injection of 1 to 2 mg is capable of blocking the termination of diapause without killing. Moreover, administration of the drug at any stage during the first few days of adult development causes cessation of further development. The findings suggest a close connection between the synthesis of DNA and the action of ecdysone. (Abstr.)

356 Wyatt, G.R. Science, N.Y. 154 (1966) 251. Presented at the "Conference on Insect Endocrines, Brno, Czechoslovakia. 22 - 26 Aug. 1966".

Studies of DNA-, RNA-, and protein synthesis in the wing epithelial cells of cecropia pupae which had been induced to end their diapause through increase of temperature or injection of ecdysone. ^{3}H-uridine was used. Measurements of uridine incorporation and of template activity suggest that there is first a selective synthesis of template RNA followed by selective synthesis of ribosomal RNA. The rate of protein and DNA synthesis rises some hours after the rise in the rate RNA synthesis. New RNA synthesis appeared to be much closer to the primary action of ecdysone than DNA synthesis is.

357 Yoon, S.B., Fox, A.S. PERMEABILITY OF PREMATURE EGGS FROM Drosophila COLLECTED WITH THE "OVITRON". Nature, Lond. 206 (1965) 910-913.

The permeability of ovariolar eggs, and the development of the "ovitron" is described which permits the collection of large numbers of such eggs through the induction of premature discharge by females. Drosophila-DNA labelled with ^{32}P was prepared from wild-type flies grown on medium containing labelled orthophosphate. Eggs were collected in the ovitron for a 4-h period, dechorionated, and divided into batches, each batch being immersed in 5 ml of a solution containing 0.7 mg of ^{32}P-DNA in 0.16 M NaCl, and incubated at 25°C for 16 h. ^{32}P derived from labelled DNA could be shown to penetrate into the eggs. The minimal frequency of such unequivocally labelled eggs was 2.5 and 0.6%. Similar results were obtained with ^{32}P-DNA from Escherichia coli and from Proteus vulgaris. In later experiments the eggs were treated differently. A dialysis bag was used, containing 0.2 mg ^{32}P-DNA from E. coli in a total volume of 5 ml of modified Ringer, dialysis being carried out for 20 h at 23°C, with constant stirring. Autoradiograms of heavily labelled eggs thus obtained disclosed a heavy deposition of grains inside the vitelline membrane, especially at the anterior end, and grains arranged in radiating fibres on the outside. Radioactivity from ^{32}P-DNA which had entered the premature eggs was found in the cytoplasm and is incorporated into nuclei. Some of the ^{32}P probably enters the eggs in relatively large portions of DNA, part of this DNA remaining in the nucleus.

358 Yoon, S.B., Fox, A.S. PERMEABILITY OF PREMATURE Drosophila EGGS TO MACROMOLECULES. Genetics 50, 2 (1964) 296. Paper presented at the "1964 Meeting of the Genetics Society of America. Boulder, Colo., USA, 24 - 26 Aug. 1964".

By the use of a special device, the ovitron, it is possible to induce Drosophila females to lay oocytes of stages 13 and 14 prematurely. These eggs are fertilized, develop normally, and can be collected in large numbers at uniform developmental stages beginning with the pronuclear stage. They differ from mature eggs in a number of respects, but most significantly with regard to permeability. Dyes like methylene blue enter freely, and their contents are autolysed when they are immersed in solutions of proteolytic enzymes. When immersed in solutions of ^{32}P-labelled E. coli or Drosophila DNA, fixed, sectioned, and examined by autoradiography, the radioactive label is found in high concentration in the peripheral cytoplasm. The details of grain distribution suggest that the label enters in long tracts of DNA. At the pronuclear stage it is found clustered around and in the pronucleus. At later multicellular stages it persists in nuclei, but little if any is found in the cytoplasm. (Abstr.)

359 Zalokar, M. ETUDES DE LA FORMATION DE L'ACIDE RIBONUCLEIQUE ET DES PROTEINES CHEZ LES INSECTES. Revue suisse Zool. 72, 1 (1965) 241-261.

La localisation de la formation de l'ARN et des protéines dans les cellules des Insectes a été étudiée par le moyen de l'autoradiographie. Les précurseurs radioactifs furent utilisés: Uridine-^{3}H, uniformément marqué, 640 mCi/mM, dans une solution contenant 40 µg/ml; Cytidine-^{3}H, 7810 mCi/mM; DL-Leucine-4,5-^{3}H, 3570 mCi/mM, 74 µg/ml; Glycine-2-^{3}H, 44.2 mCi/mM, 100 µg/ml. Après l'administration des précurseurs radioactifs (^{3}H-uridine) les chromosomes et les nucléoles de la glande salivaire de Drosophila et des ovocytes de Blattella se chargent simultanément d'ARN radioactif. L'actinomycine D inhibe la production de l'ARN à des concentrations plus basses pour les nucléoles que pour les chromosomes. La production de l'ARN dans les nucléoles

est donc indépendante de celle des chromosomes. Puisque l'ARN nucléolaire est produit, chez Blattella, près de la chromatine associée aux nucléoles, sa production dépend probablement toujours de l'ADN. Si les nucléoles apparaissent toujours plus radioactifs que le reste du noyau, c'est parce qu'ils produisent l'ARN à un taux plus élevé que les chromosomes et l'accumulent en concentration plus grande. Dans toutes les cellules des Insectes étudiés, les noyaux se chargent d'ARN radioactif bien avant le cytoplasme. Chez la mouche et chez la chenille de Malacosoma, l'uridine injecté se détruit rapidement par catabolisme, ce qui permet de suivre l'évolution de l'ARN produit dans le noyau après la disparition du précurseur externe. Après quatre à six heures, les noyaux perdent de leur radioactivité, alors que le cytoplasme continue à s'en charger. Le cytoplasme des ovocytes de Drosophila n'est certainement pas capable de synthétiser l'ARN, puisqu'il est évident que tout son ARN lui est apporté par les cellules nourricières. Le noyau de l'ovocyte peut seulement produire une quantité minime d'ARN. De même, les ovocytes des ovaires méroïstiques des Lépidoptères (Galleria) ne produisent pas d'ARN. D'autre part, l'ovaire méroïstique d'une Nématocère, Simulium, possède des ovocytes dont les noyaux sont aussi actifs dans la formation de l'ARN que ceux des cellules nourricières. Après l'administration des acides aminés radioactifs, le cytoplasme est le premier à se charger de protéines radioactives. Dans toutes les cellules étudiées, le noyau devient radioactif après un délai de quelques minutes et c'est dans le nucléole que la radioactivité est d'abord la plus grande. Ces expériences prouvent que le cytoplasme est le lieu primaire de la synthèse des protéines et que cytoplasme est le lieu primaire de la synthèse des protéines et que les protéines du noyau sont probablement synthétisées dans le nucléole et en partie au moins, dans le cytoplasme. Chez Malacosoma, la soie est produite dans le cytoplasme et non dans les noyaux, indiquant que l'ARN responsable de sa production est actif seulement dans le cytoplasme. Quand, dans les glandes séricigènes, la formation de l'ARN est totalement inhibée par l'actinomycine D pendant quatre heures, la soie continue à se produire. Si un ARN messager est nécessaire à la production de la soie, il devrait être relativement stable.

See also:

15 The elimination and differentiation of chromosomes in the germ line of Sciara. (Rieffel, S.M. et al., 1966)

16 A molecular explanation of the bobbed mutants of Drosophila as partial deficiencies of "ribosomal" DNA. (Ritossa, F.M. et al., 1966)

21 Scintillation counting of tritiated thymidine transferred to females by labelled Drosophila melanogaster males. (Trout, W.E., III., 1966)

29 Somatic mutations in the moth Ephestia. Report on Research, August 1, 1965 - September 15, 1966. (Caspari, E.W., 1966)

33 Distribution of lethals induced by tritiated DNA precursors in Drosophila melanogaster. (Kaplan, W.D. et al., 1966)

35 The production of mosaics by incorporation of P^{32} into DNA of Drosophila melanogaster spermatozoa. (Lee, W.R. et al., 1967)

36 Mutations produced by transmutation of phosphorus-32 to sulfur-32 within Drosophila DNA. (Lee, W.R. et al., 1967)

40 Some biochemical aspects of insect metamorphosis. (Gilbert, L.I. et al., 1961)

43 Metabolic control mechanisms in insects. (Harvey, W.R. et al., 1966)

72 Specific activity increase in a Balbiani ring in isolated cell nuclei of Chironomus by means of Mg^{2+}. (Lezzi, M., 1967)

92 Glycogen accumulation during oogenesis and its premature release by blocking of the RNA supply. (Study on Musca domestica L.) (Engels, W. et al., 1967)

115 The hormone ecdysone as effector of specific changes in the pattern of gene activities of Drosophila hydei. (Berendes, H.D., 1967)

116 Amino acid incorporation into giant chromosomes of D. hydei. (Berendes, H.D., 1967)

145 Gene activation without histone acetylation in Drosophila melanogaster. (Ellgaard, E.G., 1967)

157 Inhibition by certain pteridines of ribosomal RNA and DNA synthesis in developing Oncopeltus eggs. (Harris, S.E. et al., 1967)

169 Biochemical mechanisms of hormone action. (Karlson, P., 1961)

170 Biochemistry and mode of action of ecdysone. (Karlson, P., 1964)

173 The effects of ecdysone on giant chromosomes, RNA metabolism and enzyme induction. (Karlson, P., 1967)

176 Action of ecdysone on some metabolism during larval-pupal transformation of the housefly, Musca domestica L. (Diptera: Muscidae). (Kobayashi, M. et al., 1967)

202 Utilization of orotate-^{14}C in the biosynthesis of pyrimidines in Helix pomatia and Celerio euphorbia. (Porembska, Z. et al., 1966)

217 The effect of ecdysone on RNA and protein metabolism in insects. (Sekeris, C.E., 1967)

416 Study on the function of nurse cells in meroistic insect ovaries, with special reference to oogensis in adephagous Coleoptera. (Bier, K., 1965)

417 Oogenesis, the growth of giant cells. (Bier, K., 1967)

418 Structure and function of oocyte chromosomes and nucleoli and extra-DNA during the oogenesis of panoistic and meroistic insects. (Bier, K. et al., 1967)

422 An investigation of somatic reduction division in the hind-gut of the mosquito Aedes aegypti (L.) using tritium labelled thymidine. (Cronin, R.T., 1966)

423 Incorporation de la thymidine tritiée dans l'acide deoxyribonucléique des glandes sericigènes chez le ver à soie. (Daillie, J., 1960)

424 Métabolisme de la thymidine dans la glande sericigène du ver à soie. I. Les principales voies suivies par le précurseur dans la glande incubée "in vitro". (Daillie, J., 1967)

425 Métabolisme de la thymidine dans la glande sericigène du ver à soie. II. Utilisation des nucléotides radioactifs pour la synthèse de l'ADN dans la glande incubée "in vitro" au 4e jour du 5e stade. (Daillie, J., 1967)

426 Métabolisme de la thymidine dans la glandes sericigène du ver à soie. III. Incorporation dans la glande sericigène prelevée au 6ejour ou 5e âge et incubée "in vitro". (Daillie, J., 1967)

427 Métabolisme de la thymidine dans la glande sericigène du ver à soie. IV. Etudes sur la glande "in situ". (Daillie, J. 1967)

431 Radioautographic studies on the gonads of Acheta domesticus (L.). (Halkka, O. et al., 1966)

436 Contribution a l'étude du métabolisme des glandes sericigènes de Bombyx mori, incubées in vitro. (Prudhomme, J.C., 1966)

437 Effects of 6-azauridine on the development of the ovaries in the house fly "Musca domestica L." (Diptera). (Rezabova, B., et al., 1967)

439 Drosophila salivary glands in vitro. (Tulchin, N.W., 1966)

447 Studies on oogenesis in Drosophila melanogaster with ^{3}H-thymidine label. (Chandley, A.C., 1966)

448 H^{3}-Thymidine radioautographic study of spermatogenesis in the boll weevil, Anthonomus grandis (Coleoptera: Curculionidae). (Chang, T.-H. et al., 1967)

449 Puffing in giant chromosomes of Diptera and the mechanism of its control. (Clever, U., 1963)

450 Control of chromosome puffing. (Clever, U., 1967)

453 Oogenesis in Hyalophora cecropia. (King, R.C. et al., 1965)

538 Chromosome breakage associated with infection. II. Stained sections. (Halkka, O. et al., 1967)

887 The effect of apholate and thiotepa on nucleic acid synthesis and nucleotide ratios in housefly eggs. (Painter, R.R. et al., 1967)

928 Cytological evaluation of dose-rate effects of radiation on mutation frequency of silkworm gonia. I. Kinetics of proliferation and killing of spermatogonia during chronic irradiation. (Sado, T., 1966)

997 Studies of early effects of radiation on chromosomes and mitosis. Progress Report, March 1, 1966-February 28, 1967. (Carlson, J.G., 1967)

1725 Quantitative biophysical and cytochemical studies of polytene chromosomes. (Paul, J.S., 1966)

1.2.6. Lipids and Fatty Acids. Sterol and Steroid Metabolism

360 Allais, J.P., Barbier, M. UTILIZATION OF β-SITOSTEROL-28,29-$^{14}C_2$ BY THE LOCUST, Locusta migratoria. C.r. hebd. Séanc. Acad. Sci., D 263 (1966) 1252-1254. (In French)

Cholesterol was identified by mass spectroscopy as the major sterol present in L. migratoria. Locusts fed β-sitosterol-28,29-$^{14}C_2$ transformed this sterol very slowly and non-quantitatively into cholesterol.

The ^{14}C could not be detected in the respired CO_2 or in various volatile organic acids present in the lipids of the locust. (CA 66: 1967, 17339c)

361 Brak, J.A.W., Vonk, H.J., Daniels, F.J.A. BIOSYNTHESIS OF THE FATTY ACIDS IN ASEPTICALLY REARED LARVAE OF THE BLOWFLY Calliphora erythrocephala. Archs int. Physiol. Biochim. 74, 5 (1966) 821-829.

The incorporation of Na acetate-1-^{14}C into fatty acids by the 5-d-old larva of the blowfly (C. erythrocephala) was studied. The larva were not able to synthesise linoleic acid. The larva were capable of dehydrogenating saturated fatty acids to corresponding monoenoic acids. In the larva, the de novo synthesis and elongation system of fatty acids were operative; however, the end product of the de novo synthesis in this animal was mainly myristic acid and not palmitic acid. (CA 66: 1967, 35675p)

362 Candy, D.J. OCCURRENCE AND METABOLISM OF SCYLLOINOSITOL IN THE LOCUST. Biochem. J. 103, 3 (1967) 666-671.

A simple method for the identification of scylloinositol is described; this compound was identified as a component of locust (Schistocerca gregaria) haemolymph where it occurs in concentrations of 0.2 - 0.4 mg/ml. The same method was used to demonstrate the presence of scylloinositol in five other insect species (Locusta migratoria, Periplaneta americana, P. australasiae, Blaberus sp. and Calliphora sp.). Locust phospholipids contain myoinositol but no scylloinositol. - (0.02 ml saline containing 10 μCi of D-(U-^{14}C) glucose was injected into the thoracic haemocoel of an adult male locust 7 d after final moult. Radioactivity was incorporated into myoinositol and scylloinositol in vivo. (U-^{14}C) myoinositol was used in other experiments. Extracts of locust fat body catalyse the conversion of myoinositol into scylloinositol. This seems to take place by a 2-step process in which myoinositol is first oxidized with NAD^+ to myoinosose-2, and the myoinosose-2 is stereospecifically reduced with NADPH to scylloinositol.

363 Chino, H., Sudo, A., Harashima, K. ISOLATION OF DIGLYCERIDE-BOUND LIPOPROTEIN FROM INSECT HEMOLYMPH. Biochim. biophys. Acta 144, 1 (1967) 117-179.

The diglyceride released from insect fat body was previously found by the authors to be firmly bound to a specific haemolymph protein, to form a "diglyceride-bound lipoprotein". This protein is suggested to be the only possible means by which insects transport long-chain fatty acids from the fat body to the site of utilization. It has now been isolated, using the pupal haemolymph of the silkworm, Philosamia cynthia. (1-^{14}C) palmitic acid (5×10^5 cpm, 0.02 μM) was injected into the pupa. The palmitic acid is first incorporated into the glyceride fraction (mainly tri- and diglyceride) in the fat body, and only then is ^{14}C-diglyceride released rapidly and specifically into the haemolymph (here, $\sim 5 \times 10^4$ cpm of diglyceride for 1 ml of haemolymph). The lipoprotein was subsequently isolated, the steps being described. It is a globulin-like protein. Its precipitation depends not only on the ionic strength but also on the pH, the optimal pH for precipitation being $\sim$6.5. The lipoprotein is deep yellow, the colour representing carotenoid pigment (s). The solubility curve of the lipoprotein strongly suggests that both diglyceride and carotenoid are conjugated to a single protein.

364 Clayton, R.B., Hinkle, P.C., Smith, D.A., Edwards, A.M. THE INTESTINAL ABSORPTION OF CHOLESTEROL, ITS ESTERS AND SOME RELATED STEROLS AND ANALOGUES IN THE ROACH, Eurycotis floridana. Comp. Biochem. Physiol. 11 (1964) 333-350.

Commercially obtained 4-^{14}C-cholesterol, 4-^{14}C-Δ^4-cholesten-3-one, and 7α-^3H-cholesterol of high specific activity were purified and diluted. Other compounds were prepared from them as follows: 7α-^3H-cholestanol via 7α-^3H-cholesteryl acetate by hydrogenation; 7α-^3H-epicholestanol from 7α-^3H-cholesterol via 7α-^3H-cholestanone; 4-^{14}C-Δ^4-cholestenol from 4-^{14}C-Δ^4-cholesten-3-one; 4-^{14}C-Δ^7-cholestenol from 4-^{14}C-cholesterol via 4-^{14}C-7-dehydrocholesterol, 7α-^3H-cholesteryl methyl ether from 7α-^3H-cholesterol; 4-^{14}C-cholesteryl chloride from 4-^{14}C-cholesterol; 3α-^3H-sitosterol from B-sitosterol; and 3α-^3H-sitosterol via its digitonide. Individual insects showed considerable quantitative variability in handling sterols and sterol analogues fed to them. A differential double labelling technique has therefore been generally used, in which cholesterol and another sterol, ester or analogue, each differently labelled with ^3H or ^{14}C, are fed simultaneously to the same animal, the fate of the ingested cholesterol serving as internal standard. Specific activities of 5000 dpm ^{14}C and 20 000 dpm ^3H/mμM were used allowing an accuracy of $\pm$ 5% in

radioassay. Absorption of cholesterol from the intestinal tract of E. floridana was shown to occur predominantly in the crop but probably also in the gastric caeca. The amount absorbed is approx. proportional to the amount of cholesterol ingested over the range 0.05-500 μg. The role of esterification in the intestinal absorption of cholesterol was studied but remains incompletely defined. However, several lines of evidence suggest that esterification is not an obligatory event, though it may facilitate absorption at low dietary concentrations. Evidence is presented for the absorption of intact aliphatic cholesteryl esters from the gut. Cholestanol, cholesteryl methyl ether and cholesteryl chloride are absorbed about as efficiently as cholesterol. Δ^7-cholestenol is absorbed more efficiently, but β-sitosterol, Δ^4-cholestenol and epicholestanol are absorbed less efficiently than cholesterol. These findings are compared with those from similar studies in vertebrates.

365 Crone, H.D. TRIS BUFFER AS AN ETHANOLAMINE COMPETITOR IN THE METABOLISM OF PHOSPHATIDES. Biochem. J. 100, 1 (1966) 12P.

The calcium stimulated incorporation of (2-^{14}C)-ethanolamine and of serine into the phosphatides of the larval fat body of the house fly Musca domestica is being studied. During these investigations it was noticed that the rate of incorporation of ethanolamine was much less in tris (2-amino-2-hydroxymethylpropane-1,3-diol) buffer than in other buffers. Thus under comparable conditions at pH7.4 in 10mM-$CaCl_2$, 17 mM-tris-HCl gave a rate of 6×10^{-9} moles/h/g of larvae, 75 mM-sodium diethylbarbiturate-HCl gave 29×10^{-9} moles/h/g and 42 mM-imidazole-HCl gave a rate of 32×10^{-9} moles/h/g. Using tris buffer, an apparent K_m value for both ethanolamine and serine of 2×10^{-3} M was obtained. The incorporation of ethanolamine at two concentrations of tris buffer (13mM and 112mM) was studied. The graph of the reciprocals of velocity against ethanolamine concentration gave two straight lines intersecting at the 1/v axis, the conditions for competitive inhibition. From this plot values of 1.7×10^{-4} M for the K_m of ethanolamine, and of 1.8×10^{-3} M for the K of tris were obtained. It is apparent that the relatively high concentration of tris is competing with the ethanolamine to depress the rate of incorporation. The apparent K_m value observed for ethanolamine and serine in the tris buffer is therefore largely that of tris. (From abstr.)

