tonnage scale, no harmful effects have been observed on plant personnel exposed over several months.

The most important member of the class, because of its accessibility and cost, is di-(*p*-chlorophenyl)methylcarbinol,[3] $(p\text{-}ClC_6H_4)_2C(OH)CH_3$, which was first made by Bergmann and Bondi in 1931 by the action of methylmagnesium iodide on *p,p'*-dichlorobenzophenone (*1, 3*). It can also be made by other Grignard reactions such as the action of *p*-chlorophenylmagnesium bromide on ethyl acetate or on *p*-chloroacetophenone. The *p,p'*-dichlorobenzophenone, not available commercially, can be made by several Friedel-Crafts reactions, including chlorobenzene with carbon tetrachloride, with phosgene and, with *p*-chlorobenzoyl chloride. Oxidation of DDT ethyene, 1,1-di-(*p*-chlorophenyl)-2,2-dichloroethylene, yields this ketone, a reaction which first showed the structure of DDT (*2*).

Di-(*p*-chlorophenyl)methylcarbinol is a colorless, crystalline solid, melting at 69.5°–70.0° C. It cannot be vacuum-distilled at 1-mm pressure or vacuum-sublimed without decomposition. Thin films exposed to air at room temperature for 42 days volatilized less than 2%. It is insoluble in water, soluble in the common organic solvents, and most soluble in the polar type such as alcohols, ketones, etc. As a tertiary alcohol, this compound may be dehydrated to 1,1-di-(*p*-chlorophenyl)ethylene, mp 84°–86° C, by the prolonged action of heat above its melting point or by the catalytic action of strong acids in solution. Oxidation of the carbinol yields *p,p'*-dichlorobenzophenone. Catalytic reduction yields 1,1-di-(*p*-chlorophenyl) ethane. Typical alcohol derivatives such as ethers and esters are difficult to prepare because of the ease of dehydration and the sterically hindered alcohol group.

Various analytical procedures for the carbinol and related compounds have been developed. Traces of the carbinol may be estimated colorimetrically by nitration followed by treatment with alkali. The carbinol and its isomers are analyzed by measuring the water of dehydration either by Karl Fischer titration or volumetrically, if large samples are taken. Quantitative oxidation of a mixture containing carbinols and the corresponding ethylenes and ketones in which the chlorine atoms are in the *p,p'* and *o,p'* positions of the rings gives a mixture of *p,p'* and *o,p'*-dichlorobenzophenones whose composition can be estimated from setting point-composition data. From water yield and oxidation results, concentration of the most active isomer, di-(*p*-chlorophenyl)-methylcarbinol, can be calculated. Ultraviolet absorption spectra and setting point-composition diagrams are also useful in analyzing mixtures of carbinol, ethylene, and ketone.

From the preparation and testing of a number of derivatives and analogues of the di-(*p*-halophenyl)alkylcarbinols, certain conclusions on the relation of structure to activity may be drawn. For maximum activity the ring halogen atoms are necessary. Isomeric carbinols with one or both of the halogens in the ortho position are much less active. The alkyl group, R in $(p\text{-}ClC_6H_4)_2C(OH)R$, may be methyl, ethyl, etc., or cycloalkyl such as cyclohexyl, but aryl or aralkyl groups such as phenyl and benzyl give compounds of lower activity. If the alcoholic group is shifted from the tertiary carbon atom, as in the isomeric B-β-di-(*p*-chlorophenyl)ethanol, the miticidal activity is lost.

The details of these properties, syntheses, and analyses will be published at a later date.

[3] Sometimes abbreviated to DMC. Spraying compositions containing DMC have the trade-marked name of Dimite.

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Localization of C^{14} in the Tissues of Mice after Administration of C^{14} Methyl-labeled Glycine[1]

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Carbon-labeled compounds offer a wide range of experimental possibilities because of the ubiquity of carbon in living organisms. Because of its long half-life, C^{14} offers the additional advantage of an isotope that can be studied over long periods of time. However, this very fact has resulted in an understandable hesitation to use it, without more knowledge regarding the effects of prolonged exposure of living tissues to radiation. It was felt that if the radioactivity were fairly evenly distributed in the organism, the total dose could be so calculated as to keep the radiation to any one tissue or organ within a reasonably calculated safety margin.

Bloom *et al.* (*1*), using BaC^*O_3 or $NaHC^*O_3$ injected intraperitoneally into young rats, showed by means of autoradiographs that activity tended to localize in bone and remain there long after soft tissues were no longer active, although the activity in various tissues was not directly weighed and measured, so that the residual activity in bone may have been extremely small. It was felt, therefore, that further work should be done to see if use of soluble compounds resulted in radioactivity localizing in the bone.

Glycine, labeled with C^{14} in the methylene position, having an activity of 567,000 cpm (4.57 c/mg) prepared by Ostwald (*3*) was injected into the tail veins of adult, male, strain A mice. Each animal was injected with 1.728 mg of glycine*, a total activity of 1.08×10^6 cpm. Fifteen animals were injected simultaneously and sacrificed at varying time intervals from 6 hr to 43 days. Some were sealed in glass metabolic cages so that activity measurements of breath, feces, and urine could be made. Combustions, plating, corrections, etc. were carried out as described by Calvin *et al.* (*2*). The moisture removed by vacuum desiccation (in order to obtain dry tissues)

[1] The work described in this paper was sponsored by the Atomic Energy Commission.

