet second to another—Achilles—in these attributes. Dr. Carlson had no Achilles. I preferred "Carlson," a common enough name but one encompassing all strength and courage, dignity and distinction. In any academic or scientific gathering, there was never any doubt about the identity of "Carlson."

Strong and *powerful* are words that belong to Dr. Carlson. His powerful physique supported an intensely active life of full 81 years. His sturdy integrity knew no compromise with the right and the good. His strong mind cut straight through to the truth. But with all his strength, he relentlessly fought the abuse of power. Tyranny was his enemy, whether it was economic or political, scientific or academic.

He lent his strength where it was needed. At whatever session of a scientific meeting one of his graduate students appeared on the program, Dr. Carlson was sure to be on hand, usually in the front row, to encourage and support. Woe betide the unfair critic who rose to an unwarranted attack upon the graduate student's paper.

Behind an austere or even forbidding aspect, Dr. Carlson was a staunch friend; he was loyal, warm, encouraging, inspiriting to his graduate students. His conscience about teaching was boundless, almost a religion. He wanted everyone to understand something about man's body in health and disease. Scores and hundreds of medical students remember Carlson as the greatest influence in their scientific experience. He was a superb teacher of college freshmen, whose instruction he was unwilling to relegate to junior staff members.

Unerringly, he could place a finger and say of a research project, a reasoned argument, a conclusion drawn, "thou ailest here, and here, and here." His penetrating incisiveness was liberally peppered with a ready wit.

His prodigious work-drive, guided by a disciplined intellect and fired with imagination, shed new light upon the operation of virtually every organ and system of the body. Nerve conduction, the heartbeat, digestion, hunger, thirst, thyroid function, diabetes, lymph formation, nutrition, the parathyroid glands, salivary secretion, and a score more, in turn, captured his attention and yielded important secrets to his insistent probings. In his zealous pursuit of comparative physiology he scooped up every creature he could find in the Pacific Ocean for study and then repaired to the Atlantic Ocean for yet other organisms. The tremendous volume of research he stimulated in the many others who came under his influence is beyond estimation.

One modern concept of human life completely escaped his comprehension —retirement. For 16 years after he was labeled "emeritus" he continued unremittingly to fight against ignorance and superstition, disease and death—against quacks and quackery, alcoholism, antivivisection, and the processes of aging.

His beginnings were as humble as his full stature was lofty. A goatherd in the Sweden of his birth, he came to America at the age of 16, was a carpenter for a time, and then attended Augustana College at Rock Island, Illinois, where he received the B.A. and M.A. degrees. He chose a life of science, and took the Ph.D. degree at Stanford University in 1902. Two years later, he returned to the scene of earlier days, to take his place in the van of those scholars who have pronounced the "mighty learning" of the University of Chicago. Recognition of his quality as a scientist and his stature as a man of character and intellectual courage was widespread. This recognition was formally symbolized by numerous honorary degrees and by his election to the National Academy of Sciences and to the presidency of the American Association for the Advancement of Science.

I had the rare great privilege of knowing Dr. Carlson as a medical student in his classroom, quiz section, and laboratory, as a colleague in teaching, as a collaborator in research, as an associate in reporting investigation, as a coauthor upon many occasions, and as a companion in play. I knew him as well as any knowing can comprehend a powerful intellect, a sturdy soul, a great man. Yet, it was not necessary to know Carlson as well or as long as I did to know him a great deal. One encounter might suffice for a permanent impression, perhaps when Dr. Carlson arose to state: "Your research buildings and equipment are superb. Have you given as much thought to securing the brains to use them?"

Dr. Carlson loved a rough and tumble scientific scrap. He loved his work and his responsibilities, his family and his colleagues and his fellowman, his opportunities and his contributions. But, as his university's alma mater song tells, he could not have loved these so well, loved he not truth and honor more.

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T. Dantzig, Historian and Interpreter of Mathematics

Born in 1884 in Shavli, Russia, Tobias Dantzig took his licencie in Paris in 1909 and his doctorate in 1917 at the University of Indiana. While in Paris he studied under the great French masters of mathematics: Appel, Borel, Boussinesq, Darboux, Goursat, Hadamard, Picard, and Poincaré. From his stay in Paris he gained a conviction which he held throughout his life: mathematics should be acquired by study of the works of the masters. In pursuit of this belief his studies led him back through the medieval ages to the Greeks and their discoveries in science.

A lover of stories, Dantzig never forgot a tale. This vast reservoir was put to good use in the classroom, with more than one abstruse point in mathematics driven home with a salty epigram. He was intensely interested in mathematicians as people, and his writings are spiced with lively anecdotes surrounding the famous scientific personalities who captured his interest.

Dantzig's first book, *Number, the Language of Science,* broke a new path. This was the first attempt to bring mathematics to the layman in a manner calculated to capture the interest and enlarge the understanding. Starting with the rudimentary number sense displayed by birds and animals, he leads the reader by easy and gracious steps to some of the advanced outposts of mathematics. He was a great admirer of Poincaré and constantly sought to bring the genius of Poincaré within the ken of his audience. Although English was not his mother tongue, he displayed a phenomenal command of it in all his writing. This was not gained easily, however, for he wrote slowly, destroying more than he kept; on occasion, days would be spent before one or two lines reached the standard he set for himself.

After taking his doctorate and after a year each at Columbia and Johns Hopkins universities, he spent 6 years in industry bringing his mathematical training to bear on engineering problems. This acquaintance with industrial problems gave him a lifelong interest in the application of mathematics. He was one of a very few mathematicians who sought their livelihood outside academic circles 30 years ago.

Dantzig came to the University of Maryland in 1926 with promotion to full professor following in 1936. Two years later he became chairman of the department of mathematics. Under his leadership eager, young mathematicians were brought in, and mathematical research was added to the goals of the department.

After his retirement in 1946 he moved to the West Coast, seeking a climate more favorable to his health. In the 10 years that remained to him he taught courses in mathematics and in the history of mathematics, returning at times to mathematical consulting for industry and government.

His interest in the history of mathematics dominated him to the end, and his last work is entitled, *The Bequest of the Greeks.* His colorful personality made a deep impression on all who knew him, and he will long be remembered for his leadership and enthusiasm for mathematics.

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