366 Crone, H.D. THE CALCIUM-STIMULATED INCORPORATION OF ISOTOPIC SERINE AND ETHANOLAMINE INTO THE PHOSPHOLIPIDS OF HOUSEFLY (Musca domestica) LARVAE. Biochem. J. 102, 1 (1967) 4P-5P. "Proceedings of the Biochemical Society, Slough, England. 12 Nov. 1966".

The incorporation of (2-^{14}C)ethanolamine and L-(3-^{14}C)serine into the phospholipids in homogenates of the fat bodies of larval house flies has been studied. This incorporation is dependent on the calcium ion concentration, maximal rates being obtained at 20 mM in imidazole buffer. Mg will not replace Ca, but is not directly inhibitory. Mn, Zn, and ions at 10 mM completely inhibit incorporation. The pH optimum in veronal buffer lies between 7.25 and 8.25, beyond these points the activity falls off sharply. The incorporation is greatly reduced by 1 mM-cetyltrimethylammonium bromide and by 0.1% Triton X-100. Serine and ethanolamine both have K_m values of 2×10^{-4} M when measured in imidazole buffer with 10 mM calcium. The incorporation of the radioactive serine or ethanolamine is judged to be a direct exchange with existing nitrogenous bases on the phospholipids, rather than a reflexion of net synthesis of the lipids. This is because of the kinetics of the incorporation, which do not favour the presence of intermediates, and because the incorporation is Ca dependent, whereas the incorporation of (^{32}P) phosphorylethanolamine in the same system is stimulated by Mg and not by Ca. In the present work the results are in accord with the presence of one enzymic system exchanging ethanolamine, serine and foreign aminoalcohols with the bases of phospholipids, the precise nature of which has not been elucidated.

367 Crone, H.D. THE CALCIUM-STIMULATED INCORPORATION OF ETHANOLAMINE AND SERINE INTO THE PHOSPHOLIPIDS OF THE HOUSEFLY Musca domestica. Biochem. J. 104, 2 (1967) 695-704.

The Ca-stimulated incorporation of (2-^{14}C)ethanolamine and L-(3-^{14}C)-serine (initial specific radioactivity of 4.86 and 4.6 mCi/mM, respectively) into the phospholipids of homogenates of the fat bodies from larval house flies (M. domestica) was studied. Ethanolamine and serine acted as competitive inhibitors with one another. N-Methylethanolamine was not distinguished from ethanolamine by the system. Tris buffer was also a competitor with these compounds, and a number of other amino alcohols were inhibitory, probably competitively. (^{32}P)Phosphorylethanolamine

(initial specific radioactivity 100 mCi/mM) was prepared from ethanolamine, orthophosphoric acid and (^{32}P)orthophosphate solution. The incorporation of (^{32}P) phosphorylethanolamine into phospholipids was observed in suspensions of whole fat bodies. This incorporation was stimulated by Mg. During the incubation of the homogenates, a Ca-stimulated breakdown of phospholipids by a phospholipase A occurred. These results are compared with results published for similar mammalian systems, and their possible physiological significance is discussed.

368 Crone, H.D. THE RELATIONSHIP BETWEEN PHOSPHATIDE SERINE AND ETHANOLAMINE IN LARVAE OF THE HOUSEFLY, Musca domestica. J. Insect Physiol. 13 (1967) 81-90.

The incorporation of L-(3-^{14}C) serine into the phosphatides of M. domestica larvae was examined in vivo, and of this compound and [2-^{14}C]ethanolamine in vitro, using whole fat body preparations. Rapid incorporation, probably by an exchange reaction, was observed in both cases. Lipid serine was the direct precursor of lipid ethanolamine over the short time periods studied. Ethanolamine depressed the incorporation of serine but the reverse effect was not shown. These results are discussed in relation to current ideas of mammalian phosphatide metabolism. (Auth.)

369 D'Costa, M., Birt, L.M. THE OXIDATION OF FATTY ACIDS BY THORACIC TISSUES DURING THE DEVELOPMENT OF THE BLOWFLY Lucilia cuprina. Biochem. J. 104, 1 (1967) 11P.

Evidence shows that the developing thorax of Lucilia contains a particulate, carnitine-dependent system capable of oxidizing fatty acids, which virtually disappears at maturity. The oxidation of butyrate (25 mM) by a particulate preparation isolated from a filtered homogenate of bisected Lucilia thoraces required a 4-carbon acid (e.g. malate, 0.5 mM) and was stimulated by ATP (2mM). The rates of O_2 uptake, corrected for the endogenous respiration which itself appeared to be due to fatty acid oxidation, were 10-20 µl of O_2/mg protein/h. CoA, carnitine or serum albumin did not increase O_2 uptake; butyryl carnitine was not oxidized more rapidly than butyrate. Palmitate oxidation was stimulated by all these cofactors. There was a considerable dependence on carnitine and the O_2 uptake with palmitylcarnitine (50-80 µl of O_2/mg protein/h) was considerably greater than with any system where palmitate itself was the substrate (10-20 µl of O_2/mg protein/h). The distribution of the active particles during centrifuging in density gradients suggests that the developing sarcosomes themselves are responsible for the oxidation. As judged by $^{14}CO_2$ released from labelled fatty acids, the oxidase system appears about 2.5 d before adult emergence, reaches max. activity at about emergence, then declines to an extremely low level as the fly matures. Freezing and thawing the mitochondria from mature flies did not increase the oxidation which, therefore, does not appear to be limited by sarcosomal impermeability. Thus the oxidase system is active only during the period of adult formation. Its appearance and disappearance enables the fly to energise its thoracic development at the expense of pupal reserves of fat, which are unable to support adult flight. Conversely, the smaller reserves of carbohydrate are conserved to provide the energy for flight after emergence, a process in which carnitine may also be concerned.

370 Dutky, R.C., Robbins, W.E., Shortino, T.J., Kaplanis, J.N., Vroman, H.E. THE CONVERSION OF CHOLESTANONE TO CHOLESTANOL BY THE HOUSEFLY, Musca domestica L. J. Insect Physiol. 13, 10 (1967) 1501-1510.

Larvae of the house fly, M. domestica L., reared aseptically on a semi-defined diet failed to develop when either cholestenone, cholestanone, or cholestanol was used as the sole source of dietary steroid. However, when these three steroids were tested for 'sparing' activity (in combination with a sub-minimal quantity of cholesterol) cholestanone and cholestanol were 66 and 79%, respectively, as effective as an optimum concentration of cholesterol. Under the same conditions cholestenone showed only low biological activity (11%). Biochemical studies with 4-^{14}C-cholestanone indicate that the utilization of this steroid in the house fly larvae proceeds through its partial conversion to cholestanol. The 4-^{14}C-cholestanone used was prepared from 4-^{14}C-cholesterol by hydrogenation to cholestanol. The identity of cholestanol as a metabolite of cholestanone was established by radiotracer techniques, gas-liquid chromatographic analysis, and by isolation of crystalline cholestanol from house fly pupae reared aseptically on a semi-defined diet containing cholestanone plus a subminimal amount of cholesterol. Using reverse isotope dilution techniques, no significant conversion of ^{14}C-cholestanone to cholesterol was detected. In studies with adult insects, both males and females converted injected ^{14}C-cholestanone to cholestanol. (Essentially auth.)

injection of 1 to 2 mg is capable of blocking the termination of diapause without killing. Moreover, administration of the drug at any stage during the first few days of adult development causes cessation of further development. The findings suggest a close connection between the synthesis of DNA and the action of ecdysone. (Abstr.)

356 Wyatt, G.R. Science, N.Y. 154 (1966) 251. Presented at the "Conference on Insect Endocrines, Brno, Czechoslovakia. 22 - 26 Aug. 1966".

Studies of DNA-, RNA-, and protein synthesis in the wing epithelial cells of cecropia pupae which had been induced to end their diapause through increase of temperature or injection of ecdysone. ^{3}H-uridine was used. Measurements of uridine incorporation and of template activity suggest that there is first a selective synthesis of template RNA followed by selective synthesis of ribosomal RNA. The rate of protein and DNA synthesis rises some hours after the rise in the rate RNA synthesis. New RNA synthesis appeared to be much closer to the primary action of ecdysone than DNA synthesis is.

357 Yoon, S.B., Fox, A.S. PERMEABILITY OF PREMATURE EGGS FROM Drosophila COLLECTED WITH THE "OVITRON". Nature, Lond. 206 (1965) 910-913.

The permeability of ovariolar eggs, and the development of the "ovitron" is described which permits the collection of large numbers of such eggs through the induction of premature discharge by females. Drosophila-DNA labelled with ^{32}P was prepared from wild-type flies grown on medium containing labelled orthophosphate. Eggs were collected in the ovitron for a 4-h period, dechorionated, and divided into batches, each batch being immersed in 5 ml of a solution containing 0.7 mg of ^{32}P-DNA in 0.16 M NaCl, and incubated at 25°C for 16 h. ^{32}P derived from labelled DNA could be shown to penetrate into the eggs. The minimal frequency of such unequivocally labelled eggs was 2.5 and 0.6%. Similar results were obtained with ^{32}P-DNA from Escherichia coli and from Proteus vulgaris. In later experiments the eggs were treated differently. A dialysis bag was used, containing 0.2 mg ^{32}P-DNA from E. coli in a total volume of 5 ml of modified Ringer, dialysis being carried out for 20 h at 23°C, with constant stirring. Autoradiograms of heavily labelled eggs thus obtained disclosed a heavy deposition of grains inside the vitelline membrane, especially at the anterior end, and grains arranged in radiating fibres on the outside. Radioactivity from ^{32}P-DNA which had entered the premature eggs was found in the cytoplasm and is incorporated into nuclei. Some of the ^{32}P probably enters the eggs in relatively large portions of DNA, part of this DNA remaining in the nucleus.

358 Yoon, S.B., Fox, A.S. PERMEABILITY OF PREMATURE Drosophila EGGS TO MACROMOLECULES. Genetics 50, 2 (1964) 296. Paper presented at the "1964 Meeting of the Genetics Society of America. Boulder, Colo., USA, 24 - 26 Aug. 1964".

By the use of a special device, the ovitron, it is possible to induce Drosophila females to lay oocytes of stages 13 and 14 prematurely. These eggs are fertilized, develop normally, and can be collected in large numbers at uniform developmental stages beginning with the pronuclear stage. They differ from mature eggs in a number of respects, but most significantly with regard to permeability. Dyes like methylene blue enter freely, and their contents are autolysed when they are immersed in solutions of proteolytic enzymes. When immersed in solutions of ^{32}P-labelled E. coli or Drosophila DNA, fixed, sectioned, and examined by autoradiography, the radioactive label is found in high concentration in the peripheral cytoplasm. The details of grain distribution suggest that the label enters in long tracts of DNA. At the pronuclear stage it is found clustered around and in the pronucleus. At later multicellular stages it persists in nuclei, but little if any is found in the cytoplasm. (Abstr.)

359 Zalokar, M. ETUDES DE LA FORMATION DE L'ACIDE RIBONUCLEIQUE ET DES PROTEINES CHEZ LES INSECTES. Revue suisse Zool. 72, 1 (1965) 241-261.

La localisation de la formation de l'ARN et des protéines dans les cellules des Insectes a été étudiée par le moyen de l'autoradiographie. Les précurseurs radioactifs furent utilisés: Uridine-^{3}H, uniformément marqué, 640 mCi/mM, dans une solution contenant 40 µg/ml; Cytidine-^{3}H, 7810 mCi/mM; DL-Leucine-4,5-^{3}H, 3570 mCi/mM, 74 µg/ml; Glycine-2-^{3}H, 44.2 mCi/mM, 100 µg/ml. Après l'administration des précurseurs radioactifs (^{3}H-uridine) les chromosomes et les nucléoles de la glande salivaire de Drosophila et des ovocytes de Blattella se chargent simultanément d'ARN radioactif. L'actinomycine D inhibe la production de l'ARN à des concentrations plus basses pour les nucléoles que pour les chromosomes. La production de l'ARN dans les nucléoles

est donc indépendante de celle des chromosomes. Puisque l'ARN nucléolaire est produit, chez Blattella, près de la chromatine associée aux nucléoles, sa production dépend probablement toujours de l'ADN. Si les nucléoles apparaissent toujours plus radioactifs que le reste du noyau, c'est parce qu'ils produisent l'ARN à un taux plus élevé que les chromosomes et l'accumulent en concentration plus grande. Dans toutes les cellules des Insectes étudiés, les noyaux se chargent d'ARN radioactif bien avant le cytoplasme. Chez la mouche et chez la chenille de Malacosoma, l'uridine injecté se détruit rapidement par catabolisme, ce qui permet de suivre l'évolution de l'ARN produit dans le noyau après la disparition du précurseur externe. Après quatre à six heures, les noyaux perdent de leur radioactivité, alors que le cytoplasme continue à s'en charger. Le cytoplasme des ovocytes de Drosophila n'est certainement pas capable de synthétiser l'ARN, puisqu'il est évident que tout son ARN lui est apporté par les cellules nourricières. Le noyau de l'ovocyte peut seulement produire une quantité minime d'ARN. De même, les ovocytes des ovaires méroïstiques des Lépidoptères (Galleria) ne produisent pas d'ARN. D'autre part, l'ovaire méroïstique d'une Nématocère, Simulium, possède des ovocytes dont les noyaux sont aussi actifs dans la formation de l'ARN que ceux des cellules nourricières. Après l'administration des acides aminés radioactifs, le cytoplasme est le premier à se charger de protéines radioactives. Dans toutes les cellules étudiées, le noyau devient radioactif après un délai de quelques minutes et c'est dans le nucléole que la radioactivité est d'abord la plus grande. Ces expériences prouvent que le cytoplasme est le lieu primaire de la synthèse des protéines et que cytoplasme est le lieu primaire de la synthèse des protéines et que les protéines du noyau sont probablement synthétisées dans le nucléole et en partie au moins, dans le cytoplasme. Chez Malacosoma, la soie est produite dans le cytoplasme et non dans les noyaux, indiquant que l'ARN responsable de sa production est actif seulement dans le cytoplasme. Quand, dans les glandes séricigènes, la formation de l'ARN est totalement inhibée par l'actinomycine D pendant quatre heures, la soie continue à se produire. Si un ARN messager est nécessaire à la production de la soie, il devrait être relativement stable.

See also:

15 The elimination and differentiation of chromosomes in the germ line of Sciara. (Rieffel, S.M. et al., 1966)

16 A molecular explanation of the bobbed mutants of Drosophila as partial deficiencies of "ribosomal" DNA. (Ritossa, F.M. et al., 1966)

21 Scintillation counting of tritiated thymidine transferred to females by labelled Drosophila melanogaster males. (Trout, W.E., III., 1966)

29 Somatic mutations in the moth Ephestia. Report on Research, August 1, 1965 - September 15, 1966. (Caspari, E.W., 1966)

33 Distribution of lethals induced by tritiated DNA precursors in Drosophila melanogaster. (Kaplan, W.D. et al., 1966)

35 The production of mosaics by incorporation of P^{32} into DNA of Drosophila melanogaster spermatozoa. (Lee, W.R. et al., 1967)

36 Mutations produced by transmutation of phosphorus-32 to sulfur-32 within Drosophila DNA. (Lee, W.R. et al., 1967)

40 Some biochemical aspects of insect metamorphosis. (Gilbert, L.I. et al., 1961)

43 Metabolic control mechanisms in insects. (Harvey, W.R. et al., 1966)

72 Specific activity increase in a Balbiani ring in isolated cell nuclei of Chironomus by means of Mg^{2+}. (Lezzi, M., 1967)

92 Glycogen accumulation during oogenesis and its premature release by blocking of the RNA supply. (Study on Musca domestica L.) (Engels, W. et al., 1967)

115 The hormone ecdysone as effector of specific changes in the pattern of gene activities of Drosophila hydei. (Berendes, H.D., 1967)

116 Amino acid incorporation into giant chromosomes of D. hydei. (Berendes, H.D., 1967)

145 Gene activation without histone acetylation in Drosophila melanogaster. (Ellgaard, E.G., 1967)

157 Inhibition by certain pteridines of ribosomal RNA and DNA synthesis in developing Oncopeltus eggs. (Harris, S.E. et al., 1967)

169 Biochemical mechanisms of hormone action. (Karlson, P., 1961)

170 Biochemistry and mode of action of ecdysone. (Karlson, P., 1964)

173 The effects of ecdysone on giant chromosomes, RNA metabolism and enzyme induction. (Karlson, P., 1967)

176 Action of ecdysone on some metabolism during larval-pupal transformation of the housefly, Musca domestica L. (Diptera: Muscidae). (Kobayashi, M. et al., 1967)

202 Utilization of orotate-^{14}C in the biosynthesis of pyrimidines in Helix pomatia and Celerio euphorbia. (Porembska, Z. et al., 1966)

217 The effect of ecdysone on RNA and protein metabolism in insects. (Sekeris, C.E., 1967)

416 Study on the function of nurse cells in meroistic insect ovaries, with special reference to oogensis in adephagous Coleoptera. (Bier, K., 1965)

417 Oogenesis, the growth of giant cells. (Bier, K., 1967)

418 Structure and function of oocyte chromosomes and nucleoli and extra-DNA during the oogenesis of panoistic and meroistic insects. (Bier, K. et al., 1967)

422 An investigation of somatic reduction division in the hind-gut of the mosquito Aedes aegypti (L.) using tritium labelled thymidine. (Cronin, R.T., 1966)

423 Incorporation de la thymidine tritiée dans l'acide deoxyribonucléique des glandes sericigènes chez le ver à soie. (Daillie, J., 1960)

424 Métabolisme de la thymidine dans la glande sericigène du ver à soie. I. Les principales voies suivies par le précurseur dans la glande incubée "in vitro". (Daillie, J., 1967)

425 Métabolisme de la thymidine dans la glande sericigène du ver à soie. II. Utilisation des nucléotides radioactifs pour la synthèse de l'ADN dans la glande incubée "in vitro" au 4e jour du 5e stade. (Daillie, J., 1967)

426 Métabolisme de la thymidine dans la glandes sericigène du ver à soie. III. Incorporation dans la glande sericigène prelevée au 6ejour ou 5e âge et incubée "in vitro". (Daillie, J., 1967)

427 Métabolisme de la thymidine dans la glande sericigène du ver à soie. IV. Etudes sur la glande "in situ". (Daillie, J. 1967)

431 Radioautographic studies on the gonads of Acheta domesticus (L.). (Halkka, O. et al., 1966)

436 Contribution a l'étude du métabolisme des glandes sericigènes de Bombyx mori, incubées in vitro. (Prudhomme, J.C., 1966)

437 Effects of 6-azauridine on the development of the ovaries in the house fly "Musca domestica L." (Diptera). (Rezabova, B., et al., 1967)

439 Drosophila salivary glands in vitro. (Tulchin, N.W., 1966)

447 Studies on oogenesis in Drosophila melanogaster with ^{3}H-thymidine label. (Chandley, A.C., 1966)

448 H^{3}-Thymidine radioautographic study of spermatogenesis in the boll weevil, Anthonomus grandis (Coleoptera: Curculionidae). (Chang, T.-H. et al., 1967)

449 Puffing in giant chromosomes of Diptera and the mechanism of its control. (Clever, U., 1963)

450 Control of chromosome puffing. (Clever, U., 1967)

453 Oogenesis in Hyalophora cecropia. (King, R.C. et al., 1965)

538 Chromosome breakage associated with infection. II. Stained sections. (Halkka, O. et al., 1967)

887 The effect of apholate and thiotepa on nucleic acid synthesis and nucleotide ratios in housefly eggs. (Painter, R.R. et al., 1967)

928 Cytological evaluation of dose-rate effects of radiation on mutation frequency of silkworm gonia. I. Kinetics of proliferation and killing of spermatogonia during chronic irradiation. (Sado, T., 1966)

997 Studies of early effects of radiation on chromosomes and mitosis. Progress Report, March 1, 1966-February 28, 1967. (Carlson, J.G., 1967)

1725 Quantitative biophysical and cytochemical studies of polytene chromosomes. (Paul, J.S., 1966)

1.2.6. Lipids and Fatty Acids. Sterol and Steroid Metabolism

360 Allais, J.P., Barbier, M. UTILIZATION OF β-SITOSTEROL-28,29-$^{14}C_2$ BY THE LOCUST, Locusta migratoria. C.r. hebd. Séanc. Acad. Sci., D 263 (1966) 1252-1254. (In French)

Cholesterol was identified by mass spectroscopy as the major sterol present in L. migratoria. Locusts fed β-sitosterol-28,29-$^{14}C_2$ transformed this sterol very slowly and non-quantitatively into cholesterol.

