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The Effect of Carrier on Reaction Rates

TO THE EDITOR: The recent letter of Couch et al. (*1*) on the "Use of Carrier in the Preparation of Iodine-123 HEAT" represents a misconception concerning the role of carrier in radiotracer syntheses. Addition of carrier ^{127}I to a solution of ^{123}I does not increase the number or frequency of collisions between ^{123}I and the molecules to be labeled per se. The rate of the (radiochemical) reaction is not changed by this mechanism. It is true that the frequency of collisions between substrate and all iodine nuclides is increased but only those collisons between ^{123}I and substrate are pertinent to radiotracer formation. In any event an induced increase in the rate of a given reaction by some perturbation is not necessarily reflected in an increase in yield. The converse also holds—namely an observed increase in yield (as found by Couch et al.) does not require that the reaction took place more quickly.

In those cases where carrier has a favorable effect upon radiochemical yield, one must look elsewhere for reasons. Trace impurities present in the reaction medium, which are capable of consuming a significant proportion of the radionuclide or saturable adsorption sites on the walls of reaction vessels, syringes, etc. are among the many possibilities. Addition of carrier under these circumstances serves to increase the effective concentration of the radionuclide.

REFERENCE

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REPLY: Dr. Wilson has apparently misconstrued our brief discussion of the higher yield of product in the carrier-added reaction. A more complete explanation is as follows: in addition to HEAT, $^{123}I^+$ ions also interact with impurity molecules in the reagents and with the walls of reaction vessels, etc. In a no-carrier-added reaction, these interactions utilize a significant proportion of the $^{123}I^+$ ions. When carrier is added, the large number of carrier ions added also partake in these undesirable "side reactions," leaving a larger number of $^{123}I^+$ ions available for reaction with HEAT. Thus there are, *effectively*, more collisions between $^{123}I^+$ and HEAT in the carrier-added reaction than in the no-carrier-added reaction and this results in a correspondingly higher yield of product.

It is certainly correct that neither the reaction rate nor the number of collisions between two species by themselves is altered by the addition of carrier. We did not state nor did we mean to imply the contrary.

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