Letters to the Editor

CO_2 Baths

R. R. McGregor (*Science*, 1945, 102, 648) spoke of the use of silicone stopcock grease as a means of preventing the foaming in acetone-carbon dioxide "Dry Ice" baths.

His article brought up several points of interest to me, and possibly to other readers. He says that, because of the tendency to foam, "open flames in the vicinity may cause bad fires." The obvious answer to this is to use, as this laboratory does, other noninflammable liquids. We use a commercial brand of trichloroethylene, called "Triad" (DuPont Co.), as degreaser solvent. This solvent will not support combustion, gives all the effects that acetone does with "Dry Ice," and therefore has none of the fire hazards of acetone.

In several simple experiments after reading Mr. McGregor's article, it was found out that if the acetone is reasonably clean it will not foam anyway. In another experiment, the effect of silicone grease on trichloroethylene was determined. In this solvent, instead of cutting down the foaming—trichloroethylene will foam badly, too, at first, if it has been used repeatedly—the silicone increased it manyfold.

Croom Beatty, III, *Director*
Organic Research Laboratory
Sprague Electric Company
North Adams, Massachusetts

The Age of Lake Cahuilla

Lake Cahuilla is the name given by W. P. Blake to a very large shallow lake, covering an area of about 2,200 square miles, which formerly existed in the region of the present Colorado Desert. Long ago it dried up, leaving on the surface of the soil millions of fresh-water shells, both univalves and clams, of several different species. These species are living today, in much smaller numbers, in various parts of the west.

Much discussion has recently arisen concerning the age of this lake, some geologists thinking it might have existed as recently as 500 to 1,000 years ago. The end of the Pliocene period in California is not strongly marked in the marine formations, but on land or in the fresh waters it is abrupt, suggesting a considerable time interval. All the Pliocene birds are extinct; the Pliocene fresh-water shells described by Pilsbry are nearly all extinct, the exceptions being a few uncharacteristic forms; the Pliocene plants are regarded as extinct, though to some extent this is a matter of convention, the scanty remains showing no appreciable difference in several cases from living species. When we come to compare the next period, the Pleistocene, with the Recent, there is no such break. It is not unreasonable to say that we are still living in the Pleistocene. Hence, when we dispute whether Lake Cahuilla is Pleistocene or Recent (Holocene), the decision may not be evident. But during the Pleistocene, as is now well known, there were wet (pluvial) periods, alternating with relatively dry ones, and no doubt these vicissitudes had much to do with the extinction of various elements of the fauna and flora. The last of these pluvial periods, near the end of the Pleistocene, seems to be the period of Lake Cahuilla.

We seem to have various evidences of this pluvial period in southern California. The fauna of the tar pits at Los Angeles, including large herbivorous animals, such as elephants and mastodons, could hardly have been supported by such vegetation as now exists in the region. The subfossil land snails on the islands off the coast, especially San Nicolas Island, are so abundant as to suggest abundant vegetation, though it is true that the present denuded condition of the islands is largely due to the grazing of sheep. But Lake Cahuilla itself seems to furnish evidence of a pluvial period of long duration. Such a large shallow lake, supporting an enormous population of mollusks, must have existed for a long period, but it remained strictly fresh water until near the end of its existence, when the marine genus *Acteocina* appeared. This genus is represented, sparingly, by a minute species, which Willett described as new. Now the Salton Sea was formed as recently as 1905, when the Colorado River flooded the Salton Sink, an area below sea level. It is the fresh water which makes the sea salt, as the result of evaporation, and under present climatic conditions the Salton Sea has now become as salt as the ocean. It does not seem possible that Lake Cahuilla could have remained fresh under climatic conditions such as exist today.

More study of Lake Cahuilla is needed, and interesting discoveries may be made. Dr. W. O. Gregg writes that he has found an additional mollusk in the deposit, *Pyrgulopsis nevadensis* (Stearns), and suggests that still others may be found.

T. D. A. Cockerell
Box 411, Palm Springs, California

A Critique of the "Exact" Natural Sciences

The current widespread discussions on the subject of the proposed science legislation have brought forth again the old problem of the "exact" natural sciences and the "inexact" social studies. At the risk of incurring wrath from both sides, I should like to state a view which, unfortunately, has not been generally considered.