The ^{14}C could not be detected in the respired CO_2 or in various volatile organic acids present in the lipids of the locust. (CA 66: 1967, 17339c)

361 Brak, J.A.W., Vonk, H.J., Daniels, F.J.A. BIOSYNTHESIS OF THE FATTY ACIDS IN ASEPTICALLY REARED LARVAE OF THE BLOWFLY Calliphora erythrocephala. Archs int. Physiol. Biochim. 74, 5 (1966) 821-829.

The incorporation of Na acetate-1-^{14}C into fatty acids by the 5-d-old larva of the blowfly (C. erythrocephala) was studied. The larva were not able to synthesise linoleic acid. The larva were capable of dehydrogenating saturated fatty acids to corresponding monoenoic acids. In the larva, the de novo synthesis and elongation system of fatty acids were operative; however, the end product of the de novo synthesis in this animal was mainly myristic acid and not palmitic acid. (CA 66: 1967, 35675p)

362 Candy, D.J. OCCURRENCE AND METABOLISM OF SCYLLOINOSITOL IN THE LOCUST. Biochem. J. 103, 3 (1967) 666-671.

A simple method for the identification of scylloinositol is described; this compound was identified as a component of locust (Schistocerca gregaria) haemolymph where it occurs in concentrations of 0.2 - 0.4 mg/ml. The same method was used to demonstrate the presence of scylloinositol in five other insect species (Locusta migratoria, Periplaneta americana, P. australasiae, Blaberus sp. and Calliphora sp.). Locust phospholipids contain myoinositol but no scylloinositol. - (0.02 ml saline containing 10 μCi of D-(U-^{14}C) glucose was injected into the thoracic haemocoel of an adult male locust 7 d after final moult. Radioactivity was incorporated into myoinositol and scylloinositol in vivo. (U-^{14}C) myoinositol was used in other experiments. Extracts of locust fat body catalyse the conversion of myoinositol into scylloinositol. This seems to take place by a 2-step process in which myoinositol is first oxidized with NAD^+ to myoinosose-2, and the myoinosose-2 is stereospecifically reduced with NADPH to scylloinositol.

363 Chino, H., Sudo, A., Harashima, K. ISOLATION OF DIGLYCERIDE-BOUND LIPOPROTEIN FROM INSECT HEMOLYMPH. Biochim. biophys. Acta 144, 1 (1967) 117-179.

The diglyceride released from insect fat body was previously found by the authors to be firmly bound to a specific haemolymph protein, to form a "diglyceride-bound lipoprotein". This protein is suggested to be the only possible means by which insects transport long-chain fatty acids from the fat body to the site of utilization. It has now been isolated, using the pupal haemolymph of the silkworm, Philosamia cynthia. (1-^{14}C) palmitic acid (5×10^5 cpm, 0.02 μM) was injected into the pupa. The palmitic acid is first incorporated into the glyceride fraction (mainly tri- and diglyceride) in the fat body, and only then is ^{14}C-diglyceride released rapidly and specifically into the haemolymph (here, $\sim 5 \times 10^4$ cpm of diglyceride for 1 ml of haemolymph). The lipoprotein was subsequently isolated, the steps being described. It is a globulin-like protein. Its precipitation depends not only on the ionic strength but also on the pH, the optimal pH for precipitation being $\sim$6.5. The lipoprotein is deep yellow, the colour representing carotenoid pigment (s). The solubility curve of the lipoprotein strongly suggests that both diglyceride and carotenoid are conjugated to a single protein.

364 Clayton, R.B., Hinkle, P.C., Smith, D.A., Edwards, A.M. THE INTESTINAL ABSORPTION OF CHOLESTEROL, ITS ESTERS AND SOME RELATED STEROLS AND ANALOGUES IN THE ROACH, Eurycotis floridana. Comp. Biochem. Physiol. 11 (1964) 333-350.

Commercially obtained 4-^{14}C-cholesterol, 4-^{14}C-Δ^4-cholesten-3-one, and 7α-^3H-cholesterol of high specific activity were purified and diluted. Other compounds were prepared from them as follows: 7α-^3H-cholestanol via 7α-^3H-cholesteryl acetate by hydrogenation; 7α-^3H-epicholestanol from 7α-^3H-cholesterol via 7α-^3H-cholestanone; 4-^{14}C-Δ^4-cholestenol from 4-^{14}C-Δ^4-cholesten-3-one; 4-^{14}C-Δ^7-cholestenol from 4-^{14}C-cholesterol via 4-^{14}C-7-dehydrocholesterol, 7α-^3H-cholesteryl methyl ether from 7α-^3H-cholesterol; 4-^{14}C-cholesteryl chloride from 4-^{14}C-cholesterol; 3α-^3H-sitosterol from B-sitosterol; and 3α-^3H-sitosterol via its digitonide. Individual insects showed considerable quantitative variability in handling sterols and sterol analogues fed to them. A differential double labelling technique has therefore been generally used, in which cholesterol and another sterol, ester or analogue, each differently labelled with ^3H or ^{14}C, are fed simultaneously to the same animal, the fate of the ingested cholesterol serving as internal standard. Specific activities of 5000 dpm ^{14}C and 20 000 dpm ^3H/mμM were used allowing an accuracy of $\pm$ 5% in

radioassay. Absorption of cholesterol from the intestinal tract of E. floridana was shown to occur predominantly in the crop but probably also in the gastric caeca. The amount absorbed is approx. proportional to the amount of cholesterol ingested over the range 0.05-500 μg. The role of esterification in the intestinal absorption of cholesterol was studied but remains incompletely defined. However, several lines of evidence suggest that esterification is not an obligatory event, though it may facilitate absorption at low dietary concentrations. Evidence is presented for the absorption of intact aliphatic cholesteryl esters from the gut. Cholestanol, cholesteryl methyl ether and cholesteryl chloride are absorbed about as efficiently as cholesterol. Δ^7-cholestenol is absorbed more efficiently, but β-sitosterol, Δ^4-cholestenol and epicholestanol are absorbed less efficiently than cholesterol. These findings are compared with those from similar studies in vertebrates.

365 Crone, H.D. TRIS BUFFER AS AN ETHANOLAMINE COMPETITOR IN THE METABOLISM OF PHOSPHATIDES. Biochem. J. 100, 1 (1966) 12P.

The calcium stimulated incorporation of (2-^{14}C)-ethanolamine and of serine into the phosphatides of the larval fat body of the house fly Musca domestica is being studied. During these investigations it was noticed that the rate of incorporation of ethanolamine was much less in tris (2-amino-2-hydroxymethylpropane-1,3-diol) buffer than in other buffers. Thus under comparable conditions at pH7.4 in 10mM-$CaCl_2$, 17 mM-tris-HCl gave a rate of 6×10^{-9} moles/h/g of larvae, 75 mM-sodium diethylbarbiturate-HCl gave 29×10^{-9} moles/h/g and 42 mM-imidazole-HCl gave a rate of 32×10^{-9} moles/h/g. Using tris buffer, an apparent K_m value for both ethanolamine and serine of 2×10^{-3} M was obtained. The incorporation of ethanolamine at two concentrations of tris buffer (13mM and 112mM) was studied. The graph of the reciprocals of velocity against ethanolamine concentration gave two straight lines intersecting at the 1/v axis, the conditions for competitive inhibition. From this plot values of 1.7×10^{-4} M for the K_m of ethanolamine, and of 1.8×10^{-3} M for the K of tris were obtained. It is apparent that the relatively high concentration of tris is competing with the ethanolamine to depress the rate of incorporation. The apparent K_m value observed for ethanolamine and serine in the tris buffer is therefore largely that of tris. (From abstr.)

366 Crone, H.D. THE CALCIUM-STIMULATED INCORPORATION OF ISOTOPIC SERINE AND ETHANOLAMINE INTO THE PHOSPHOLIPIDS OF HOUSEFLY (Musca domestica) LARVAE. Biochem. J. 102, 1 (1967) 4P-5P. "Proceedings of the Biochemical Society, Slough, England. 12 Nov. 1966".

The incorporation of (2-^{14}C)ethanolamine and L-(3-^{14}C)serine into the phospholipids in homogenates of the fat bodies of larval house flies has been studied. This incorporation is dependent on the calcium ion concentration, maximal rates being obtained at 20 mM in imidazole buffer. Mg will not replace Ca, but is not directly inhibitory. Mn, Zn, and ions at 10 mM completely inhibit incorporation. The pH optimum in veronal buffer lies between 7.25 and 8.25, beyond these points the activity falls off sharply. The incorporation is greatly reduced by 1 mM-cetyltrimethylammonium bromide and by 0.1% Triton X-100. Serine and ethanolamine both have K_m values of 2×10^{-4} M when measured in imidazole buffer with 10 mM calcium. The incorporation of the radioactive serine or ethanolamine is judged to be a direct exchange with existing nitrogenous bases on the phospholipids, rather than a reflexion of net synthesis of the lipids. This is because of the kinetics of the incorporation, which do not favour the presence of intermediates, and because the incorporation is Ca dependent, whereas the incorporation of (^{32}P) phosphorylethanolamine in the same system is stimulated by Mg and not by Ca. In the present work the results are in accord with the presence of one enzymic system exchanging ethanolamine, serine and foreign aminoalcohols with the bases of phospholipids, the precise nature of which has not been elucidated.

367 Crone, H.D. THE CALCIUM-STIMULATED INCORPORATION OF ETHANOLAMINE AND SERINE INTO THE PHOSPHOLIPIDS OF THE HOUSEFLY Musca domestica. Biochem. J. 104, 2 (1967) 695-704.

The Ca-stimulated incorporation of (2-^{14}C)ethanolamine and L-(3-^{14}C)-serine (initial specific radioactivity of 4.86 and 4.6 mCi/mM, respectively) into the phospholipids of homogenates of the fat bodies from larval house flies (M. domestica) was studied. Ethanolamine and serine acted as competitive inhibitors with one another. N-Methylethanolamine was not distinguished from ethanolamine by the system. Tris buffer was also a competitor with these compounds, and a number of other amino alcohols were inhibitory, probably competitively. (^{32}P)Phosphorylethanolamine

(initial specific radioactivity 100 mCi/mM) was prepared from ethanolamine, orthophosphoric acid and (^{32}P)orthophosphate solution. The incorporation of (^{32}P) phosphorylethanolamine into phospholipids was observed in suspensions of whole fat bodies. This incorporation was stimulated by Mg. During the incubation of the homogenates, a Ca-stimulated breakdown of phospholipids by a phospholipase A occurred. These results are compared with results published for similar mammalian systems, and their possible physiological significance is discussed.

368 Crone, H.D. THE RELATIONSHIP BETWEEN PHOSPHATIDE SERINE AND ETHANOLAMINE IN LARVAE OF THE HOUSEFLY, Musca domestica. J. Insect Physiol. 13 (1967) 81-90.

The incorporation of L-(3-^{14}C) serine into the phosphatides of M. domestica larvae was examined in vivo, and of this compound and [2-^{14}C]ethanolamine in vitro, using whole fat body preparations. Rapid incorporation, probably by an exchange reaction, was observed in both cases. Lipid serine was the direct precursor of lipid ethanolamine over the short time periods studied. Ethanolamine depressed the incorporation of serine but the reverse effect was not shown. These results are discussed in relation to current ideas of mammalian phosphatide metabolism. (Auth.)

369 D'Costa, M., Birt, L.M. THE OXIDATION OF FATTY ACIDS BY THORACIC TISSUES DURING THE DEVELOPMENT OF THE BLOWFLY Lucilia cuprina. Biochem. J. 104, 1 (1967) 11P.

Evidence shows that the developing thorax of Lucilia contains a particulate, carnitine-dependent system capable of oxidizing fatty acids, which virtually disappears at maturity. The oxidation of butyrate (25 mM) by a particulate preparation isolated from a filtered homogenate of bisected Lucilia thoraces required a 4-carbon acid (e.g. malate, 0.5 mM) and was stimulated by ATP (2mM). The rates of O_2 uptake, corrected for the endogenous respiration which itself appeared to be due to fatty acid oxidation, were 10-20 µl of O_2/mg protein/h. CoA, carnitine or serum albumin did not increase O_2 uptake; butyryl carnitine was not oxidized more rapidly than butyrate. Palmitate oxidation was stimulated by all these cofactors. There was a considerable dependence on carnitine and the O_2 uptake with palmitylcarnitine (50-80 µl of O_2/mg protein/h) was considerably greater than with any system where palmitate itself was the substrate (10-20 µl of O_2/mg protein/h). The distribution of the active particles during centrifuging in density gradients suggests that the developing sarcosomes themselves are responsible for the oxidation. As judged by $^{14}CO_2$ released from labelled fatty acids, the oxidase system appears about 2.5 d before adult emergence, reaches max. activity at about emergence, then declines to an extremely low level as the fly matures. Freezing and thawing the mitochondria from mature flies did not increase the oxidation which, therefore, does not appear to be limited by sarcosomal impermeability. Thus the oxidase system is active only during the period of adult formation. Its appearance and disappearance enables the fly to energise its thoracic development at the expense of pupal reserves of fat, which are unable to support adult flight. Conversely, the smaller reserves of carbohydrate are conserved to provide the energy for flight after emergence, a process in which carnitine may also be concerned.

370 Dutky, R.C., Robbins, W.E., Shortino, T.J., Kaplanis, J.N., Vroman, H.E. THE CONVERSION OF CHOLESTANONE TO CHOLESTANOL BY THE HOUSEFLY, Musca domestica L. J. Insect Physiol. 13, 10 (1967) 1501-1510.

Larvae of the house fly, M. domestica L., reared aseptically on a semi-defined diet failed to develop when either cholestenone, cholestanone, or cholestanol was used as the sole source of dietary steroid. However, when these three steroids were tested for 'sparing' activity (in combination with a sub-minimal quantity of cholesterol) cholestanone and cholestanol were 66 and 79%, respectively, as effective as an optimum concentration of cholesterol. Under the same conditions cholestenone showed only low biological activity (11%). Biochemical studies with 4-^{14}C-cholestanone indicate that the utilization of this steroid in the house fly larvae proceeds through its partial conversion to cholestanol. The 4-^{14}C-cholestanone used was prepared from 4-^{14}C-cholesterol by hydrogenation to cholestanol. The identity of cholestanol as a metabolite of cholestanone was established by radiotracer techniques, gas-liquid chromatographic analysis, and by isolation of crystalline cholestanol from house fly pupae reared aseptically on a semi-defined diet containing cholestanone plus a subminimal amount of cholesterol. Using reverse isotope dilution techniques, no significant conversion of ^{14}C-cholestanone to cholesterol was detected. In studies with adult insects, both males and females converted injected ^{14}C-cholestanone to cholestanol. (Essentially auth.)

371 Earle, N.W., Walker, A.B., Burks, M.L. STORAGE AND EXCRETION OF STEROIDS IN THE ADULT BOLL WEEVIL. Comp. Biochem. Physiol. 16, 3 (1965) 277-288.

Adult boll weevils (Anthonomus grandis Boh.) required about 20 mg of cholesterol/100 g of diet for sustained egg production and normal longevity. Nutritional and radiotracer experiments indicated a high rate of replacement of body cholesterol. The mean lifespan for adult weevils on sterol-deficient diets was 14 d as compared with the normal range of 55-89 d for laboratory-reared weevils. Sterol-deficient females laid almost no eggs. Significant amounts of sterol were carried over from the larval to the adult stage. A high percentage of the cholesterol in newly emerged adults was replaced within 15 d by 4-^{14}C-cholesterol given in the diet. Fat weevils contained more sterol esters than lean weevils, but about the same quantity of free sterols. (Auth.)

372 Eldefrawi, M.E., O'Brien, R.D. PERMEABILITY OF THE ABDOMINAL NERVE CORD OF THE AMERICAN COCKROACH TO FATTY ACIDS. J. Insect Physiol. 12 (1966) 1133-1142.

The following 1-^{14}C-labelled fatty acids were used in the study: acetic, propionic, butyric, valeric, hexanoic, heptanoic, and octanoic acid. The rates of influx of ^{14}C-labelled fatty acids into the abdominal nerve cord of the cockroach Periplaneta americana L. are directly correlated with their octanol/water partition coefficients. Low temperature and exposure to 2,4-dinitrophenol decrease the rate of influx slightly. It is suggested that influx of the acids into the abdominal nerve cord is due to simple diffusion facilitated by the acid's high lipid solubility and the involvement of these acids in the normal metabolism of nerve tissue. Efflux of these acids is characterized by a two-stage process with simultaneous rapid and slow phases. The fast phase is 30 times faster than the slow one. It is suggested that the rapid phase involves the efflux of a pool confined to the extracellular spaces, whereas the slow efflux is that of acids from intracellular spaces within the perineurium. The nerve sheath offers a resistance to efflux of the anions of about 13 times that which it offers to glucose. However, a much larger barrier is offered by the neuronal and glial cell membranes that regulate the movement of these acids within the cord.

373 Gilbert, L.I. LIPID METABOLISM AND FUNCTION IN INSECTS. p. 69-211 of "Advances in Insect Physiology. Vol.4". London, Academic Press, 1967, 415p.

Very comprehensive review of the field. A classification of lipids is given, and the lipid content of various insect species tabulated in terms of stage and % lipid. Alterations during metamorphosis, and the nature of insect lipids is discussed. The remaining article is divided into sections on lipid utilization (digestion and absorption, lipid release and transport, extra-digestive lipases, fatty acid catabolism); lipid biosynthesis (general mechanism of fatty acid synthesis, fatty acid biosynthesis in insects, phospholipid and triglyceride, fatty acids in nutrition, substrate interconversion); hydrocarbons and waxes (cuticle, and extra-cuticular); and isoprenoid compounds (nutritional studies, isoprenoid biosynthesis content, sterol modification, function, and insect hormones). - Throughout the text, a large number of supporting studies are quoted in which radioisotopes have been used (which are also mentioned specifically). Some unpublished observations by the author, based on radioisotope studies, are cited in the text. - An extensive bibliography is appended.

374 Gilbert, L.I. CHANGES IN LIPID CONTENT DURING THE REPRODUCTIVE CYCLE OF Leucophaea maderae AND EFFECTS OF THE JUVENILE HORMONE ON LIPID METABOLISM IN VITRO.

Lipid is stored in both the ovaries and fat body of female L. maderae during the 20 d period of oogenesis and is a major substrate for the developing embryos during the ensuing two months of embryogenesis. The lipid picture for the period of embryogenesis is characterized by a decreasing content of embryonic triglyceride and an increasing proportion of phospholipid. Both the fat body and ovaries (maturing oocytes) are capable of incorporating labelled palmitate into glyceride and phospholipid. In vitro studies demonstrated the transfer of labelled lipid from the fat body of ovaries and it is likely that this takes place in vivo as well. The metabolic activity of the fat body is influenced by the stage of the reproductive cycle, particularly in reference to lipid metabolism. In vitro studies with active corpora allata suggest that one reason the juvenile (gonadotropic) hormone is indispensable for oocyte maturation is its ability to enhance lipid synthesis in the ovary (maturing oocytes) during oogenesis. These studies suggest that the juvenile hormone may act to depress the lipid synthetic ability of the fat body at this stage and thus make more substrate available to the developing oocytes. (CA 66: 1967, 113448h)

375 Goodfellow, R.D. THE BIOCHEMISTRY AND METABOLISM OF STEROLS AND ISOPRENOIDS IN THE METAMORPHOSIS OF THE AMERICAN SILKMOTH, Hyalophora cecropia (L.). Diss. Abstr. 27 (1966) 2543-B - 2544-B.

