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Citation Classics

Bray G A. A simple efficient liquid scintillator for counting aqueous solutions in a liquid scintillation counter. **Anal. Biochem. 1**:279-285, 1960.

...The author asserts that amodification or the naphthalene-dioxane system" for "counting radioactive compounds in aqueous solutions using a liquid scintillation counter" has a relatively high efficiency "for both carbon-14 and tritium." The modification of the "naphthalene-dioxane" procedure has "been used to count glycolytic intermediates on paper chromatograms. It has also been used to determine radioactive glucose incorporation into glycogen by counting the acid hydrolyzate of the isolated glycogen."

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"The march of science is paced by the appearance of new ideas. Broadly speaking, these ideas can be divided into two groups: those which provide new methods and those which provide a broad conceptual framework for thought. Among the former are the printing press, the microscope, the stethoscope, X-rays and liquid scintillation counting. In the latter category are the heliocentric theory of the planetary system, the circulation of the blood, the theory of evolution and the microbial theory of disease.

The paper which is described above contributes to one aspect of a major methodologic advance. The use of liquid scintillation techniques for assaying the radioactivity of beta-emitting isotopes has been a significant and important advance in technology. The ability to measure beta-emitting isotopes in aqueous solutions provided one corner of this methodology.

In looking back at the development of the liquid scintillation cocktail cited above, it seems appropriate to note the contribution of two individuals without whose ideas this method would not have been developed. In 1958, liquid scintillation continue was in its infancy. When radioactive compound containing carbon-14 or tritium were obtained from biological fluids or in aqueous solution, they usually had to be extracted or otherwise treated in order to determine the amount of radioactivity. As a renal physiologist, I was confronted with the problem of counting tritium-labelled compounds in the urine from dogs. I consulted with Dr. Daniel Steinberg about my problem and he suggested the use of anthracene and triton, a method which he had just published.[1] Unfortunately, this technique had an efficiency of only 1% for tritiated compounds. Dr. Steinberg then suggested that I try a mixture of dioxane and napthalene but the samples froze when put in the freezers used to house counting vials. The obvious solution was to add antifreeze. A 20% mixture of ethylene glycol in dioxane and naphthalene worked very well and for over a year the cocktail had this composition (dioxane, ethylene glycol, naphthalene and appropriate scintillation compounds).

It was at this time that Dr. jean Wilson entered the scene. He too was faced with counting aqueous solutions of radioactive compounds. We shared an office which also housed an analytical balance for his laboratory. One day when he was weighing out 3.0 gm aliquots of anthracene, I suggested he might like to try the cocktail that I had been using for the past year. A few weeks later, Jean asked where I had published this method. Since there was no manuscript, he encouraged my literary efforts. Before publication, however, the efficacy of this 'homemade' cocktail had to be tested to see whether it might not be modified to make it more useful. After trying a variety of antifreeze solutions and other ingredients, the final composition was established and in due course published."[2]

1. **Steinberg D.** A new approach to radioassay of aqueous solutions in the liquid scintillation spectrometer. **Anal. Biochem. 1**:23 39, 1960.
2. **Bray G A.** Personal communication, November 15, 1976.