and all officers from the beginning of the association in 1892 are listed in the official directories, published each year or two and available in many libraries.

It seems obvious that the volume would have to be at least five or 10 times its present length (1406 pages) in order to include all "eligible" individuals, for if one is to judge by the qualifications of persons listed, most employed educators, especially at the college level, meet its minimum requirements for "eminence."

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Change in pK'_a of Representative Compounds with Solvent Composition

Determination of the apparent dissociation constant (pK'_a) by the potentiometric method is a useful tool in qualitative organic structural chemistry, in the estimation of molecular weights or purity of samples and as an adjunct to absorption spectrophotometry (*1*). In the course of these operations, samples are often found inadequately soluble in water for accurate titration, so that a solvent-water mixture is necessary.

The apparatus (*1*) works well with mixed solvents, generally to concentrations containing as little as 10 to 20 percent water. Below these concentrations, the system may behave erratically. The pK'_a values are usually modified in mixed solvents, depending on such factors as the solvent, the solvent concentration, and the nature of the dissociating group. These variations may provide additional information for the assignment of structure.

In order to use the change in pK'_a with solvent composition in group identification, it is necessary to know the expected direction and magnitude of the changes. These have been determined for a number of representative compounds with different solvents, for example, ethanol (*2*) and dioxane (*3*). In this study (*4*), ionization changes for compounds that are useful in the pharamaceutical field are examined in the alcohols and in two particularly effective solvents, dimethylformamide (DMF) and dimethylacetamide (DMA).

Techniques for titration, calculation, and determination of pK'_a have been described (*1*). In the preparation of mixed solvents, measured volumes of distilled water and of solvent were combined. Percentages refer to volumes of the pure components; thus, a 40-percent methanol solution was prepared by delivering 1.2 ml of methanol and 1.8 ml of water into the titration vessel. Solvents were checked for suitable physical characteristics and redistilled if necessary. The samples were commercially available materials of sufficient purity to yield satisfactory titration curves, selected to provide types of ionization common in structural identification work, individually and in combinations within the same molecule.

Results of the titrations, taken at a room temperature of 25°C, are shown in Figs. 1 and 2, in which the pK'_a is plotted against the concentration of organic solvent. The following observations may be made on these data.

All the acidic groups (carboxyl or phenolic hydroxyl) are greatly weakened by the addition of organic solvent. This is also characteristic of dibasic acids, where both groups show a large increase in pK'_a. The increase in pK'_a is generally greater with DMF and DMA than with the alcohols, and the smallest increase in pK'_a is with methanol.

Amine groups show comparatively little change in strength with change in solvent. In otherwise uncharged molecules, they are decreased slightly. In the zwitterion amino acids, the basic group or groups may be strengthened slightly in some solvents. Shifts in pK'_a with DMF and DMA tend to be greater than with the alcohols.

The response curves obtained with DMF and DMA indicate that these solvents are essentially interchangeable in titration experiments.

Although they follow these general trends, the curves of change in pK'_a with change in solvent do not behave in a uniform manner from solvent to solvent or between different compounds in the same sol-

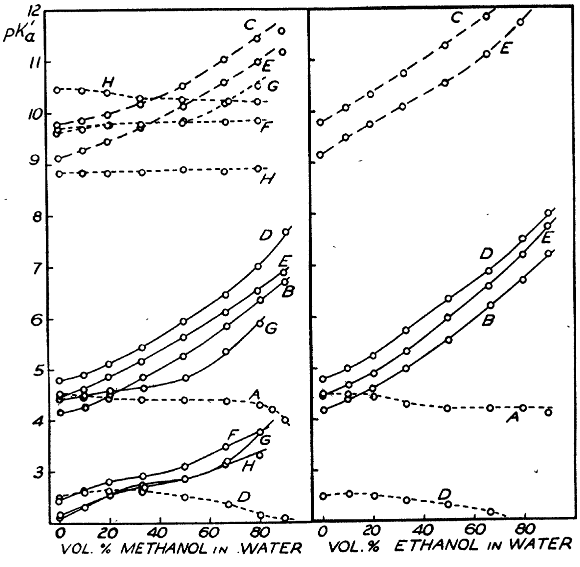

Fig. 1. Change in pK'_a with volume percentage of alcohols in water. Solid lines, carboxyl groups; dashed lines, hydroxyl groups; dotted lines, amino groups. The compounds titrated are identified by letters: (*A*) aniline; (*B*) benzoic acid; (*C*) phenol; (*D*) *p*-aminobenzoic acid; (*E*) *p*-hydroxybenzoic acid; (*F*) *dl*-alanine; (*G*) *l*-glutamic acid; and (*H*) *l*(+)-lysine.