The metabolism of sterols was analysed by using radioactive mevalonic acid, plant sterols, and cholesterol. Cholesterol, β-sitosterol, and campesterol were identified as the sterols of Cecropia during metamorphosis. Cholesterol is the major sterol at all stages of the life history investigated in this study. The quantity of cholesterol increases from the larva to the adult with a concomitant decrease in the relative amount of the other sterols. This increase continues in the male until senility but there is a marked decrease in the cholesterol level of the female after oviposition. Cholesterol is the major sterol of the eggs. There is no significant biosynthesis of cholesterol or squalene from ^{14}C-mevalonate. Box elder leaves, the food plant of H. cecropia, contain no cholesterol. They do contain campesterol and β-sitosterol, and thus supply the organism with these plant sterols. It was determined that Cecropia dealkylates the plant sterols to produce cholesterol. This conversion process is active at all stages of the life cycle. A small amount of sterol in Cecropia is esterified with preponderantly unsaturated long-chain fatty acids. The quantity of unsaturated fatty acids as esters of cholesterol is higher than the quantity of these same fatty acids in the neutral lipid of this organism. The utilization of cholesterol in Cecropia was determined by tracing the metabolic fate of injected cholesterol-4-^{14}C. The greater part of this cholesterol remains unchanged. The major portion of the free cholesterol in the thoracic muscle was associated with cellular membranes and other particulate fractions. The role of cholesterol in thoracic muscle was interpreted to mean a utilization of cholesterol as a unit of the cellular membranes of all cells of this organism. Support for the role of cholesterol as a unit of cell structure is suggested, also, by the constant quantity of sterol throughout the pupal-adult transformation. Large amounts of free sterol were also associated with the nervous system. This cholesterol may be associated with myelin membranes. The "polar steroids" of Cecropia derived from cholesterol are an index of the oxidative metabolism of steroids. "Polar steroids" are ubiquitous in Cecropia, with a higher concentration of "polar steroids" in the intestine and lumen contents. Also many of these "polar steroids" may be metabolites in the production of insect hormones like ecdysone, ecdysone itself, of other steroidal hormones of unidentified nature. None of these categories of "polar steroids" in Cecropia are mutually exclusive and all may form a part of the "polar steroid" pool of metamorphosing animals. 98% of the cholesterol and "polar steroids" in the haemolymph are bound to protein. The higher levels of cholesterol in the haemolymph than the tissues suggests mobilization of sterol as a part of adult development. The high titers of cholesterol in the haemolymph are cogent evidence against the role of cholesterol as the active principle of the prothoracic gland stimulating hormone. The binding of "polar steroids" to specific haemolymph protein acceptors may be involved in hormone transport. Other isoprenoids do occur in Cecropia and the major are trans-nerolidol, trans-trans farnesol, geraniol and the 20 carbon analogues of nerolidol. Their quantitative changes during pupal-adult transformation are not great enough to account for the increase in juvenile hormone activity in the adult male moth. Experiments in which the corpora allata, the source of the juvenile hormone, were extirpated demonstrated no significant difference in the isoprenols in these moths and those of normal moths. The column chromatographic fraction containing these compounds incorporated 75% of the count of mevalonate-^{14}C in the non-saponifiable lipid. Very small amounts of pyrophosphate esters of these compounds were found in Cecropia lipids. The low levels of the pyrophosphate compounds may be due to in vivo dephosphorylating enzyme systems. Also, extremely small amounts of ^{14}C label were associated with the acids of Cecropia lipids but these were not identified as any of the isoprenoic acids found in other organisms. (From DA)

376 Happ, G.M., Meinwald, J. BIOSYNTHESIS OF MONOTERPENES IN AN ANT. Adv. Chem. Ser. 53 (1966) 27-33.

Terpenoid substances are of broad distribution and diverse function in insects. One set, elaborated by the mandibular glands of Acanthomyops claviger, acts both as a defensive secretion and as an alarm releaser. When fed ^{14}C-labelled acetate or mevalonate, laboratory colonies of these ants produce radioactive citronellal and citral, providing unambiguous evidence for de novo synthesis of these terpenes by the ant. The incorporations of these precursors implicate the mevalonic acid pathway as the likely biosynthetic route. (CA 65: 1966, 5935h)

377 Ikekawa, N., Suzaki, M., Kobayashi, M., Tsuda, K. STEROLS OF Bombyx mori. IV. STEROL CONVERSION IN THE SILKWORM. Chem. pharm. Bull., Tokyo 14, 8 (1966) 834-836.

Dietary β-sitosterol-^{3}H was incorporated by B. mori larvae into cholesterol. Radioactivity was also incorporated into the cholesterol of the free fraction, but was not found in the sterol ester fraction, in the pupa. Larval cholesterol therefore originates from the β-sitosterol of the mulberry leaf, and sterol metabolism in the pupa differs from that in the larva. (CA 65: 1966, 17437b)

378 Keith, A.D. FATTY ACID METABOLISM IN D. melanogaster: FORMATION OF PALMITOLEATE. Life Sci. 6, 2, Pt.2 (1967) 213-218.

The presence of dietary linoleate (I) drastically altered the relative proportions of palmitate (II) and palmitoleate (III) in D. melanogaster. The addition of dietary II in the presence of dietary I only slightly elevated the relative proportion of III. Therefore, I prevented the enzymic desaturation of II. The uptake of labelled acetate into III was relatively unchanged by dietary I, although the uptake of label into II was somewhat reduced. The extent to which II-^{14}C was desaturated, however, was highly dependent on dietary I. The presence of I almost completely inhibited the desaturation of II. When both acetate-^{3}H and II-1-^{14}C were added simultaneously in the normal diet, ^{3}H from acetate and ^{14}C from II were both found in III in about the same proportions. Simultaneous labelling in the presence of I resulted in the incorporation of labelled II, but only 2.45% of II was converted into III, while the label from acetate which appeared in III was undisturbed. Therefore, D. melanogaster has two ways of producing III: a de novo route which is undisturbed by dietary I, and the direct desaturation of pre-existing II which is inhibited by dietary I. (CA 66: 1967, 62940c)

379 Keith, A.D., Gauslaa, G., Anderson, B.S. IN VITRO BIOSYNTHESIS OF FATTY ACIDS IN Drosophila melanogaster. Lipids 2, 5 (1967) 429-431.

A new in vitro technique, utilizing ruptured larvae of D. melanogaster, was employed to study the incorporation of acetate-^{3}H into long-chain fatty acids. Preparative gas-liquid chromatography and scintillation spectroscopy were used to determine the relative activity of each fatty acid from total lipid extracts. Quantitative changes were observed in the distribution of label during the course of the incubation times, which ranged from 5 min to 9 h. All fatty acids which incorporated acetate in previous in vivo studies also showed incorporation of label under these in vitro conditions. It is concluded that this system may be useful for studying aspects of insect metabolism for short intervals of time. (CA 67: 1967, 88627b)

380 Khan, M.A.Q., Hodgson, E. PHOSPHOLIPIDS OF SUBCELLULAR FRACTIONS FROM THE HOUSEFLY, Musca domestica L. J. Insect Physiol. 13 (1967) 653-664.

The phospholipids of subcellular fractions from the house fly, Musca domestica L., were studied. In the first series of experiments adult flies were fed on sucrose cubes and water for 2 d after emergence. In the second series, 1 mCi of $H_3{}^{32}PO_4$ was added to the water. The analyses show that there are variations in the distribution of some phospholipids among these fractions. The most unusual is the microsomal fraction which contains only 36% phosphatidylethanolamine whereas the other fractions contain 50 to 59% of this phosphatide. The microsomal fraction also differs from other fractions in its higher content of phosphatidylcholine, lysophosphatidylethanolamine, and ethanolamine sphingolipid. Mitochondria contain 5% cardiolipin, whereas the microsome and residue fractions contain 4 and 3% respectively. The supernatant fraction contains only 7% of the total phospholipids, most of this being in the form of phosphatidylethanolamine.

381 Kinsella, J.E., Smyth, T. LIPID METABOLISM OF Periplaneta americana L. DURING EMBRYOGENESIS. Comp. Biochem. Physiol. 17, 1 (1966) 237-244.

The weight of the oothecae of the P. americana decreased by 25% during embryogenesis; 17% of this was due to water loss and the remainder was due to lipid catabolism. Chromatographic analysis revealed that a decrease in the neutral lipids, exclusively the triglyceride fraction, accounted for the major loss in dry matter of the eggs. A sharp increase in monoglycerides and diglycerides during nymphal emergence indicated that intense hydrolysis of triglycerides was occurring. The very high neutral lipid content of the ootheca is consistent with its function of energy storage in the egg. Thus, the American cockroach, like other oviparous animals, metabolise lipid material as its principal source of respiratory energy. (CA 64: 1966, 11606h)

382 Lasser, N.L. THE FUNCTION OF STEROLS IN INSECTS. Diss. Abstr. 27, 6 (1966) 1781-B-1782-B.

In the hide beetle, Dermestes vulpinus, over 90% of the cholesterol supplement can be replaced by a sparing sterol. The present work was undertaken to investigate possible sterol transformations in Dermestes and to extend the studies of Clayton on intracellular sterol distribution and sterol turnover in Eurycotis. It was found by gas chromatographic analysis that neither cholesterol nor eight other sterols undergo any appreciable molecular transformation in Dermestes. The beetle does, however, selectively concentrate cholesterol from a diet also containing large amounts of sparing sterol; the degree of this selectivity varies with the nature of the sparing sterol. The histological effects of sterol deprivation were studied in Eurycotis. The effects, seen in every tissue, are non-specific and could be related to aging. The distribution and turnover of radioactive sterols were studied in aseptic Eurycotis reared from time of hatching on 0.005% cholesterol-^{14}C and 0.1% cholestanol-^{3}H. Cholestanol is in part converted to Δ^7-cholestenol. The studies with whole tissue of Eurycotis showed that cholesterol is preferentially accumulated in most tissues and remains almost entirely unesterified. On the other hand, sparing sterols are esterified to a varying degree. The proportion of Δ^7-cholestenol found also varies from tissue to tissue. In fat body it constitutes over 80% of the esterified sterol, but no other pattern suggestive of definite functional significance is discernible. Cholesterol is displaced slowly if at all in most tissues, while non-esterified cholestanol turns over at a considerably greater rate. The displacement is accompanied by a shift of sterols from the unesterified to the esterified pool and from other tissues to the fat body, where much of the ester formed is apparently stored during growth. In insects grown on a diet containing both cholesterol and cholestanol intracellular sterol distribution was examined by autoradiography and subcellular fractionation. The fractions were characterized by their light and electron microscopic appearance and by their content of DNA, RNA, protein, succinic dehydrogenase, and lipid phosphorus. Autoradiography shows both sterols to be primarily cytoplasmic and in some instances localized in membranous structures. Satisfactory subcellular fractions were obtained from muscle, nerve, and salivary gland. Free sterol is found primarily in mitochondria and microsomes, the fractions also richest in sterol per mg. of protein. Sterol ester is apparently distributed randomly but probably originates from the depot fat in all the tissues. The free sterols are present in a relatively constant ratio to each other throughout the cell. A purified nuclear preparation from salivary gland contains 5% of the cell's free sterol, and all the free sterol of microsomes is in the membranous portion prepared by RNAase treatment. It is concluded that free sterols are incorporated as components of all the cellular membrane systems in insect tissues. There are probably at least two functionally characteristic spaces common to all membranes, one space being structurally more specific and more inert than the other. Sterol ratios, constant in a single tissue, vary among the different tissues, and the variation may reflect functional differences among the membranes of these tissues. (From DA)

383 Lasser, N.L., Edwards, A.M., Clayton, R.B. DISTRIBUTION AND DYNAMIC STATE OF STEROLS AND STEROIDS IN THE TISSUES OF AN INSECT, THE ROACH Eurycotis floridana. J. Lipid Res. 7, 3 (1966) 403-412.

The insects were reared aseptically from the time of hatching on a semi-synthetic diet containing sterols of known activity. The diets contained either an optimal concentration (0.1%) of cholesterol-4-^{14}C as the sole sterol, or a minimal concentration of 0.005% cholesterol-4-^{14}C supplemented with 0.1% cholestanol-7α-^{3}H. Other radioactive sterols used were cholesterol-26-^{14}C, cholesterol-3α-^{3}H and cholesterol-7α-^{3}H. In some experiments the insects received the same diet throughout the experimental period; in others they were given a diet containing a different sterol or combination of sterols during a later phase of the experiment. Data are presented in tabulated form on 1) concentration of steroids in tissues of E. floridana reared on diets containing different concentrations of cholesterol; 2) chromatographic fractionation of steroids in tissues of roach reared on diets containing different sterols; 3) displacement of cholesterol from tissues by cholestanol; 4) turnover of steroids in tissues during growth while receiving a diet containing 0.005% cholesterol and 0.1% cholestanol; 5) tissue steroid turnover on a diet containing 5% cholesterol. When the insect was reared on the mixed sterol diet, the cholesterol became concentrated in most tissues in preference to cholestanol. The extent of this preferential incorporation of cholesterol varies from tissue to tissue but is most marked in the nerve, where the two sterols are present in approx. equal amounts. The sum of the concentration of ^{14}C- and ^{3}H-labelled sterols found in almost all the tissues of animals fed the mixed sterol diet is remarkably close to that found in animals reared on 0.1% cholesterol alone. The concentrations of sterols found in the tissues of E. floridana are generally

higher than reported for Periplaneta americana. Cholesterol would appear to fulfil similar functions in both mammalian and insect tissues.

384 Deleted.

385 Mayer, R.J., Candy, D.J. CHANGES IN HEMOLYMPH LIPOPROTEINS DURING LOCUST FLIGHT. Nature, Lond. 215 (1967) 987.

Electrophoresis of haemolymph from resting locusts and from those flown for 2 h was carried out on cellulose acetate using 0.05M Na glycinate buffer at pH 9.8. In the resting haemolymph, 2 of the 8 bands contained lipid; after being flown for 2 h, 4 bands contained lipid and the total lipid content was increased 2.5-fold. Experiments were also carried out with palmitate-^{14}C. A 3-fold increase in lipids was found and thin-layer chromatograph showed that the increase was almost entirely in the diglyceride fraction, the triglycerides remaining essentially constant. (CA 67: 1967, 114625w)

386 Mehendale, H.M., Dauterman, W.C., Hodgson, E. PHOSPHATIDYL CARNITINE: A POSSIBLE INTERMEDIATE IN THE BIOSYNTHESIS OF PHOSPHATIDYL β-METHYLCHOLINE IN Phormia regina (Meigen). Nature, Lond. 211 (1966) 759-761.

Carnitine can replace dietary choline when P. regina larvae are reared on a chemically defined diet, when β-methylcholine almost complete replaces choline in the lecithin of the larva. Carnitine labelled with ^{14}C in the methyl groups was used. P. regina larvae were grown in axenic culture on a chemically defined diet. Chromatograms of the hydrolysate of the whole lipid extract of larvae fed ^{14}C-DL-carnitine showed only 1 radioactive spot corresponding to β-methylcholine. When ^{14}C-carnitine and TMAA (trimethyl-(3-hydroxypropyl) ammonium acetate) are fed, however, two radioactive compounds, β-methylcholine and carnitine, can be found. Carnitine appears to be incorporated into a lipid-soluble compound before decarboxylation to the β-methylcholine of phosphatidyl β-methylcholine, the compound apparently being phosphatidyl carnitine. The inhibitor, TMAA, causes this lipid-soluble carnitine derivative to accumulate to the point where detection is possible. The fact that TMAA is incorporated into a phospholipid may be of importance in elucidating the mechanism of its inhibitory action.

387 Mehrotra, K.N., Sethi, G.R., Bhamburkar, M.W. PHOSPHOLIPIDS IN THE HEMOLYMPH OF DESERT LOCUST, Schistocerca gregaria. Indian J. Ent. 28, 4 (1966) 468-476.

The presence of phospholipids in the haemolymph of the desert locust, S. gregaria, was demonstrated by using ^{32}P labelling and thin-layer chromatography. The phospholipid concentration was 1.8 mg/ml. The results of chromatographic separation and of various hydrolyses performed on different fractions indicated that phosphatidylcholine (40%) was most abundant, that the ratio of phosphatidylethanolamine to phosphatidylcholine was 1:3, and that sphingomyelin was present. It was possible to differentiate insects into three major types depending on their phospholipid composition: insects in which phosphatidylethanolamine is the major phospholipid (house flies and blowflies); insects in which phosphatidylcholine is the major phospholipid (S. gregaria, Periplaneta americana, and Blattella germanica); and insects in which sphingomyelin is present (A(edes) aegypti and S. gregaria). Faster phospholipid turnover has been implicated in the house fly resistance to dieldrin. High phospholipid turnover may reflect a modification in membrane permeability in resistant strains. (CA 67: 1967, 114623u).

388 Meinwald, J., Happ, G.M., Labows, J., Eisner, T. CYCLOPENTANOID TERPENE BIOSYNTHESIS IN A PHASMID INSECT AND IN CATMINT. Science, N.Y. 151 (1966) 79-80.

The stick insect, Anisomorpha buprestoides, and the catmint, Nepeta cataria, produce closely related cyclopentanoid terpenes, anisomorphal and nepetalactone. Tracer experiments with isotopes* indicate that anisomorphal is synthesised by the walking stick from normal terpene precursors (acetate or mevalonate). In the catmint plant, isolated leaf disks synthesised nepetalactone, utilizing the same precursors. (Auth.)

* ^{14}C-mevalonate and sodium acetate-2-^{14}C.

389 Mezei, C., Newburgh, R.W. THE FORMATION OF LIPID-BOUND CARNITINE DERIVATIVES IN THE FAT BODY OF Phormia regina. J. Insect Physiol. 13, 9 (1967) 1489-1499.

DL-(Methyl-^{14}C)-carnitine, DL-(carboxy-^{14}C)-carnitine, (1,2,-^{14}C)-choline were obtained from Tracerlab; DL-(methyl-^{14}C)-palmityl-carnitine and DL-(N-methyl-^{14}C)-β-methylcholine chloride were synthesised, using (^{14}C)-methyliodide in the case of the chloride. Carnitine is incorporated into a phosphatide as β-methylcholine in several insects. The object of this investigation was to further elucidate the mechanism involved. Cell-free fat-body preparations of P. regina larvae catalyse the formation of acyl-carnitines, and this reaction is inhibited by CoA, γ-butyrobetaine, and trimethylamino-propane-1-ol. A minor lipid component was also isolated and this behaved in several tests similar to a phosphatide. In vivo the major carnitine derivative is phosphatidyl-methylcholine whereas in vitro preparations of fat body favour enzymic pathways leading to the formation of long-chain acyl-carnitine derivatives.

OMISSION. Reference should here be made to 466, erroneously listed in the wrong context.

466 Monroe, R. E., Hopkins, T.L., Valder, S.A. METABOLISM AND UTILIZATION OF CHOLESTEROL-4-C^{14} FOR GROWTH AND REPRODUCTION OF ASEPTICALLY REARED HOUSEFLIES, Musca domestia L.

390 Przelecka, A., Dutkowski, A. AUTORADIOGRAPHIC INVESTIGATION OF INCORPORATION OF FATTY ACIDS INTO THE LIPIDS OF INSECT OVARIOLES. Bull. Acad. pol. Sci. Cl. II Sér. Sci. biol. 13, 10 (1965) 573-575.

Isolated ovaries of Galleria mellonella and of Carausius morosus were incubated at 30°C in insect physiological saline supplemented with sodium ^{14}C-palmitate (5 μCi/0.21 μM/ml) for 30 min. Fixation and embedding procedures are described. Lipids were extracted in some experiments. It would appear that the radioactivity detected in the follicular vesicles was not due to labelled free palmitate but to lipids into which the fatty acid had been incorporated. The presence of ^{14}C was demonstrated not only in free fatty acids but also in mono-, di-, and tri-glycerides in cholesterol esters and in some unidentified compounds, detected approximately at the cholesterol level. The presence of ^{14}C was detected in lysolecithin, lecithin, ethanolamine phosphatides and in phosphatidic acids. Tissue autoradiography may allow the detection of biosynthesis of lipids from fatty acids as precursors and localization of the newly formed lipids within the cell.

391 Przelecka, A. INCORPORATION OF 14-C-SODIUM PALMITATE INTO LIPIDS AND CELL INTERACTION IN OVARIOLES OF Galleria mellonella (LEPIDOPTERA). Ann. Histochim. 11, 4 (1966) 403-411. (In English)

Incorporation of ^{14}C-sodium palmitate into lipids followed by means of autoradiography has been found to occur in the follicular vesicle of G. mellonella, chiefly in the trophic cells. These cells seem to provide the oocyte with newly synthesised lipids. The follicular epithelium cells appear to be more active in this process than the trophocytes. (Auth. summary)

392 Rajalakshmi, S.S., Sarma, D.S.R., Sarma, P.S. CHOLESTERIN METABOLISM IN Corcyra cephalonica. Indian J. exp. Biol. 1 (1963) 186-189.

It is known that all insects depend on an exogenous supply of sterin. In the case of C. cephalonica, growth of larval tissue is inhibited when γ-hexachlorocyclohexane (I) is added, together with an enrichment in cholesterin (II). Experiments were carried out with compounds known to reduce the cholesterin content in higher organisms. Nicotinic acid, nicotinamide, sitosterin, stigmasterin, ^{14}C-ergosterin, and rice-bran oil were tested. In experiments to raise eggs of the insect on wheat flour ^{14}C-sodium acetate or $^{14}C_2$-mevalonic acid were added, to elucidate whether larval tissue was able to synthesise II. The results indicate that the effect due to I can only be caused by meso-inosit but not by any of the other compounds tested. The inability of larval tissue to synthesise II was demonstrated but ergosterine was seen to be transformed to II. The structural similarity (metabolite, antimetabolite) between inosit and I is discussed on hand of the supporting literature.