The apparent basis for the argument is that the "exact" sciences deal with subjects and materials which are under rigorous experimental control of the investigator, while the "inexact" sciences are mainly concerned with the irrational and, at times, irresponsible activity of a mass of individuals amenable only to a statistical treatment. The apparently rather general acceptance of this state of affairs leads one to consider the actual merits of such a differentiation; such consideration, it is sad to say, does not lend too much weight to the claims of the former group. At this point, the writer wishes to mention that in all such discussion his arguments have been with the "exact scientists" in a general sort of way and that the following line of argument is based on a long period of work in the "exact" sciences (specifically, organic chemistry). The general examples to be cited are based on general practice in organic chemistry, which is, after all, a fairly representative branch of the natural sciences.

The science of organic chemistry is based essentially on a collection of observations which were made on the behavior of physical entities and agglomerations of these. The materials under observation must be regarded as statistical aggregates of a large number of molecules possessing a variable degree of identity, which is controllable to a certain degree by the manipulations entailed in the preparation of such aggregates. It must be conceded that any of the commonly used methods of purification and separation are essentially statistical methods, which cannot lead to the degree of isolation which can be used to justify the commonly-met statement: "pure compounds." Speaking in the sense of absolute logic I do not believe that anyone is justified in saying that this heap of crystals or that vial of liquid is a collection of identical molecules. There is no fractionating column in existence nor a crystallization technique nor any other physical or chemical method capable of absolute separation of materials in the course of an investigation. Whether one starts with the fundamental natural sources or buys the starting material as a "pure starting material" from a scientific supply house, the problem of separation is ever present. Now, the great bulk of work in the field is done with materials which are purified to the practicable extent and represent aggregates which show the gross variations of one unit or somewhat less in their most commonly used indices of purity: the melting point and the boiling point. Much of the technical work is done on materials with considerable extension of this range. Some work, essentially on standards, has been more exacting, but even here the justification for absolute identity of the aggregate is a matter of concern. Let us say, then, that the bulk of the organic chemistry is based on observations of compounds which are 99–99.8 per cent pure, with the emphasis being perhaps on the first figure. Even in the latter case a mole of such a compound will contain 1.2×10^{21} molecules of other substances which were either picked up en route during the manipulations or remaining from the initial starting material. Now, relatively speaking, this number is small; in the absolute sense it is a very large one. It must be conceded that the work in the field of catalysis shows at times spectacular effects produced by materials which are present in fractional per cent amounts in a given mixture; the effects of biological catalysts are at times even more pronounced. Therefore, is there a justification for the neglect of the presence of such large numbers of molecules as cited above in materials under study in so far as the chemical behavior is concerned? Of course, there is the practical justification which can be carried to the logical conclusion, which is that there is no physical apparatus possible (at least in our present state of knowledge) capable of absolute resolution of molecular aggregations. But this is just another way of saying that our "exact" science is not exact; that we do not really *know* that many reactions are or are not initiated by at least some of those miscellaneous molecules which are swarming in our "pure" compounds. These reactions need not be the spectacular ones induced by the well-known catalytic agencies, but merely the "everyday" classical reactions. We see the gross statistical effects only and have little or no true representation of the actual events.

Does not this seem to be similar to the criticisms leveled at the "social" scientists? Certainly, there is a striking parallel between the "materials" under study. As a matter of fact, the social sciences, especially in recent years, have devoted much time and effort in dealing with problems induced by relatively small fractions of national population. As an example, a well-known radical party which numbers some 50,000 members, *i.e.* some 0.03 per cent of our population, has had more words written about it by the "inexact" scientists than have been written by the "exact" organic chemists on the "missing" 1 per cent (or somewhat less) of their materials. On this basis, how much logical separation can we make between the two fields of work?

G. M. Kosolapoff

Monsanto Chemical Company, Dayton

Pandora's Box

The Army and the Navy appear to be determined to go ahead with experimental atomic bombing of naval vessels, despite the grave warnings by some physicists that any uncontrolled release of atomic energy might set off a chain reaction which would detonate the entire earth, and despite the fears of biologists concerning the possible effects of a subsurface explosion of an atomic bomb on marine life. The announced plans to carry out this experiment in the face of these warnings betrays a profound lack of understanding of the force which scientists have placed at the disposal of military men, and a regrettable paucity of imagination and lack of concern for other life on this planet. The chief concern of mankind should be the prevention of any further release of the atomic bomb: Hiroshima and Nagasaki are examples enough of its power, and adequate warning of the shape of things to come, and this unnecessary and dangerous experimental bombing should be abandoned before it is carried any further. Certainly its possible effects, in the light of our present inadequate knowledge, should be called to the attention of every one concerned in this scheme. War is out of date, and even admission of the possibility of future wars is welcoming the premature extinction of mankind. It is already far later than our military minds think it is.

Joel W. Hedgpeth

Texas Game, Fish and Oyster Commission, Rockport