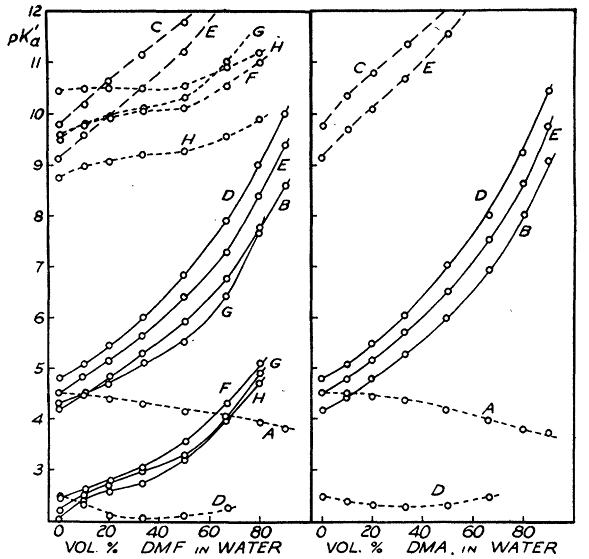

Fig. 2. Change in pK'_a with volume percentage of DMF and DMA in water. Solid lines, carboxyl groups; dashed lines, hydroxyl groups; and dotted lines, amino groups. The compounds titrated are identified by letters: *(A)* aniline; *(B)* benzoic acid; *(C)* phenol; *(D)* *p*-aminobenzoic acid; *(E)* *p*-hydroxybenzoic acid; *(F)* *dl*-alanine; *(G)* *l*-glutamic acid; and *(H)* *l*(+)-lysine.

vent. Plots of pK'_a versus log concentration of water in DMF yield a reasonably good line at the higher concentrations for aliphatic carboxylic and dicarboxylic acids, but such regularity is an exception.

Rigorous treatment of the factors that affect the values of dissociation constants in nonaqueous or mixed media is given in the literature (*5*). For empirical application of these measurements to qualitative organic structure analysis, it is not necessary to have complete knowledge of such factors, among which are (i) the change in hydrogen-ion activity and the consequent change in glass electrode response to concentrations of acid or alkali, (ii) the change in dielectric constant of the medium, and (iii) the change in solvation or hydrogen bonding of the ionizing groups. Interaction of these effects leads to nonuniformity of the plotted curves but does not interfere with their empirical use in determining the nature of dissociating groups.

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More on Contemporary Science and the Poets

Apparently J. Z. Fullmer originally set out to discuss, in her article on contemporary science and poetry [*Science* **119**, 855 (1954)], the use of scientific terminology and references to technologic objects in poetry. Judging by her communication [*Science* **120**, 953 (1954)], one can assume that she did not intend that the subject should get so far out of hand as it did in the letters of Hagopian and Hirsch. The fatal error that led to this is contained in this statement in her letter:

> Questions about the function of the poet are different, not only in degree from the problem in "Contemporary science and the poets," but also in kind. They are in fact *sui generis.*

This error is the separation of form from content, which is a grave and fundamental error. Hirsch makes this same error in a most explicit and flagrant way:

> It is a misconception . . . to think that it is the task of poetry to interpret man's place in nature. This is the province of philosophy. The poet is preoccupied with images, form, and expression. . . .

Hagopian also tends toward this error, with his emphasis on "symbolic linguistic forms" and their use in the presentation of "human conative-affective experiences."

All three writers are caught in a fatal dualism—that is, the separation of the mind and the material universe into two incompatible and irreconcilable worlds. This leads them to compartmentalize human knowledge and experience to such an extent that Hirsch not only concludes that no real fusion is possible between poetry and science but that they will diverge even further in the future. Thus, we find it asserted that science does not deal with the fundamental questions of the universe, that poetry deals only with images and form, and that the symbolic forms of art and science are fundamentally different (Hagopian quoting Langer).

All these assertions are in basic error. Science must deal with the fundamental questions of the universe, and so must poetry! The real, material universe exists and is a basic reality. Human life and thought are a part of it and emerge from it. Thought is the result of the activity of an organized part of the material world, and the human brain is a reflection of, and in interaction with, this material universe.

It follows from this that Hinshelwood, as quoted by Fullmer, is incorrect in stating that science is

> . . . the attempt by the human mind to order these facts into satisfying patterns. Now a pattern or de-