393 Ritter, F.J., Wientjens, W.H.J.M. STEROL METABOLISM OF INSECTS. T.N.O. Nieuws 22, 10 (1967) 381-392.

A review is given of the present knowledge of sterol metabolism in insects including sterol requirements, biosynthesis of Δ^7 sterols, the occurrence of ecdysone and other steroid hormones, in plants, and use of the knowledge of sterol metabolism in developing selective insecticides. Results of unreported exper-

iments are given on the conversion of C_{28} and C_{29} sterols into C_{27} sterols by Blattella germanica. (CA 68: 1968, 66735d)

394 Robbins, W.E., Thompson, M.J., Kaplanis, J.N., Shortino, T.J. CONVERSION OF CHOLESTEROL TO 7-DEHYDROCHOLESTEROL IN ASEPTICALLY REARED GERMAN COCKROACHES. Steroids 4 (1964) 635-644.

Blattella germanica were maintained aseptically on a semidefined diet containing 0.1% of 4-^{14}C-cholesterol for periods of from 36-56 d. The cholesterol used in the diet had a specific activity of 2.08×10^5cpm and a radiochemical purity of 99%. The previously reported conversion of cholesterol to 7-dehydrocholesterol by non-aseptically reared German cockroaches has been confirmed using aseptically reared insects. The identity of the 7-dehydrocholesterol was established by u.v. and infrared spectroscopy and gas-liquid chromatographic analyses of the free sterol and/or derivatives. This metabolic pathway for cholesterol in the German cockroach is discussed.

395 Saito-Suzuki, M., Ikekawa, N., Kobayashi, M. STUDIES ON THE STEROL OF Bombyx mori L. III. FAT AND DISTRIBUTION OF 4-^{14}C-CHOLESTEROL IN THE SILKWORM. Appl. Ent. Zool. 1, 1 (1966) 37-40.

The present study was carried out to elucidate a contribution of the pupal brain to sterol metabolism, observing the fate and the distribution of 4-^{14}C-cholesterol* in both normal and dauer pupae of the silkworm, B. mori. After the injection of labelled cholesterol into the normal and the dauer pupae, the blood, several tissues, and remainder were dissected out from these pupae on 1 d after injection, 7 d and 1 d before emergence. Methanol extract was refluxed with ether, following each sample's extraction with methanol. The radioactivity of both the sterol ester and the free sterol fractions separated from the ether extract was counted. The incorporation of the labelled cholesterol into several tissues and the blood did not show any remarkable difference between the normal and the dauer pupae. In the former, however, a large amount of cholesterol was demonstrated as ester form, while in the latter, free sterol was observed. Furthermore, the rate of esterification in dauer pupa sterol was slower than that of normal pupa, suggesting that unknown factor originating from brain had an intimate relation to sterol metabolism. (Auth.)

*1 μCi (15.7 μg) dissolved in 0.015 ml of olive oil.

396 Schmidt, G.H. THE BIOCHEMISTRY OF INSECT STEROLS AND REVIEW OF LITERATURE. Fette, Seifen, Anstr.-Mittel 68, 10 (1966) 811-816. (In German)

Not all arthropods are able to synthesise sterines from C_2-elements. On the other hand, insect cells contain cholesterin as structural element, associated with phospholipid-protein complexes. Sterines are essential for normal growth. The article reviews insect sterines, sterines in nutrition and their utilization, sterine requirements, sterine deposits stored in adipose tissue, the biosynthesis of sterines, sterines in metabolism, steroid hormones, and immunophysiological effects. Radioisotopes had been used in a considerable number of the studies cited.

397 Sridhara, S., Ravi Rao, U., Bhat, J.V. METABOLISM OF SATURATED 1-^{14}C-LABELLED FATTY ACIDS IN THE SILKWORM, Bombyx mori. Biochem. J. 98, 1 (1966) 260-265.

Only a small percentage of 1-^{14}C-labelled saturated fatty acids injected in the silkworm is respired as CO_2. The rate of utilization of fatty acids is low both at the larval and pupal stages. The insect has the ability to elongate C_{12} and C_{16} saturated fatty acids and to desaturate C_{18} saturated fatty acids. Much of the administered radioactivity is found in the triglyceride fraction, followed by the phospholipid and diglyceride fractions. Diglycerides seem to be the transport form of fatty acids. The insect seems to handle both natural and unnatural fatty acids in the same manner. (CA 64: 1966, 8686c)

398 Sun, G.Y.C. NEUTRAL LIPID METABOLISM IN THE FAT BODY OF THE LARVA OF THE FLESHFLY, Sarcophaga bullata. Diss. Abstr. 28, 2 (1967) 483-B – 484-B.

The weight of the larva, the fat body as well as its lipid content were examined in relationship to the growth of the larva. The average larva attained max. body weight of about 220 mg in 70 h. Fat body lipid continued to increase in weight after the feeding stage of the larva during which time there

was a small decrease in total larval wet weight. The fat body lipid comprised mainly of the neutral lipid and triglyceride formed the major portion of the neutral lipid. Approx. 60% of the total fatty acids analysed was found to be unsaturated and an increase in unsaturated fatty acid content was found in the fat body of the 9-d-old larvae. The major portion of fatty acids in the fat body as analysed by gas liquid chromatography were palmitic, palmitoleic, stearic, oleic and linoleic acids. A very small amount of acetate-1-^{14}C was incorporated into the fat body lipid. Palmitate-1-^{14}C, on the other hand, was more extensively incorporated. Most of the radioactivity which was incorporated into the neutral lipid was present in the three glyceride fractions, of which the diglycerides showed the highest specific activity. It is suggested that diglyceride could play an important role in lipid transport in the insect system. A very rapid uptake of palmitate-1-^{14}C into fat body was observed in the first 30 min of incubation. Comparison of palmitate-1-^{14}C incorporation between the 3-d- and 7-d-old larvae showed that larvae at their prepupal stage were still able to incorporate long-chain fatty acids but to a somewhat lesser extent. Fatty acids of neutral lipid were separated into saturated and unsaturated components on thin-layer plates. After incubation of fat body of 3-d-old larvae with palmitate-1-^{14}C, the ratio of the distribution of the label between unsaturated and saturated fat was ~60-40, achieved within 10 min of incubation. In 7-d-old larvae, most of the label was found in the saturated fraction. (Based on DA)

399 Svoboda, J.A., Thompson, M.J., Robbins, W.E. DESMOSTEROL, AN INTERMEDIATE IN DEALKYLATION OF β-SITOSTEROL IN THE TOBACCO HORNWORM. Life Sci. 6, 4 (1967) 395-404.

β-Sitosterol-^{3}H fed to tobacco hornworm (Manduca sexta) was converted to desmosterol (cholesta-5,24-dien-3β-ol) (I) and desmosterol acetate. Even when the digestive tract was bypassed by injecting β-sitosterol into the anal horn, considerable dealkylation occurred. M. sexta also metabolised 90% of the ^{14}C-labelled I administered in the diet to cholesterol (II), but none of the II administered via the diet could be metabolised to I. It appears that I must be the terminal intermediate in dealkylation before the formation of II in M. sexta. (CA 66: 1967, 74638m)

400 Svoboda, J.A., Robbins, W.E. CONVERSION OF BETA SITOSTEROL TO CHOLESTEROL BLOCKED IN AN INSECT BY HYPOCHOLESTEROLEMIC AGENTS. Science, N.Y. 156 (1967) 1637-1638.

Two vertebrate hypocholesterolemic agents (triparanol and 22,25-diazacholesterol) block the conversion of β-sitosterol to cholesterol in the larva of the tobacco hornworm, Manduca sexta (Johannson). A primary site of inhibitory action is the terminal step in this conversion – the reduction of desmosterol (24-dehydrocholesterol) to cholesterol. * This is also the site at which these compounds inhibit de novo cholesterol biosynthesis in higher animals. Both agents severely inhibit growth and maturation of the tobacco hornworm. (Auth.)

---

* The Δ^{24}-sterol reductase in gut tissue normally converts ^{14}C-desmosterol to ^{14}C-cholesterol.

401 Thomas, K.K., Gilbert, L.I. IN VITRO STUDIES ON THE RELEASE AND TRANSPORT OF PHOSPHOLIPIDS. J. Insect Physiol. 13, 6 (1967) 963-980.

When incubated in vitro, fat body from several developmental stages of the silkmoth, Hyalophora cecropia, and from the cockroaches, Leucophaea maderae and Periplaneta americana, has the ability to incorporate labelled precursors into phospholipid. Palmitate-1-^{14}C as the Na salt, albumin complex, or ethanolamine-^{14}C, glycerol-^{14}C, or ^{32}P-disodium phosphate were used as labelled substrates. When this 'prelabelled fat body' is reincubated in unlabelled medium containing haemolymph, radioactive phospholipids are released into the incubation medium. Flight muscle placed into an incubation medium containing radioactive phospholipids is capable of incorporating some of this phospholipid into flight muscle phospholipid. The majority of the labelled phospholipid released from the prelabelled fat body consists of phosphatidylcholine, phosphatidylethanolamine, and phosphatidylserine. Electrophoretic analysis of the haemolymph containing incubation medium revealed that phospholipids released from the fat body were conjugated to specific haemolymph proteins. One of these lipoproteins is thought to be analogous to the high-density lipoproteins of mammalian blood. In vivo labelling of the fat body was effected by injecting ^{32}P-disodium phosphate. The release of phospholipids from the fat body was similar to the results obtained in vitro. The study suggests that insect fat body has the capacity to synthesise phospholipids from simple precursors and release this phospholipid into the haemolymph from where it is transported in the form of lipoprotein.

402 Thomas, K.K., Gilbert, L.I. PHOSPHOLIPID SYNTHESIS DURING FLIGHT MUSCLE DEVELOPMENT IN THE AMERICAN SILKMOTH, Hyalophora cecropia. Comp. Biochem. Physiol. 21, 2 (1967) 279-290.

The major phospholipid fractions of the flight muscle and sarcosomes are phosphatidylcholine and phosphatidylethanolamine. The cardiolipin fraction increases from 1.3 - 11.8% of the lipid P of the flight muscle during muscle maturation. Unsaturated fatty acids predominate in the various flight muscle phospholipids with linolenic acid comprising about 70% of the total fatty acids in the cardiolipin fraction. The phospholipid composition of the moth sarcosomes more closely approximates that of beef heart mitochondria than that of house fly flight muscle sarcosomes. Radioisotope and chemical studies indicate the synthesis of phospholipids during adult development of H. cecropia. (CA 66: 1967, 113416w)

403 Tietz, A. FAT SYNTHESIS IN CELL-FREE PREPARATIONS OF THE LOCUST FAT-BODY. J. Lipid Res. 2, 2 (1961) 182-187.

It was shown that cell-free preparations of the fat body of the migratory locust, Locusta migratoria, incorporated acetate into fatty acids in the presence of ATP, CoA, glutathione, Mg^{++}, TPN, malonate, α-ketoglutarate, and $KHCO_3$. The major fatty acid component synthesised was palmitic acid. The newly synthesised acids were esterified by the system with glycerol as glycerides and phospholipids. Mitochondria were not required for synthesis. Fat body homogenates could also activate and decarboxylate malonate and form malonic acid by CO_2 fixation. In the enzymatic assays, acetate-1-^{14}C was used (incubated with cofactors and enzyme). At a later state, the decarboxylation of malonate-1-^{14}C and malonate-2-^{14}C was measured. To determine optimal conditions for fatty acid synthesis from acetate by fat body homogenates the latter were incubated with acetate-1-^{14}C in the presence of different substrates and cofactors, and the recovery of ^{14}C in fatty acids was estimated. To study the effect of CO_2 on fatty acid synthesis, $^{14}CO_2$ fixation by fat body homogenates was investigated. The effect of malonate on fatty acid synthesis was studied via the metabolism of malonate by fat body preparations, use being made of malonate-1-^{14}C.

(See also II/402)

404 Tietz, A. FAT TRANSPORT IN THE LOCUST: THE ROLE OF DIGLYCERIDES. Europ. J. Biochem. 2 (1967) 236-242.

An analysis of the lipids of the fat body of Locusta migratoria showed that approx. 97% are triglycerides and 2-3% diglycerides; free fatty acids and phospholipids were present only in small amounts. In the haemolymph, diglycerides and phospholipids were the major lipid components; free fatty acids were present in very small amounts, triglycerides were absent. The concentration of the diglycerides in the haemolymph was found to increase with the age of the locust and during sustained flight; the phospholipids remained constant. The concentration of the free fatty acids in the tissue and haemolymph was also increased during flight. When fat body tissue was incubated in vitro with (1-^{14}C)-palmitate, the acid was incorporated into the di- and triglycerides of the tissue. The specific activity of the diglycerides was at least 50 times higher than that of the triglycerides. When prelabelled tissue was transferred into a medium containing haemolymph, diglycerides were released into the medium. The amount of diglyceride released was dependent on the time of incubation and on the amount of haemolymph which was added to the medium. Although the amount of diglycerides which was released, was greater than their concentration in the tissue, the amount of the latter did not change. However, their specific activity was very markedly reduced. When the fat body tissue was prelabelled in vivo and the specific activity of the di- and triglycerides was identical, the specific activity of the diglycerides was not reduced during diglyceride release. When fat body tissue of locusts after flight was incubated with (1-^{14}C)-palmitate, incorporation of the acid into the diglycerides was very markedly reduced. This inhibition was reversed by the addition of glucose to the medium. When prelabelled tissue of locusts after flight was incubated in haemolymph obtained from the same locusts, diglycerides and free fatty acids were released into the medium. (Auth.)

405 Wlodawer, P., Lagwińska, E., Barańska, J. ESTERIFICATION OF FATTY ACIDS IN THE WAX MOTH HAEMOLYMPH AND ITS POSSIBLE ROLE IN LIPID TRANSPORT. J. Insect Physiol. 12 (1966) 547-560.

Haemolymph of wax moth larvae (Galleria mellonella L.) was incubated with 1-^{14}C-palmitate at 37°C for various periods. Gradual esterification of free fatty acids occurred in the haemolymph concomitantly with hydrolysis of some ester bonds. Incorporation of ^{14}C-palmitate took place predominantly in the triglyceride fraction of the haemolymph lipids. Very little radioactivity was found in the diglycerides, which represent the largest fraction of the glycerides in the haemolymph of the larvae. Incorporation of ^{14}C-palmitate was strongly inhibited by sodium chloride and sodium fluoride, known inhibitors of lipoprotein lipase and pancreatic ('true') lipase, respectively. The incorporation of labelled fatty acid was found to take place chiefly at the α-position of the glyceride molecule. The process of esterification may represent an exchange reaction between free fatty acids and glyceride fatty acids, catalysed by lipases present in the haemolymph. (Auth.)

406 Wlodawer, P., Łagwińska, E. TRANSPORT OF LIPIDS IN WAX MOTH LARVAE. p.179 of "Abstracts of Communications of 3rd FEBS Meeting, Warsaw, Poland, 24 Apr. 1966". New York, Academic Press, 1966.

The fat body of fully grown wax moth larvae extensively takes up ^{14}C-palmitate from a buffered medium and esterifies part of it into the triglycerides of the tissue. Concomitantly with the synthesis of the glycerides a continuous release of FFA takes place from the fat body. This may indicate that at least a part of the tissue triglycerides is in a state of dynamic equilibrium. Both the release and esterification of fatty acids are strongly inhibited by lipase inhibitors. When the "labelled" fat body is incubated in the wax moth haemolymph radioactivity appears in the haemolymph lipids, especially in the triglyceride fraction. Diglycerides which represent the largest fraction of the haemolymph lipids contain only little radioactivity, and the FFA fraction even less. In order to elucidate whether the FFA released from the fat body can be esterified in the haemolymph itself, ^{14}C-labelled palmitate was added to isolated haemolymph. It has been found that the labelled fatty acid is extensively incorporated into lipid esters, predominantly into the TG fraction. These and additional results, based on determinations of liberated glycerol, indicate that the fatty acids released from the "prelabelled" fat body are esterified in the haemolymph, thus leading to formation of radioactive triglycerides. The esterification takes place predominantly at the α-position of the glyceride-glycerol and it may represent an exchange reaction catalysed by lipase present in the wax moth haemolymph. Like the lipids in the fat body, part of the haemolymph lipids present as lipoprotein complexes undergo rapid breakdown and resynthesis. It seems that the haemolymph lipids may serve as an additional depot of fatty acids readily available for immediate use by other tissues. (Abstr.)

407 Wlodawer, P., Łagwińska, E. UPTAKE AND RELEASE OF LIPIDS BY THE ISOLATED FAT BODY OF THE WAX MOTH LARVA. J. Insect Physiol. 13 (1967) 319-331.

When isolated fat body of the wax moth larva was incubated with 1-^{14}C-palmitate the fatty acid was readily incorporated into neutral lipids. There was a positive correlation between the concentration of fatty acid in the medium and the amount incorporated into tissue glycerides. The process of triglyceride synthesis involves diglycerides as intermediates; a possible role of tissue lipases is suggested. Hydrolysis of triglycerides and formation of free fatty acids seem to occur before incorporation of triglyceride fatty acids from the medium into the tissue lipids. When the fat body labelled by incubation with 1-^{14}C-palmitate was reincubated in wax moth haemolymph, radioactivity appeared in the triglyceride and free fatty acid fractions of the haemolymph. It is suggested that the fat body of the wax moth larva releases into the haemolymph free fatty acids which are partly resynthesised into triglycerides and are partly transported as free fatty acids bound to protein. (Auth.)

408 Zandee, D.I. ABSENCE OF CHOLESTEROL SYNTHESIS AS CONTRASTED WITH THE PRESENCE OF FATTY ACID SYNTHESIS IN SOME ARTHROPODS. Comp. Biochem. Physiol. 20, 3 (1967) 811-822.

After administration of acetate-1-^{14}C, absence of cholesterol synthesis was demonstrated in the lobster Homarus gammarus, the spider Avicularia avicularia, and in the millipede Graphidostreptus tumuliporus. The animals utilize acetate for the synthesis of fatty acids (except for polyunsaturated ones) and for some non-saponifiable lipids. Gas-liquid chromatography demonstrated even- and odd-numbered fatty acids, saturated and unsaturated ones, iso, anteiso and probably neobranched-chain fatty acids. The fatty acid composition of the mixtures from the animals and the biosynthesis of the fatty acids are discussed. (CA 66: 1967, 83452k)

409 Zielińska, Z.M., Dominas, H. THE ORIGIN OF PHOSPHOLIPID ETHANOLAMINE AND CHOLINE IN A SAWFLY, Acantholyda nemoralis. J. Insect Physiol. 13, 12 (1967) 1769-1779.

The origin of phospholipid ethanolamine and choline was investigated in A. nemoralis by injecting the larvae with ^{14}C formate as a precursor of 3-C of serine. Phospholipids were then extracted and chromatographed on silicic acid and alumina columns. The homogeneity of each of the fractions was checked using thin-layer chromatography, and their nature was proved by means of paper chromatography of the products of the mild alkaline hydrolysis. The predominant phospholipids are stated to be those containing choline (64%) and ethanolamine (23%). The radiocarbon was detected in all phospholipids including the cardiolipin-like acidic phosphatides. The highest specific radioactivity was found in the phosphatidylethanolamine fraction, containing labelled phosphatidylmonomethyl- and phosphatidyldimethylethanolamine. The probable pathways of the biosynthesis of phosphatidylethanolamine and phosphatidylcholine in A. nemoralis are discussed. In A. nemoralis and in C. morosus the specific radioactivity of the total phospholipids after treatment with 3-^{14}C-serine was higher than that after injection of ^{14}C-formate, especially when administered together with homocysteine, a known precursor of methionine. In insects the hydroxymethyl group of serine may really serve as a precursor of the methyl group of phospholipids.

See also:

40 Some biochemical aspects of insect metamorphosis. (Gilbert, L.I. et al., 1961)
84 Permeability of the ganglia of the willow aphid, Tuberolachnus salignus, to organic ions. (Toppozada, A. et al., 1967)
130 Intermediary metabolism of nitrogenous and lipid compounds in insects. (Chefurka, W., 1965)
286 Effects of substrates on gene-controlled enzyme activities in cultured embryonic cells of Drosophila. (Horikawa, M. et al., 1967)
420 The release of triglycerides and free fatty acids from the fat body of the cockroach, Periplaneta americana. (Cook, B.J. et al., 1967)
421 The larval fat body of Sarcophaga bullata (Diptera) as a system for studying phospholipid biosynthesis. (Crone, H.D. et al., 1966)
891 Observations on the mode of action of 2-imidazolidinone, a female sterilant of the adult housefly Musca domestica L. (Diptera: Muscidae). (Wickramasinghe, D.N.T., 1965)

1.2.7. Organic Acids

410 Johnston, N.C., Law, J.H., Weaver, N. METABOLISM OF 9-KETODEC-2-ENOIC ACID BY WORKER HONEYBEES (Apis mellifera L.). Biochemistry 4 (1965) 1615.