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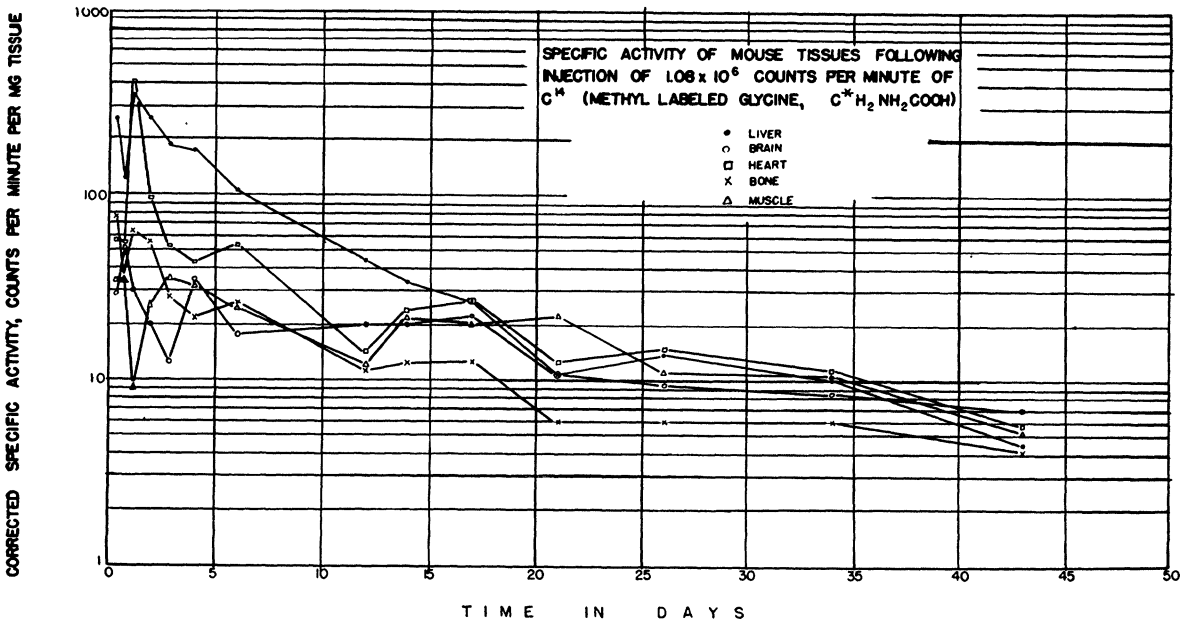

FIG. 1.

was collected in a liquid nitrogen trap and subjected to wet combustion (*4*) to determine the presence of any volatile activity in two cases. Less than ½ cpm was present in the entire sample, so it was felt reasonable to ignore this as a possible site of activity loss. Reid (*5*), using DL-tyrosine labeled with C^{14} has also found negligible amounts of volatile activity in a similar procedure.

The total activity of each tissue showed a steady drop over a period of time. After 43 days the total activity was only a fraction of 1% of the original injected activity, and this was fairly evenly distributed in all the tissues examined. The individual tissues from the 43-day animal had a total activity of 0.81% of the injected dose.

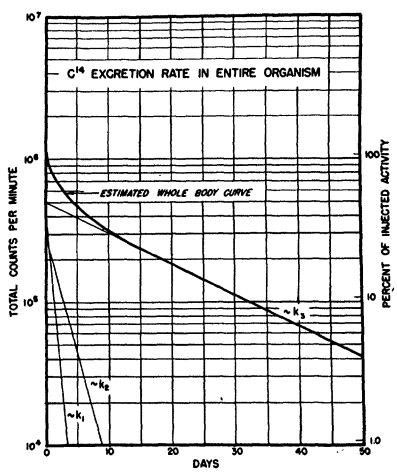

FIG. 2.

The remaining carcass retained 4.73% of the original activity. Therefore 5.54% of the initial total injected dose was still present in the entire body after 43 days.

Specific activity (cpm/mg dry tissue) was also calculated for each tissue and corrected for the varying carbon content of each tissue, so as to make the values comparable. These values showed a steady drop, as can be seen in Fig. 1. Bone did not show any greater activity than any of the other tissues. (More complete and detailed data will be published in another article.)

From this data, turnover rates were calculated for each tissue and integrated into three components. If one averages the daily percent turnover of C^{14} of each of these three components, the estimated average components for the entire organism may be plotted on a curve from which the percent retention of injected C^{14} at any time may easily be seen. This is done in the curve in Fig. 2. At any one time the percent activity in the organism will be the sum of the three components.

C^{14} when injected into mice as methyl-labeled glycine is evenly distributed throughout the animal body. From 8% to 70% is lost as radioactive CO_2 in the breath in the first 48 hr. After this time there is a slow but steady loss in the urine, feces, and breath, so that after 43 days only 5.54% of the injected activity is present in the body, with an over-all biological half-time of 10.5 days. Turnover rates in all tissues are quite similar.

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