Letters to the Editor

Effects of New Herbicides on Fish

During the course of some experiments to determine the effects of certain of the new herbicides on fish, we set up some tests, largely out of curiosity, using the new rodenticide 1080. In view of the extreme toxicity of this substance, as reported by E. R. Kalmbach (*Science*, 1945, 102, 232), we were certainly surprised to find that fingerling bream and bass would survive in concentrations of 1080 as great as 370 ppm for an indefinite period and with no apparent discomfort.

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Some Reflections on the Cause of Heat and Cold

Not many Americans know of M. V. Lomonósov, a noted Russian scientist, and very few are aware of the scope of his research. The writer of this article wishes to pay tribute to this great early Russian physicist, one of the first academicians of the Russian Academy of Sciences, for his research in the theory of heat.

M. V. Lomonósov's name has never been mentioned in the West-European and American scientific literature in connection with the development of our concept of heat, although he, as early as the first half of XVIII century, did not believe in phlogiston, but that heat is a kind of motion of constituent particles within a body.

In his dissertation under the title "Some Reflections on the Cause of Heat and Cold," read 21 and 25 January 1745 at a session of the Russian Academy of Sciences, Lomonósov had two paragraphs which I translate and quote (B. N. Menshutkin. *Works of M. V. Lomonósov in physics and chemistry.* Moscow-Leningrad: Academy of Sciences of the USSR, 1936. Pp. 109, 110).

"A body A which acts upon a body B cannot add to the latter a greater velocity than that which it itself possesses. If, therefore, the body B is cold and immersed in a warm gaseous body A, the heat movement of the particles of the body A brings the particles of the body B into a heat movement, but it cannot induce in the particles of the body B a greater speed than that which is present in the particles of the body A. Therefore, the cold body B being immersed in the body A cannot perceive a greater degree of heat than that which the body A has."

". . . Furthermore, one cannot mention some definite velocity, a such one that someone else could not visualize mentally another, a greater velocity. This, of course, should be referred to the heat motion also: therefore, the highest and the last degree of heat is not a thinkable motion. *Vice versa*, the very same motion can decrease to such an extent that finally a body reaches a condition of an absolute rest—and no farther decrease in motion is possible. Consequently, by necessity, there should exist the greatest and the last degree of cold expressed in the complete rest of the particles, in the complete absence of their spinning movements."

In the first quotation Lomonósov expresses the Second Principle of Thermodynamics which was rediscovered and established 85 years later.

In the second he points out that there is no higher limit for temperature and gives an inference about the necessity for the lower limit of temperature—the absolute zero—a concept introduced into science about 1870, *i.e.* 125 years later. Even still further this self-made scientific genius goes: he defines the absolute zero as absence of the spinning movements of particles. Therefore Lomonósov's absolute zero temperature excludes even null-point energy due to the spin of electrons, and the theory of null-point energy based on Fermistatistics is a development of recent years; the measurement of temperature under zero null-point energy is yet among achievements of the future physics.

Paying this tribute I wish to reinstate that Miháilo Vasílievich Lomonósov developed his mechanical concept of heat in which an impossibility of heat transfer from a colder body to a warmer one, and the idea of the absolute zero temperature as a cessation of any kind of motion in or between the constituent particles of a body were incorporated far ahead of those scientists to which the discovery and the development of these two cornerstones of the contemporary thermodynamics were credited.

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Science in the Albuquerque High School

I feel that Charles A. Gramet (*Science*, 1946, 103, 149) has made some good suggestions as to how science enrollments might be increased in secondary schools. He feels that his own school system of Brooklyn, New York, gives a pretty good science education and that it need not feel inferior to challenges which come from colleges. I feel the same way about our schools, out here in the deserts of New Mexico.

I would like to make a few additional remarks about the nationwide decline in science enrollment in secondary schools. Here in our own school (Albuquerque High School) we require only one unit of science for graduation, anything taken above that is strictly on an elective basis. Back in 1930 I felt that such a requirement was inadequate but there seemed no way to promote additional requirements. Our school decided to go out and get the students, requirements or not. We could not use legal requirements, so we used other means to popularize the classes. These included advertising campaigns, an assembly or two, and a crew of physics students that carried scientific shows to our city and county grade schools.

The campaign bore fruit in a hurry. We believe now