Inactive title compound → corresponding ketal ester, ozonisation, condensation of the C_8-aldehyde with malonic acid-2-^{14}C by the method of Jaeger and Robinson (Tetrahedron 14, 320) → 45% 9-ketodec-2-enoic acid-2-^{14}C and 52% 3-ene-isomer; separation by a selective esterification procedure; specific activity 9.6×10^6 dpm/mg. (J. Labelled Compounds)

411 Levenbook, L. ORGANIC ACIDS IN INSECTS . III. CITRATE OXIDATION AND TURNOVER DURING METAMORPHOSIS OF THE SOUTHERN ARMYWORM Prodenia eridania. Acta biochim. pol. 13, 4 (1966) 405-416.

The dynamics of citrate metabolism at various stages of the life cycle of the southern armyworm (P. eridania) were studied following the injection of citrate-1,5-^{14}C. At all stages of development, the radioactive citrate was oxidized to $^{14}CO_2$ and converted to labelled glutamate. These reactions indicate the functioning of the Krebs cycle and were employed to assess its activity from larva to adult. Both cycle activity and total radiochemical yield decreased in the order: adult > larva and early pupa > developing (pharate) adult. Oxidation rates and radiochemical yields followed distinctly U-shaped curves during adult development. Kinetic measurements on the larva indicated a miscible citrate pool of 8.1 μM, with a half-life of 1.6 h and a turnover rate of 3.5 μM/h. The decreasing citrate pool during metamorphosis is probably due to a decreased rate of citrate synthesis. (CA 66: 1967, 44521n)

412 McEnroe, W. IN-VIVO PREFERENTIAL OXIDATION OF UREIDE CARBON No. 2 OF URIC ACID BY Periplaneta americana. Ann. ent. Soc. Am. 59, 5 (1966) 1011.

Uric acid ^{14}C-labelled on C-2(I) and C-8(II) was injected into the adult female cockroach (1.65 mg suspension in 16.5 µl vegetable oil) and the respiratory CO_2 in the following 24 h was precipitated as $BaCO_3$, weighed, and counted at infinite thickness. P. americana (L.) injected with I and II produced an average of 5% of the injected activity in $^{14}CO_2$, and the I-cockroaches produced an average of 8% of the injected activity in respiratory $^{14}CO_2$. These results indicate a preferential oxidation of ureide carbon-2, assuming that equal amounts of uric acid were available for degradation. Paper chromatography of extracts of I-injected cockroaches (phenol, H_2O saturated; tert-butanol formic acid, H_2O: 7: 1: 1) showed activity only in uric acid. The results are discussed in the light of data from elsewhere.

413 McEnroe, W. EXCRETION OF URIC ACID IN Periplaneta americana. Ann. Ent. Soc. Am. 59, 5 (1966) 1012-13.

^{14}C-uric acid was injected into the bodies of adults, and internal organs were subsequently tested for radioactivity either 12 h or 12 d later. The only significant activity was found in the fat bodies and the Malpighian tubules. This activity was extracted with hot 1% LiCl solution, added to the carrier uric acid, and carried through three recrystallizations, indicating that the activity was in uric acid. The Malpighian tubules are therefore able to remove uric acid from the blood and eliminate it into the gut.

414 Mitlin, N., Mauldin, J.K. URIC ACID IN NITROGEN METABOLISM OF THE BOLL WEEVIL: A PRELIMINARY STUDY. Ann. ent. Soc. Am. 59, 4 (1966) 651-653.

Uric acid is stored in the tissues of the boll weevil, Anthonomus grandis Boh., throughout its life cycle, but guanine does not appear to be stored. Apparently no meaningful relationship exists between the total body content of nitrogen and uric acid. However, uric acid appears to be in a dynamic state and is evidently involved in N metabolism, since uric acid-2-^{14}C injected into metamorphosing weevils causes labelling of at least six of the free amino acids. For the metabolic study, uric acid-2-^{14}C of relatively high specific activity (8.23 mCi/mM) was dissolved in lithium carbonate (0.6%) and injected into 1st-stage pupae. Preliminary testing had shown it to be nontoxic to the weevil.

415 Stumper, R. AMEISENSÄURE-SEKRETION DER FORMICINEN. (Formic acid secretion of Formicidae.) Naturwissenschaften 51 (1964) 277-279. (In German)

The aqueous secretion from the poison gland of Formica polyctenea contains free formic acid (I) at a concentration of 55-65%, ~ 3% amino acid, and some aromatic substances. The biosynthesis of I is not understood. In the animal organism it may be the result of oxidation of the labile methyl groups of methionine, choline, betaine, or sarcosine. Formation from acetone or acetic acid may also be envisaged. Systematic feeding of ^{14}C-labelled potential precursors are proposed in order to determine whether a serine-glycine transformation or other substances play a significant part in the biosynthesis of I.

See also:

349 RNA, protein, and uric acid content of body tissues of Periplaneta americana (L.) as influenced by corpora allata during ovarian development. (Thomas, K.K. et al., 1966)

537 Uric acid metabolism by symbiotic bacteria from the fat body of Periplaneta americana. (Donnellan, J.F. et al., 1967)

1.2.8. Antimetabolites

See:

288 Effects of actinomycin D on nucleic acid metabolism and protein biosynthesis during metamorphosis of Tenebrio molitor. (Ilan, J. et al., 1966)

1.2.9. Cell. Tissue. Organ

416 Bier, K. ZUR FUNKTION DER NÄHRZELLEN IM MEROISTISCHEN INSEKTENOVAR UNTER BESONDERER BERÜCKSICHTIGUNG DER OOGENESE ADEPHAGER COLEOPTEREN. (Study on the function of nurse cells in meroistic insect ovaries, with special reference to oogenesis in adephagous Coleoptera.) Zool. Jb., Physiol. 71 (1965) 371-384. (In German)

RNA metabolism in polytrophic meroistic ovaries of adephagous coleoptera(1), lepidoptera(2), and hymenoptera(3) was examined, using ^{3}H-uridine (specific activity 500 mCi/mM). Ovarian proteins were studied by means of ^{3}H-L-histidine (specific activity 1.1 Ci/mM). The doses injected in aqueous solution were ~20 µCi for Carabus, Vespa, and Malacosoma, and ~10 µCi for Formica. Between the start of the growth period and the completion of oogenesis the oocyte nucleus takes no, or hardly any, part in RNA synthesis. Nor does any RNA synthesis occur in the accessory nuclei of the hymenopteran oocyte. The nurse cell nuclei synthesise RNA intensively during that period. The RNA requirements of the euplasmatically growing oocyte is met by the nurse cells which pass on RNA to oocyte during their period of function. There is no indication of any simultaneous protein transfer, nor of an active part played by the follicle epithelium in supplying the oocyte with RNA. When the nurse cells begin to degenerate, cytoplasm rich in RNA passes into the oocyte. The speed of the macromolecular RNA passing into the oocyte is very variable, which reflects their heterogeneity. The existence of a rapidly moving RNA-fraction of high metabolic rate is discussed.

(1) Carabus canellatus Ill. and C. granulatus L.
(2) Malacosoma neustria L.
(3) Formica polyctena Förster and Vespa vulgaris L.

417 Bier, K. OOGENESE, DAS WACHSTUM VON RIESENZELLEN. (Oogenesis, the growth of giant cells.) Naturwissenschaften 54, 8 (1967) 189-195. (In German)

Review article, freely illustrated with results drawn particularly from insects (Locusta migratoria, Musca domestica). The use of tritiated amino acids and RNA precursor has been widespread in attempts at elucidating the sequence of processes involved in oogenesis.

418 Bier, K., Kunz, W., Ribbert, D. STRUKTUR UND FUNKTION DER OOCYTENCHROMOSOMEN UND NUKLEOLEN SOWIE DER EXTRA-DNS WAEHREND DER OOGENESE PANOISTISCHER UND MEROISTISCHER INSEKTEN. (Structure and function of oocyte chromosomes and nucleoli and extra-DNA during the oogenesis of panoistic and meroistic insects.) Chromosoma 23, 2 (1967) 214-254. (In German)

Panoistic ovaries (without nurse cells) contain three predominating structures: lampbrush chromosomes, multiple nucleoli, and the hitherto undescribed endobody (Binnenkörper). Nucleoli are always multiple during the growth period of the oocyte of panoistic ovaries. This is true even in the case of Blattella which seems to possess only one big nucleolus, if examined in the light microscope. In the meroistic type of ovary (with nurse cells) the development of nucleoli and lampbrush chromosomes in the oocyte is much reduced. Only in the early growth stages of the oocyte the chromosomes despiralize in a species-specific degree before they condense to a karyosphere. On the other hand, the endobody is bigger in the meroistic than in the panoistic ovary. Lampbrush chromosomes and multiple nucleoli are sites of a very intensive RNA-synthesis. The nucleoli are built up by granules measuring 125 Å in diameter. In the endobody, no RNA-metabolism could be demonstrated. The endobody is very homogeneous in electron microscope pictures and clearly distinct from the granular nucleoli. The labelling pattern after incubation with ^{3}H-amino acids suggests a permanent exchange of protein molecules between the karyoplasm and the endobody. In the meroistic type of ovary the oocyte obtains RNA from the nurse cells, and RNA-synthesis in the oocyte nucleus is decreased in the same measure as its chromosomes are condensed. The water-beetles Dytiscus and Acilius possess extra-DNA and deviate from the rule of restricted

RNA-synthesis in the oocyte nucleus of the meroistic ovary albeit their chromosomes form a karyosphere too, and RNA streams also from the nurse chamber into the ooplasm. The extra-DNA resolves itself into a network of fine fibrils no longer stainable by the Feulgen reaction. True multiple nucleoli develop on the fibrils suggesting the extra-DNA contains a huge mass of nucleolus organizers. The case of Dytiscus is very similar to the development of the multiple nucleoli in Gryllus.

419 Condoulis, W.V., Locke, M. THE DEPOSITION OF ENDOCUTICLE IN AN INSECT, Calpodes ethlius Stoll (LEPIDOPTERA, HESPERIIDAE). J. Insect Physiol. 12, 3 (1966) 311-323.

Intermoult endocuticle is laid down progressively in the 5th instar of C. ethlius. The incorporation of cuticular precursors into the intermoult endocuticle has been followed autoradiographically. The uptake of general cuticular precursors in the intermoult period is fast enough to clear most of an unchased pulse of ^{14}C-acetate from the haemocoele to the edge of the epidermis and into the cuticle in 2 h. There are two patterns of incorporation, layered and diffuse. ^{3}H-glucose, a precursor of chitin, is incorporated in discrete layers corresponding to the new cuticle synthesised during the period of incorporation and deposited at the edge of the epidermis. ^{3}H-amino acids, L-proline-^{3}H, L-histidine-^{3}H, L-tryptophan-^{3}H, L-tyrosine-^{3}H, L-phenylalanine-^{3}H, on the other hand, are incorporated not only in layers but also diffusely throughout the thickness of the cuticle. L-cystine-^{35}S was diffusely incorporated in the endocuticle and also heavily in the epidermis. The cuticle stretches during the instar as the larva feeds and grows. In spite of this, electron microscopical observations on the thickness of the lamellae suggest that an increase in separation of the first formed lamellae takes place by the end of the instar, presumably as a result of the material added in the diffuse form of incorporation. These experiments suggest that the endocuticle grows both by the addition of lamellae at the epidermal surface and by intussusception.

420 Cook, B.J., Eddington, L.C. THE RELEASE OF TRIGLYCERIDES AND FREE FATTY ACIDS FROM THE FAT BODY OF THE COCKROACH, Periplaneta americana. J. Insect Physiol. 13, 9 (1967) 1361-1372.

For radioisotope studies, the fat body was labelled by incubating the tissues for 60 min with 0.25 μCi of 1-^{14}C-palmitate (specific activity 143 μCi/mg) in a 1 ml phosphate-saline medium. Gravimetric, colorimetric, and radioisotope analyses showed that the triglycerides and free fatty acids were the major lipids released from the fat body after incubation with haemolymph. The time course of triglyceride release was initially rapid; within 30-60 min, however, the process slowed to a standstill. The limiting factor in release was not the fat body but the saturation of the medium. The optimum release of triglyceride occurred in medium which exceeded a concentration of 50% haemolymph, and mobilization of the triglycerides was haemolymph specific. The mechanisms of lipid mobilization and their control are discussed.

421 Crone, H.D., Newburgh, R.W., Mezei, C. THE LARVAL FAT BODY OF Sarcophaga bullata (DIPTERA) AS A SUSTEM FOR STUDYING PHOSPHOLIPID BIOSYNTHESIS. J. Insect Physiol. 12 (1966) 619-624.

The larval fat body of S. bullata was shown to be an effective system for the study of phosphatidylcholine biosynthesis. ^{32}P-phosphorylcholine and ^{14}C-1,2-choline were used. ^{32}P-phosphorylcholine was incorporated to the extent of 4.7% in 1 h at 30°C. This substrate was a precursor of phosphatidylcholine.

422 Cronin, R.T. AN INVESTIGATION OF SOMATIC REDUCTION DIVISION IN THE HIND-GUT OF THE MOSQUITO Aedes aegypti (L.) USING TRITIUM LABELED THYMIDINE. Diss. Abstr. 26 (1966) 4123.

The somatic reduction in the hind-gut of A. aegypti was investigated using ^{3}H-thymidine as tracer. Larvae were exposed to the ^{3}H-thymidine during different periods of their active life, and sacrificed shortly after pupation or after emergence, and autoradiographs of the hind-gut prepared. The audoradiographs of complexes at various stages of first and later divisions have evidence of such uptake that was generally proportional to the duration of the exposure of the larva to the isotope. However some complexes showed less uptake than did others of the same tissue, while some tissues that had received less exposure showed a greater uptake. Evidently the larval hind-gut cells do not all manufacture DNA at the same rate nor at an even pace. Proof of this is seen in the wide variance of ploidy attained among these cells. The autoradiographs of adult hind-guts showed labelling over

most nuclei, giving evidence that these cells were derived from the giant gomplexes of the larval hind-gut, and not from regenerative cells which are not found in this tissue. These findings confirm the fact that the adult hind-gut is derived from the larval hind-gut complexes. A possible degree of DNA turnover in some cells and tissues may explain some of the differences in labelling of the complexes observed. The reported incorporation of thymidine in extranuclear particles)e.g. mitochondria) may account for some of the extranuclear labelling observed in the study.

423 Daillie, J. INCORPORATION DE LA THYMIDINE TRITIEE DANS L'ACIDE DEOXYRIBONUCLEIQUE DES GLANDES SERICIGENES CHEZ LE VER A SOIE. C. r. hebd. Séance. Acad. Sci., Paris 250 (1960) 3053-3054.

Des chenilles de Bombyx mori, au 4e jour du dernier âge reçoivent, par injection dans l'hémocoele, 3 µCi de thymidine tritiée (900 mCi/mM). Des dosages de thymine, par dilution de thymine-$2^{14}C$, ont été effectués sur le glandes séricigènes provenant de chenilles témoins, au moment de l'injection et 5 j plus tard; ils montrent que la quantité de thymine liée à l'ADN passe, durant ce temps, de 10 à 25 µg environ dans une glande séricigène, une synthèse assez faible lorsqu'on la compare à la croissance pondérale. L'incorporation de la thymidine dans L'ADN est évidemment très rapide puisque la radioactivité maximale apparaît 1 h après l'injection. Ce qui est remarquable est la diminution de l'activité: 3 h après l'injection l'activité spécifique de la thymine isolée a diminué de moitié. La décroissance des activités moyennes entre 4 h et 5 j après l'incorporation est compatible avec l'hypothèse d'une dilution résultant de la synthèse.

424 Daillie, J. METABOLISME DE LA THYMIDINE DANS LA GLANDE SERICIGENE DU VER A SOIE. I. LES PRINCIPALES VOIES SUIVIES PAR LE PRECURSEUR DANS LA GLANDE INCUBEE "IN VITRO". Annls Biol. anim. Biochim. Biophys. 7, 3 (1967) 115-129. (In French, with English summary)

The silk gland (secretory tube) of the silkworm was incubated in vitro for a few hours. Under these experimental conditions, the metabolic pathways of ^{3}H-thymidine were analysed in the gland. It was found that (i) the nucleoside penetrates easily into the glandular cells where it converts to nucleotides. Catabolic reactions are negligible. (ii) The total amount of nucleotides increases to a max. reached within 30 min and maintained for at least 30 min. The nucleotides formed in the cells partly turn back to the incubation medium. The silk gland contains, previous to the incorporation of thymidine, the phosphorylating kinases required to convert thymidine to TMP(1), TDP(2), and TTP(3). The evolution of the distribution of radioactivity between these thymidine-phosphates is rather intricate during the first half-hour. (iii) The precursor incorporates into DNA at constant speed. DNA labelling thus seems insensitive either to variations in the amount of TTP and to increases in radioactive nucleotides. Various interpretations of these findings are discussed.

(1) thymidine monophosphate.
(2) thymidine diphosphate.
(3) thymidine triphosphate.

425 Daillie, J. METABOLISME DE LA THYMIDINE DANS LA GLANDE SERICIGENE DU VER A SOIE. II. UTILISATION DES NUCLEOTIDES RADIOACTIFS POUR LA SYNTHESE DE L'ADN DANS LA GLANDE INCUBEE "IN VITRO" AU 4e JOUR DU 5e STADE. Annls Biol. anim. Biochim. Biophys. 7, 3 (1967) 227-243. (In French, with English summary)

1. Une partie des nucléotides thymidyliques marqués accumulés dans les glandes séricigènes incubées in vitro s'échange facilement avec le milieu d'incubation. L'utilisation relative des nucléotides subit une diminution marquée dans les premières minutes de l'incubation en présence de thymidine radioactive. Cependant le marquage de l'ADN s'effectue à vitesse constante. Ces faits suggèrent qu'une partie seulement des précurseurs, après phosphorylation, est directement disponible pour la synthèse d'ADN. La radioactivité de ce compartiment actif atteindrait en quelques minutes un niveau élevé, maintenu ensuite à peu près stable. 2. La quantité de thymidine présente dans le milieu au début de l'expérience retentit sur la taille du pool radioactif et sur sa participation à la synthèse d'ADN, ce qui conduit à admettre que le compartiment actif entre en compétition avec les précurseurs endogènes. 3. La synthèse horaire d'ADN qui se produit dans l'organe explanté est comprise entre 0,20 et 0,40 p. 100 de son contenu en acide nucléique, c'est-à-dire entre 1/5 et 1/3 de la quantité d'ADN produit in situ. Le pool endogène permanent représente environ la quantité de nucléotides nécessaire pour assurer la synthèse d'ADN pendant une demi-heure. - Différents modèles capables de rendre compte des échanges entre les compartiments sont discutés. (Aut.)

426 Daillí, J. METABOLISME DE LA THYMIDINE DANS LA GLANDE SERICIGENE DU VER A SOIE. III. INCORPORATION DANS LA GLANDE SERICIGENE PRELEVEE AU 6e JOUR DU 5e AGE ET INCUBEE "IN VITRO". Annls Biol. anim. Biochim. Biophys. 7, 3 (1967) 347-354. (In French, with English summary)

Bien que la synthèse de l'ADN soit réduite dans la glande sérigène au 6e jour du 5e âge larvaire, la thymidine fournie à l'organe incubé in vitro pénètre avec facilité par diffusion. Mais l'activité des kinases qui assurent la phosphorylation du nucléoside se trouve affaiblie par rapport à ce qu'on a observé avec des glandes jeunes. La production des nucléotides dépasse toutefois les possibilités de leur utilisation par l'ADN. Ce dernier incorpore le précurseur à un taux très faible. Lorsqu'on fait varier la concentration du milieu en thymidine, on atteint très vite, dans l'ADN, l'incorporation maximum du précurseur. Celle-ci représente, au plus, une synthèse d'acide nucléique de 0,5 p. 1000 à l'heure. On n'a pu évaluer avec précision la quantité de précurseurs thymidyliques endogènes disponible en permanence: cette réserve, qui ne paraît pas pouvoir assurer plus de 15 minutes de synthèse, représente environ 0,1 p. 1000 de la quantité de thymine contenue dans l'ADN des glandes. - L'intervention éventuelle des kinases de la thymidine ou de la production des précurseurs endogènes dans la régulation de la synthèse d'ADN est discutée. (Aut.)

427 Daillie, J. METABOLISME DE LA THYMIDINE DANS LA GLANDE SERICIGENE DU VER A SOIE. IV. ETUDES SUR LA GLANDE "IN SITU". Annls Biol. anim. Biochim. Biophys. 7, 3 (1967) 355-372. (In French, with English summary)

1. Le transfert du nucléoside injecté dans l'hémocoele vers les organes, et en particulier la glande sérigène, se réalise à grande vitesse. Aux 3e et 4e jours, la majeure partie de la thymidine disparaît de l'hémolymphe en l'espace de 10 à 15 minutes. Ce phénomène résulte d'une transformation immédiate du nucléoside introduit. Au 3e jour, 15 minutes après injection d'une dose traceuse de thymidine, la radioactivité soluble dans la glande apparaît entièrement sous la forme de nucléotides, ou de composés de dégradation. 2. Les nucléotides radioactifs se trouvent à bref délai incorporés au pool d'utilisation et, ainsi, mêlés aux précurseurs endogènes. Il est donc possible, en première approximation, d'assimiler la vitesse de disparition des nucléotides marqués à la vitesse de renouvellement du pool endogène. On a pu évaluer que ce renouvellement, au 3e jour, s'effectue 0,6 fois par heure. 3. Dans ces conditions, l'ADN incorpore le précurseur très rapidement, dès le début de l'expérience. La vitesse du marquage se ralentit ensuite; la radioactivité maximum de l'acide nucléique est atteinte après 2 à 8 heures, aux 3e et 4e jours. Après ce maximum, la décroissance de la radioactivité spécifique permet de mesurer la synthèse d'ADN qui se produit dans la glande. 4. Avec des chenilles plus âgées (6e jour), on note essentiellement un ralentissement des divers processus. - Ces résultats sont comparés à ceux qu'on a obtenus in vitro. (Aut.)

428 Ehrhardt, P. UNTERSUCHUNGEN ÜBER BAU UND FUNKTION DES VERDAUUNGSTRAKTES VON Megoura viciae Buckt. (APHIDIDAE, HOMOPTERA) UNTER BESONDERER BERÜCKSICHTIGUNG DER NAHRUNGSAUFNAHME UND DER HONIGTAUABGABE. (Study of the structure and function of the alimentary tract of Megoura viciae Buckt. (Aphididae, Homoptera), with special reference to food uptake and honeydew excretion.) Z. Morph. Ökol. Tiere 52 (1963) 597-677. (In German)

The structure of the alimentary tract was investigated and described. From p. 641 on, tracer experiments are described. The aphids were labelled via their host plants. Young 15-cm Vicia fabae had their roots dipping into an isotonic orthophosphate solution (pH 6-7, activity 5 mCi/ml). M. viciae is essentially a phloem feeder so that isolated leaves were only used in special cases, particularly when a higher isotope concentration was desired in the parenchyma. Aphids were placed on the plants 48 h after labelling. The aphid uses a trial and error technique to find the sieve tubes. It pierces intercellularly through the parenchyma of the plant. The pricking behaviour of starved and sucking animals differs. Neither type, however, takes up any ^{32}P from the tissues in their brief (up to 60 sec) probing. Taste probes are not made in the parenchyma itself. At the earliest, ^{32}P is taken up 7 min after the plant has been pricked. In that period the aphid may have reached a sieve tube although it may take up to 1 h. The variation in time is very considerable. About 60% of the aphids reach the phloem 1 h after the plant has been pricked. Once the sieve tube has been pierced the quantity of ^{32}P taken up, up to its first elimination, not for 3 h at least, is linearly related to the duration of sucking. After 24 h the animal is already satiated with tracer. Starved animals take up ~10% more. The aphid apparently only recognizes the suitability of a

plant as a host after reaching the phloem. Tracer appears in aphid haemolymph 30 min, at the earliest, after the onset of sucking. It can be detected, at the earliest, after 6 h in larvae, 4 h in saliva, and 2½ h in deposited honeydew. As for honeydew, there is a rise with increasing aphid age in deposition, the volume of the drops, and the rate of excretion. There is no relation between honeydew deposition and the birth of larvae or the time of day. There is, however, a rise in the frequency of deposition and excretion with temperature. Honeydew deposition is not a continuous process: periods of excretion (average 8.26 h) are followed by intervals (~3.76 h), indicating that food uptake is no continuous process either. The stream of sap from the sieve tubes can, presumably, be stopped with the so-called suction pump. Fasted animals do not have periods of no-excretion. Their excretion rate and their feeding rate are also higher than those of the sucking aphids. The quantity of food absorbed can be regulated by the aphids, using their suction pump.

429 Eldefrawi, M.E., O'Brien, R.D. PERMEABILITY OF THE ABDOMINAL NERVE CORD OF THE AMERICAN COCKROACH, Periplaneta americana (L.) TO ALIPHATIC ALCOHOLS. J. Insect Physiol. 13 (1967) 691-698.

The rates of influx and efflux of ^{14}C- and ^{3}H-labelled aliphatic alcohols* in the abdominal nerve cord of the American cockroach were studied. Influx was biphasic and positively correlated with octanol/water partition coefficients, with a cut-off point at butanol. All alcohols, except methanol, established a higher concentration inside the nerve cord than outside within 60 min exposure. Influx rates of alcohols were lower than their analogous fatty acids, the difference being attributed to the absence of metabolism of the alcohols in the nerve cord. Compared to the analogous cations, the alcohols had higher influx rates, yet when comparing an alcohol with a cation with similar partition coefficient the influx rates were similar. Charge therefore seems to lower influx because it increases the polarity. Efflux of the alcohols is characterized by a two-stage process with simultaneous rapid and slow phases. Based on the rates of the fast efflux, the nerve sheath appears to be equally permeable to alcohols and tetra-alkylammonium cations and 2-5 times less permeable to fatty acids. (Auth.)

*Methyl alcohol-^{14}C (specific activity 10 mCi/mM), ethyl alcohol-2-^{3}H (specific activity 753mCi/mM), butyl alcohol-, hexyl alcohol-, and octyl alcohol-1-^{14}C (specific activity 1 mCi/mM) were all available commercially.

430 Feir, D., O'Connor, G. TRITIATED THYMIDINE STUDIES ON INSECT HEMOCYTES. p.233 of "Proceedings of the 12th International Congress of Entomology. London, England, 8-16 Jul, 1964". 1965.

The large milkweed bug, was the experimental animal in these studies. ^{3}H-thymidine was injected into different groups of Oncopeltus fasciatus on the day of moult into the 5th instar and on successive days after the moult for the duration of the stadium. Two experimental and two control insects from each group were sacrificed and haemolymph smears were made every 24 h after the injection for the duration of the stadium. The slides were dipped in Kodak NTB2, stored in light tight boxes at 4-8 °C for 8 d, developed in D19, rinsed in acid fixer and water, and stained with Giemsa blood stain for 15 min. 150 cells on each slide were counted. The percentage of haemocytes with ^{3}H-thymidine incorporation, the percentage of mitotic figures, and the percentage of mitotic figures with ^{3}H-thymidine incorporation were determined. A haemocyte was considered to have radioactive incorporation if the number of reduced silver particles in the emulsion over the nucleus was at least twice the background. With one exception there was no appreciable incorporation until 48 h after injection regardless of when the injection was given, a surprising delay since most investigators report that the thymidine is used within 60 min of injection. There is the possibility that the majority of the haemocytes are formed in a haemopoietic organ or site and then released into the circulating haemolymph. In most cases the peaks of haemocytes with incorporation occurred on the 5-6 d and the 9-10 d after the moult into the 5th instar regardless of when the injections were given. When the ^{3}H-thymidine was injected on the 9th or 10th day of the stadium, i.e. 48 or 24 h before the adult moult, there was no incorporation although there was incorporation on these days when the injections were made earlier in the stadium. When ^{3}H-thymidine was injected on the 4th or 5th day after the stadium, which lasted 10-11 days under laboratory conditions, there was very little incorporation for the entire stadium. This suggests little DNA synthesis in the haemocytes or haemopoietic tissue at this time or that another tissue is much more active mitotically at this time and it is utilizing the ^{3}H-thymidine. When the injections were made early in the stadium there was a 2nd peak of incorporation around the 9th or 10th day after the moult and approx. 4

or 5 d after the 1st peak of cells with incorporation. There was a consistent low level of mitosis throughout the stadium. The percentage of mitosis, or mitotic index, varied from 0-15. No correlation of the higher peaks of mitotic activity with age, time of injection, time of day when the haemolymph was taken, or high peaks of thymidine incorporation could be seen. The percentage of mitosis with ^{3}H-thymidine incorporation varied from 0-100. (From abstr.)

431 Halkka, O., Heinonen, L. RADIOAUTOGRAPHIC STUDIES ON THE GONADS OF Acheta domesticus (L.). Annls Med. exp. Biol. Fenn. 44 (1966) 120-124.

In Acheta domesticus larvae fixed 6, 24 or 48 h after injection of ^{3}H-thymidine, no label was found in the 64- or 128-cell spermatogonial cysts at metaphase. The 8-, 16- and 32-cell cysts were labelled 48 h post injection. Under the test conditions employed, neither the nucleus nor the cytoplasm of the oocyte was found to incorporate or absorb radioactive thymidine in macromolecules or other structures not washed away by the subsequent treatment of the sectioned oocyte. Chloramphenicol or mitomycin C pretreatment did not cause changes in the incorporation pattern of the ovarioles. In the earliest spermatogonial cell generations, one of the chromosomes incorporated ^{3}H-uridine at a time the other members of the genome were inactive. Uridine incorporation into the cytoplasm, nucleolus and nucleus of the oocyte, in this order, was reduced considerably by application of mitomycin C. (Auth.)

432 Münchberg, P. ZUR DURCHBLUTUNG DER LIBELLENFLÜGEL UND IHRER EIGNUNG ALS SUBSTRAT VON PARASITISCHEN Arrenurus-LARVEN (ACARINA, HYDRACHNELLAE). (Haemolymph circulation in the dragonfly wing and its suitability as substrate for the parasitic Arrenurus larvae (Acarina, Hydrachnellae).) Z. ParasitKde. 22 (1963) 375-386. (In German)

$Na_2H^{32}PO_4$ was used and injected into the dragonfly body, the precise position varying with the size of the species used. Details of dosages and exposure times are given. Veination and circulation were demonstrated autoradiographically in the following species: Calopteryx splendens, Libellula quadrimaculata, Somatochlora flavomaculata, Sympetrum vulgatum, S. danae, Platycnemis pennipes, and Lestes sponsa. The dragonfly wing evidently lends itself as a substrate for the larvae of Arrenurus papillator (O. F. Müll.). The basal portions of the thicker veins of S. meridionale Selys and S. fonscolombei Selys are specifically vulnerable to attack by the parasite.

433 Münchberg, P. ZUR ILLUSTRIERUNG DER DURCHBLUTUNGSVERHÄLTNISSE DES LIBELLENKÖRPERS UND SEINER ANHÄNGSEL MIT RADIOAKTIVEN MITTELN. (An illustration, by means of radiotracers, of the way in which haemolymph circulates in the body and appendages of the dragonfly.) Gewäss. Abwäss. 39/40 (1965) 64-79. (In German)

In order to make such circulation visible autoradiography was used which proved particularly suitable for wings and legs. A complete illustration of Odonata circulation by such a technique proved possible only in the smaller Zygoptera: in Anisoptera, only body fragments would be autoradiographed. $Na_2^{35}SO_4$ * proved more appropriate than $Na_2H^{32}PO_4$. Abdominal and thoracic injections were used, the amount depending on the size of the insect (0.025-0.05 ml for Zygoptera, 0.05-0.1 ml for Anisoptera). No noticeable autoradiographic differences were observed between the front and the hind wings. The direction (or existence of reversion) of haemolymph circulation cannot be gauged. Experimental conditions and exposure times are discussed.

* injected in physiological saline.

434 Münchberg, P. APHORISMEN ZUM BAU DES LIBELLENFLÜGELS AUF GRUND SEINER AUTORADIOGRAPHIERUNG MIT $Na_2^{35}SO_4$ UND ZUM SITZ DER FLÜGELPIGMENTE. (Aphorisms on the structure of dragonfly wings, based on autoradiography by means of $Na_2^{35}SO_4$, on the location of wing pigments.) Opusc. zool. 82 (1965) 1-9. (In German)

Autoradiographs demonstrate that the haemolymph entering the wing is only found in the veins and does not circulate among the chitin lamellae as has sometimes been suggested. Details of the method have already been given elsewhere. - Autoradiography was not used in the study on wing pigments.

435 Münchberg, P. ZUM BAU DER LIBELLENFLÜGEL UND NOCHMALS ZUR ILLUSTRATION IHRER DURCHBLUTUNG DURCH INJEKTIONEN VON $Na_2^{35}SO_4$. (Structure of the dragonfly wing and further illustration of its blood circulation by injecting $Na_2^{35}SO_4$.) Dt. ent. Z. 13, 4/5 (1966) 383-391. (In German)

Previous work on various species and with various autoradiographic techniques is discussed. The use of juvenile dragonflies (Libellula depressa) gave very satisfactory results with ^{35}S, probably partly due to the fact that immediately after ecdysis there is intensified circulation of haemolymph. The flattening out of the wings of the imago leaving the exuviae parachute-like, needs to be completed before the chitin has finished hardening. In Odonata an epidermal adherence or interconnection appears to exist between the veins for the formation of an extremely stable wing skeleton. The concept of an intercommunicating tubular network for haemolymph circulation cannot be maintained in the face of the autoradiographs obtained. Diffuse accumulations of haemolymph are indicated between chitin lamellae.

436 Prudhomme, J.C. CONTRIBUTION A L'ETUDE DU METABOLISME DES GLANDES SERICIGENES DE Bombyx mori, INCUBEES IN VITRO. Thesis, Lyon Univ. (France), Sep. 1966, 60p.

Silk glands can be maintained in vitro in media characterized by the presence of lactalbumin hydrolysate as source of amino acids, glycogen as glucidic source, and a salt solution buffered at pH 6.6. A decreasing but sufficiently high respiratory activity can be demonstrated, which persists for at least 20 hours; the glands, in addition, incorporate the exogenous thymidine at a high rate into DNA for at least 13 h. Apart from the temperature, a number of other factors in the medium, which appear to be essentially linked with the glucide content, the total concentration and possibly the ionic force may modify quantitatively the degree of respiratory activity. The quantity of exogenous thymidine incorporated into DNA depends on the presence in the medium of an extract of haemolymph and a lactalbumin hydrolysate. Without them, the incorporation drops rapidly. Whereas the blood extract leads to a kind of equilibrium during incubation, the hydrolysate, over a period of time, stimulates the capacity of the organ to incorporate thymidine into DNA. An optimal medium cannot yet be defined. Nevertheless, the presence of a haemolymph abstract seems essential. - ^{3}H-thymidine was used.

437 Řežábová, B., Landa, V. EFFECT OF 6-AZAURIDINE ON THE DEVELOPMENT OF THE OVARIES IN THE HOUSE FLY Musca domestica L. (DIPTERA). Acta ent. bohemosl. 64, 5 (1967) 344-351. (In English)

In a histoautoradiographic study, the incorporation of labelled precursors of nucleic acid and of ^{14}C-6-azauridine into the normal and 6-azauridine treated ovaries was investigated. ^{3}H-uridine, -cytidine, -uracil, and -thymidine were used. The application of 6-azauridine in food immediately after emergence, and its further continued application resulted in the division of nuclei and nucleoli of the follicular epithelium cells in the ovary and its proliferation. Incorporation of labelled precursors of nucleic acid proved that before the onset of proliferation and during its course, follicular epithelium cells are highly active. The biochemical findings which are in close connection with the anatomical observations showed increased RNA and DNA synthesis in the ovaries of house flies after 6-azauridine application. The degree of incorporation of such nucleic acid precursors into treated ovaries also suggests increased synthesis of RNA and DNA. The action of 6-azauridine on the ovaries is not via the endocrine system but direct.

438 Treherne, J.E. GUT ABSORPTION. A. Rev. Ent. 12 (1967) 43-58.

The physiology of gut absorption is reviewed and the specialization among the absorptive processes of the insect gut is discussed. The article deals with the movement of substances within the gut lumen, the uptake of water and inorganic ions (absorption in the fore- and midgut) and with the absorption of sugars, amino acids and lipids. In some of the studies cited radioisotopes (^{14}C, ^{32}P, ^{42}K, ^{131}I) were used. A bibliography is included, completed in April 1966.

439 Tulchin, N.W. Drosophila SALIVARY GLANDS IN VITRO. Diss. Abstr. 27, 4 (1966) 1040-B - 1041-B.

The salivary glands of 3rd-instar larvae of D. melanogaster were excised and transferred to various insect tissue culture media in order to determine the degree of maintenance and replication in an in vitro system. The two salivary glands of one individual explanted for 24 h to Jones and Cunningham's medium to which ^{3}H-thymidine had been added showed salivary gland nuclei in which chromosomes were completely labelled, completely unlabelled, and partially labelled. The same categories of isotope incorporation in the chromosomes were found after 1 h explantation. A 1-h pulse of ^{3}H-thymidine after 24 h of explantation of salivary glands showed only chromosomes which

were completely unlabelled or partially labelled. These results indicate that total replication of DNA in salivary gland cells can be completed in 1 h at the beginning of explantation, and at the end of 24 h of explantation is much slower or only possible at certain loci of the chromosomes. The pattern of incorporation was analysed in the two salivary glands of one individual explanted for 24 h to Jones and Cunningham's medium with serum to which ^{3}H-thymidine had been added. The chromocentre comprising the heterochromatic regions of the chromosomes was heavily labelled when the nucleus was labelled. There were no nuclei in which the euchromatic portions of the chromosomes were heavily labelled and the chromocentre was unlabelled. Therefore, the heterochromatic regions of the chromosomes replicate asynchronously with respect to the euchromatic regions. The pattern of incorporation in the euchromatic regions was predominantly on the horizontal axis of the chromosome, at specific bands or regions of the chromosomes, and the degree of labelling of euchromatin varied from cell to cell. The nucleolar organizer showed incorporation of ^{3}H-thymidine in totally labelled and partially labelled nuclei. The variability in incorporation of ^{3}H-thymidine among the cells of late 3rd-instar larval salivary glands in vitro is resolvable at the level of the bands of the euchromatic regions of the chromosomes. The degree of labelling of the chromosome complement in each of the cells, when arranged in series, represents stages in the replication of the chromosomes. The salivary glands of late 3rd-instar larvae of D. melanogaster when explanted in vitro present a system in which the pattern of replication of the chromosomes is a reflection of the competence of the cells. The effects of different substances in the external medium, puff-pattern analyses, as well as different genetic combinations, can thus be studied in relation to the pattern of replication of the chromosomes. (From DA)

440 Wan-Yuen, C., Tak-Ming, C. MACRO-AUTORADIOGRAPHIC STUDY OF THE DISTRIBUTION AND TRANSLOCATION OF SEMEN IN THE FEMALE REPRODUCTIVE SYSTEM OF SILKWORM (Bombyx mori). Acta ent. sin. 15, 1 (1966) 65-69. (In Chinese)

Male pupae of B. mori, 3 d before adult eclosion, received 0.02 ml of ^{32}P (using $Na_2H^{32}PO_4$) by injection, giving 1 μCi radioactivity/pupa. Adults were allowed to copulate with virgin females. The reproductive system and the fat body were dissected out of the females at intervals of 10 min, ½ h, 1 h, 5 h, and 9 h after mating. The following was observed: (1) in the spermathecae, Ag grain reduction increased with the interval between dissection and mating; (2) within 5 h after copulation, sperm were beginning to fill the ovariole, with accompanying reduction of Ag; (3) sperm follow a definite pattern along the ducts and will not pass to other organs. - After 9 h, oviposition is completed. After oviposition, the picture is the same as 5 h after mating. ^{32}P can only be traced in the spermatheca and the ovariole. When a labelled pupa develops into an adult moth of either sex, the reproductive system of the adult is radioactive, and Ag reduction is observed. It can be concluded that in B. mori sperm can only pass from the spermatheca to the ovariole. The presence of any sperm along the middle oviduct cannot be determined with any certainty by this method, nor whether any penetration to the outside is possible from spermatheca or the ovariole, other than via the ducts.

441 Wolfsberg, M. F. STUDIES ON OVARIAN STRUCTURE, FUNCTION AND GROWTH IN ADULT Drosophila pseudo-obscura. Diss. Abstr. 27, 12 Pt. 1 (1967) 4253-B - 4254-B.

Ovarian structure, function and growth were studied in adult females by means of the following techniques: Kahle-fixed, Feulgen-stained ovarian whole mounts, daily egg-laying records of individual females and tracer studies involving ^{32}P and 2, 4-dinitrophenol (DNP). Mated and virgin females show a marked periodicity with respect to the number of eggs laid per day. Periods of active egg-laying which last, on the average, for 2 d are followed by periods of rest which last, on the average, for 1 d. The development of an egg in the ovariole has been divided into 14 consecutive stages. The development of the egg chamber, oocyte, nurse cells, follicular epithelium and accessory structures has been described. The stage distribution of oocytes within a given ovariole has been determined for mated females of various ages and in various phases of the egg-laying cycle. Estimates have been given for the time required for an egg to pass through each developmental stage. A model which describes the distribution of oocytes within a given ovariole as a function of time has been suggested. Fluctuations in the stage distribution of oocytes have been correlated with egg-laying behavior. During egg-laying, the ovary contains mature eggs; during rest, it contains immature and intermediate oocytes. A hormonal regulation of the ovarian rhythm involving the corpus allatum has been proposed. DNP, in concentrations of 1×10^{-3} M to 1×10^{-5} M, was added to "standard" food which had been labelled non-homogeneously with ^{32}P. The radioactivity of the

tissues of adult females was later determined. The distribution of ^{32}P within tissues reaches a steady state such that the relative percentage of ^{32}P in each organ remains constant even though the total radioactivity of the fly is increasing. Growth of the ovaries upsets the steady state distribution although the relative percentages of ^{32}P in each organ become constant again after the cessation of ovarian growth. The relative percentage of ^{32}P within the ovary may be correlated with the amount of growth which has occurred in this organ. The distribution of ^{32}P in control and DNP poisoned flies is similar provided that the gonads of both groups have reached the same developmental stage. At 1×10^{-3}M DNP, oocytes do not develop beyond stage 7: at 5×10^{-4}M DNP, ovarian growth is merely delayed. It is difficult to separate the effects of DNP from those of starvation. Excretion of ^{32}P in intact females follows a 2-phase system. A large amount of ^{32}P turns over by means of a slow phase: a small amount turns over by means of a fast phase. Females poisoned with 5×10^{-4}M DNP lose P more slowly than control sibs. When radioactive females are removed to unlabelled food, the growing ovary accumulates ^{32}P until the relative percentage of ^{32}P in the gonad reaches that characteristic of the mature ovary. A mechanism which involves the mobility of phosphorus throughout the fly has been proposed for maintaining the relative ^{32}P-content of various tissues at characteristic values. It has been suggested that DNP may retard ovarian growth by interfering with the production of energy rich compounds which are normally formed during oxidative phosphorylation. (From DA)

442 Zylberberg, L. VARIATION DE LA TENEUR EN GLYCOGENE APRES IRRADIATION DES CELLULES DE LA PAROI DE TESTICULE CHEZ Pieris brassicae. J. microsc. 4, 2 (1965) 172.

Abstract of paper presented at meeting.

For some additional information
on some cellular components, tissues, and organs,
see also:

chromosomes	276, 285.
nucleolus	246, 270, 273, 291, 335, 343-4.
(single) cells	274.
central nervous system	51, 61, 207, 372, 622-3, 637-8, 658-9, 930.
corpora allata	229, 349.
fat body	100, 101, 105-6, 134, 140, 141, 187, 203, 205, 235, 348, 352, 365-8, 389, 398, 403-4, 406-7, 537.
midgut	51, 64-66, 351, 353.
muscle	47, 56, 402.
salivary gland	180, 181, 237, 246, 262, 271, 309, 328, 331, 341, 351.
silk gland	117, 122, 155, 220-1, 258-261, 299, 300, 319, 329, 436.
thoracic tissue	369.
wing	432-5.

1.2.10. Miscellaneous (including Nutrition, Metabolism and Growth Phenomena, Respiration, Metabolism and Accumulation of Chemosterilants and Insecticides)

443 Anonymous. HEALTH IN URANIUM MINING. Int. atom. Energy Ag. Bull. 6 (1964) 26-29.

The principal radiation hazard encountered in mining U and Th arises from the radioactive gases Rn and Tn, and the further dangerous products to which they give rise. In U mines the gas Rn is a decay product of Ra: Rn itself decays rapidly to a series of daughter products, which are solids. The most dangerous radioisotope in U mill wastes was ^{226}Ra. Many detailed studies have taught much about the monitoring and surveillance of various environmental media. Methods used include monitoring of water, of sediments, of aquatic biota (algae, insects, fish), and other media such as mill effluents, soil and crops. (Battelle Geneva Card File)

444 Balboni, E.R. THE RESPIRATORY METABOLISM OF INSECT FLIGHT MUSCLE DURING ADULT MATURATION. J. Insect Physiol. 13, 12 (1967) 1849-1856.

As the maturation of honeybee flight muscle proceeded, distinct patterns in the development of the energetic capabilities of the mitochondria were apparent. Mitochondrial ATPase and ATP-Pi exchange activities were evident in newly emerged bees and exhibited generally parallel increases in activity with increasing age.* Respiratory control by ADP concentration, however, was not apparent in mitochondrial preparations from young, 1-d- and 4-d-old bees. Also, phosphorylation linked to the oxidation of succinate, α-glycero-P or pyruvate + malate was either not apparent or at best negligible during this period of adult life. This, however, may be due to an age-related fragility of the mitochondria rather than to an actual lack of these attributes. The mitochondrial α-glycero-P oxidase system appeared to exhibit considerable activity even during the early stages of adult life after emergence. Most likely, the operation of this system is responsible for mediating a significant portion of the energy production for the limited flight activity exhibited by bees during the early stages of adult life. The pyruvate metabolizing system was not fully functional until relatively late in adult maturation (16-20 d after emergence). This would appear to indicate that sustained flight, exhibited by fully matured flying bees, is possible only when the Krebs cycle is in a fully functional state. (Auth.)

---

* For the ATP-Pi exchange studies, 5 μM ^{32}P-Pi (10^6 cpm) were added to the standard assay medium indicated in the article.

445 Carney, G.C. OXIDATIVE PHOSPHORYLATION AND RESPIRATORY CONTROL IN ISOLATED HOUSE FLY MITOCHONDRIA. Bull. ent. Soc. Am. 13, 3 (1967) 193. Abstr. 128. "New York Meeting of the Entomological Society of America, New York, N.Y., 27-30 Nov. 1967".

Mitochondria were allowed to respire with substrate ^{14}C-labelled ADP. Respiratory stimulation by ADP was measured polarographically. ATP, ADP and AMP concentrations were monitored almost continuously. Efficiency of oxidative phosphorylation varied with substrate but bore no relation to the respiratory response to ADP. (Abstr.)

446 Chambers, D.L., Brookes, V.J. HORMONAL CONTROL OF REPRODUCTION. - I. INITIATION OF OÖCYTE DEVELOPMENT IN THE ISOLATED ABDOMEN OF Leucophaea maderae. J. Insect Physiol. 13 (1967) 99-111.

Abdomens of female L. maderae have been isolated and maintained in a viable condition for several months. When acetate-1-^{14}C was injected into isolates about one-half of the label was recovered as $^{14}CO_2$ within 12 h. Glucose-U-^{14}C was oxidized much more slowly and nearly 70% of the label was still retained after 5 d. Leucine-U-^{14}C was readily incorporated into the protein of the fat body, blood, and immature ovaries. Isolation effectively terminated the development of the ovaries, but when active corpora allata were implanted there was an increase of 10-34% in the size of the terminal oöcyte. The data suggest that only the corpora allata are necessary for the initiation of ovarian development, but other factors such as hormone titre and nutritional state may influence the rate at which development takes place. (Auth.)

447 Chandley, A.C. STUDIES ON OOGENESIS IN Drosophila melanogaster with ^{3}H-THYMIDINE LABEL. Expl Cell Res. 44, 1 (1966) 201-15.

Autoradiography of ovaries fixed 30 min after injection of Drosophila females with ^{3}H-thymidine reveals that the labelled germ cells are confined to the anterior region of the germarium. The labelled cells fall into groups of 1, 2, 4, 8 and 16 which presumably correspond to successive generations of oogonia. The amount of label in 2-, 4- and 8-cell groups is proportional to the number of cells in a group, which indicates that the rate of DNA-synthesis is the same over successive oogonial generations. In the case of 16-cell cysts the amount of label appears to be slightly lower than that expected immediately after injection by comparison with the various oogonial cysts, and may indicate a slower rate of synthesis in the oocyte S-period. The early stages of development of the oocyte were followed in material fixed at 3, 6, 12, 24, 48 and 72 h after labelling. The total grain count over a cyst of 16 cells indicates the labelled oogonial generation from which it has differentiated. Cysts of 16 cells with maximum label (i.e. labelled at the meiotic S-period) first appear in the middle of the germarium (Region 2) at 24 h. The first labelled Stage 1 egg-chambers (labelled at the meiotic S-period) were seen at 48 h in the posterior region of the germarium. More were found at 72 h, when the first Stage 2 egg chambers were found. (Auth. summary)

448 Chang, T.H., Riemann, J.G. ^{3}H-THYMIDINE RADIOAUTOGRAPHIC STUDY OF SPERMATOGENESIS IN THE BOLL WEEVIL, Anthonomus grandis (COLEOPTERA: CURCULIONIDAE). Ann. ent. Soc. Am. 60, 5 (1967) 975-979.

The time sequence of spermatogenesis in the boll weevil, A. grandis Boheman, was studied with ^{3}H-thymidine radioautography. The spermatocytes required 10 d to mature into sperm (from the premeiotic DNA synthetic period). Of these, a little more than 4 d is used to reach prophase I, less than 1 d is spent in meiotic division, and more than 5 d is spent in spermiogenesis. The cyst cells, some epithelial cells of the vas deferens, and follicle cells were also labelled with thymidine. (Auth.)

449 Clever, U. PUFFING IN GIANT CHROMOSOMES OF DIPTERA AND THE MECHANISM OF ITS CONTROL. p.317-334 of "The Nucleohistones". Bonner, J., Ts'o, P., Eds. San Francisco, Calif., USA, Holden-Day, Inc. 1964, 398p. Paper presented at "1st World Conference on Histone, Biology and Chemistry, 1963".

Comprehensive review article. Much of the work described was carried out on Chironomus tentans. The role of ecdysone is discussed in detail.

450 Clever, U. CONTROL OF CHROMOSOME PUFFING. p.161-186 of "The Control of Nuclear Activity". Goldstein, L., Ed. Englewood Cliffs, N.J., USA, Prentice-Hall, Inc. 1967.

Review of present data obtained variously and also by the author to elucidate the control of chromosome puffing. - Both the inhibition of protein synthesis and that of RNA synthesis seem to interfere with RNA and protein removal from the puffs. An inducing and a repressive factor appear to control the activity of the IV-2-B locus in Chironomus tentans, both formed - sequentially - by ecdysone stimulation. In Drosophila salivary glands a specific puff was induced by L-tryptophan. Ritossa concluded from results on D. buskii that puffing at certain loci was related to O-metabolism. The effect of actinomycin on uridine incorporation proved to be an inhibiting one. The control of puff formation appears to be ultimately related to RNA synthesis and transport and to protein synthesis. Various interpretations of experimental data are discussed. It is not clear at present whether synthesis or removal of some puff material may be affected by cycloheximide. The author's own studies are described including studies on the role of protein synthesis in the action of ecdysone on puffing. The steps between primary action of ecdysone and its activation of some specific puffs do not appear to include synthesis of new protein.

451 Emmerich, H., Schmialek, P. DIE LOKALISATION CANCEROGENER KOHLENWASSERSTOFFE IN DER SPEICHELDRÜSE VON Drosophila hydei. (The localization of carcinogenic hydrocarbons in the salivary gland of Drosophila hydei.) Expl Cell Res. 43, 1 (1966) 228-231. (In German)

D. hydei were raised on food containing one of the following ^{3}H-labelled hydrocarbons: the carcinogens, 3,4-benzopyrene, 7,12-dimethylbenzanthracene, and 3-methylcholanthrene and the non-carcinogen, anthracene. The distribution of the radioactivity in the salivary glands was determined after 18 d by normal fixation with ethylene glycol and 10% Cl_3CCO_2H and subsequent autoradiography. The radioactivity of anthracene was evenly distributed in the cells, whereas that of the carcinogenic hydrocarbons was significantly localized to the giant chromosomes; the activity per unit area of the chromosomes was more than twice that of the cytoplasm. The binding of the carcinogenic hydrocarbons was rather loose. (CA 65: 1966, 20569d)

452 Eschrich, W. BIDIREKTIONELLE TRANSLOKATION IN SIEBRÖHREN. (Bidirectional translocation in sieve tubes.) Planta 73 (1967) 37-49. (In German)

The honeydew of aphids feeding on the horizontally fixed stem of a Vicia faba plant was collected on a turning table. When the leaf below the pierced stem was provided with fluorescein, and the leaf above with a ^{14}C-compound, the honeydew mostly contained both tracers. It could be shown that the attractive force of a single aphid is not strong enough to change the direction of transport. The tracers must have moved bidirectionally in the same bundle and joined each other in the sieve tube before it was pierced by the aphid. There exists either a bidirectional movement in the single sieve tube, or the tracers move side by side in a "homodromous loop-path". (Auth.)

453 King, R.C., Aggarwal, S.K. OOGENESIS IN Hyalophora cecropia. Growth 29 (1965) 17-83.

Briefly, data are presented bearing on oogenesis in H. cecropia and some related moth species, and various aspects of the comparative oogenesis of these lepidopterans with Drosophila and other muscoid Diptera are discussed. Attention is drawn to the contrast between H. cecropia and D. melanogaster with respect to the importance of the transfer to developing oocytes of proteins synthesized outside the ovary. Some of the studies cited utilized radioisotopes.

454 Kloft, W., Schulze, E.-F. VERWENDUNG VON TRITIIERTEM WASSER (THO) ZUR FORTLAUFENDEN REGISTRIERUNG DES TRANSPIRATIONSVERLAUFES BEI INSEKTEN. (Use of tritiated water (THO) for continuous registration of insect transpiration.) Atompraxis 13, 6 (1967) 265-268. (In German, with English and French summaries)

Continuous registration of insect transpiration had not previously been possible. After application THO mixes with normal body water and is therefore released simultaneously by the transpiring insect. Continuous measurement and registration are possible by means of an ionization chamber of 100 cm^3 capacity and a vibrating-reed electrometer with attached recorder. To reduce the memory effect the inner surface of the chamber is gold-plated. Environmental factors influencing insect transpiration, e.g. temperature, air humidity, and wind velocity, can be varied in this apparatus. This method permits the course of transpiration to be followed qualitatively over an extended period as well as to detect spontaneous regulating effects. (Based on auth. summary)

455 Marcuzzi, G., Degasperi, P. APPLICATION OF THE AUTORADIOGRAPHIC TECHNIQUE TO THE STUDY OF THE EXCRETION IN THE COLEOPTEROUS INSECT Tenebrio molitor L. p.127-129 of "Proceedings of the Symposium on the Preparation and Bio-Medical Application of Labeled Molécules. Venice, Italy, 23-29 Aug. 1964". Sirchis, J., Ed. Brussels, EURATOM. Dec. 1964, 500 p. EUR 2200.e, European Atomic Energy Community, Brussels (Belgium).

The potassium salt of benzylpenicillin-^{14}C was used, with a mol. wt of 372, and a specific activity of 66.6 μCi/mg. The penicillin was diluted in distilled water and then injected (5.5 μl of solution or 7.5 μg of 0.5 μCi activity) into larvae. The larvae were dissected after 24, 48, 72, 98 or 168 h, and the Malpighian tubules extracted and autoradiographed. Penicillin was found to be eliminated by a process of passive diffusion, perhaps reinforced by secretion when the substance is much diluted in the haemolymph. Accumulation could be demonstrated in the hind-gut. The proximal portion of the tubules proved most active. This was associated with localized alkaline phosphatase. All Malpighian tubules function equally.

456 Martoja, R. DEUX EXEMPLES D'APPLICATION DES RADIOISOTOPES A L'ETUDE DE LA NUTRITION DES INSECTES. Bull. Soc. zool. Fr. 98, 4 (1964) 476-477.

Utilisation des sulfates par les Orthoptères. Urée dans l'alimentation des Grillons. (Bull. sign. biol. physiol.) (See also III/37)

457 Riddert, D. DIE POLYTÄNCHROMOSOMEN DER BORSTENBILDUNGSZELLEN VON Calliphora erythrocephala UNTER BESONDERER BERÜCKSICHTIGUNG DER GESCHLECHTSGEBUNDENEN STRUKTURHETEROZYGOTIE UND DES PUFFMUSTERS WÄHREND DER METAMORPHOSE. (The polytene chromosomes of the bristle-forming cells of Calliphora erythrocephala, with special reference to sex-linked structural heterozygosis and the puffing pattern during metamorphosis.) Chromosoma 21, 2 (1967) 296-344. (In German, with English summary)

Review article. Evidence from autoradiographic studies is cited.

458 Sacktor, B., Childress, C.C. METABOLISM OF PROLINE IN INSECT FLIGHT MUSCLE AND ITS SIGNIFICANCE IN STIMULATING THE OXIDATION OF PYRUVATE. Archs Biochem. Biophys. 120, 3 (1967) 583-588.

Mitochondria from flight muscle of the blowfly, Phormia regina, oxidize proline with a $Q\,O_2$ of 130, a rate that accounts for the rate of utilization of the amino acids during flight. Respiratory control and ADP:O ratios for the flavoprotein-catalyzed oxidation of proline are less than 2. Oxidation of proline generates Δ'-pyrroline-5-carboxylate, glutamate, and subsequently intermediates of the Krebs cycle. Proline, but not glutamate or malate, stimulates oxidation of pyruvate. Flight muscle mitochondria are permeable to proline, α-glycerophosphate, and pyruvate, but not to glutamate and

substrates of the citric acid cycle. These findings suggest that proline enhances the rate of pyruvate metabolism by penetrating the mitochondrial barrier, forming intramitochondrial precursors of oxaloacetate, and effecting the complete oxidation of pyruvate via the Krebs cycle at a maximal rate. It is suggested that a similar mechanism may be operative in vivo to explain how the limitations of pyruvate oxidation, found at the initiation of flight, may be relieved. - Sodium pyruvate-2-^{14}C and proline-$^{14}COOH$ were used. Radioactivity was measured in a Tri-Carb liquid scintillation counter after $^{14}CO_2$ was trapped in hyamine hydroxide and added to 10 ml of toluene containing 0.01% POPOP and 0.4% PPO.

459 Steele, W.F. OXIDATIVE PHOSPHORYLATION AND RELATED REACTIONS IN PARTICULATE FRACTIONS FROM INSECTS. Diss. Abstr. 27, 1 (1966) 89-B.

Oxidative phosphorylation and related reactions, particularly as affected by 2,4-dinitrophenol (DNP), were studied with mitochondria and submitochondrial particles isolated from the flight muscle of the blowfly (Phormia regina) and house fly (Musca domestica). In the presence of a phosphate acceptor, the mitochondria oxidized pyruvate rapidly, and this was tightly coupled to phosphorylation. Added succinate and other citric acid cycle intermediates were not readily oxidized by the intact mitochondria. However, submitochondrial particles coupled succinate or NADH oxidation to phosphorylation, but did not utilize pyruvate. The substrate specificity of intact mitochondria appears to be related to a membrane permeability barrier. Pyruvate oxidation was stimulated by DNP, but only in the presence of ATP(1) (or ADP(2)) and Pi. DNP inhibited the ATP-Pi(3) exchange reaction and promoted ATP hydrolysis with no substrate present. However, with sufficient ATP and Pi-^{32}Pi added, little or no net ATP hydrolysis occurred when pyruvate oxidation was stimulated by DNP, and $AT^{32}P$ continued to be formed. The ATP (or ADP) and Pi requirements are due to their need in substrate-level phosphorylation because DNP still promoted respiration (in the presence of ATP, ADP, and Pi) after coupled phosphorylation and DNP-ATPase were completely inhibited by oligomycin. In the presence of oligomycin, DNP stimulated respiration, with ATP and Pi added, only when sufficient $MgCl_2$ (2 mM) was present to provide ADP for substrate-level phosphorylation. $MgCl_2$, however, did not promote respiration in the presence of oligomycin and in the absence of DNP, and $MgCl_2$ was not essential when ADP was present. These findings show that ATP (or ADP) and Pi are not obligatory in the basic mechanism by which DNP promotes electron transport in insect mitochondria; they also show that DNP can 'release' respiration at all three sites of coupled phosphorylation in the presence of oligomycin. However, at 0.1-0.15 mM DNP, maximal respiratory stimulation was obtained only in the absence of oligomycin, when DNP could promote ATP hydrolysis and uncouple phosphorylation. $AT^{32}P$ formation from oxidative phosphorylation was demonstrated in experiments in which respiration was stimulated nearly maximally by 0.1 mM DNP in the presence of ATP and Pi-^{32}Pi. Other experiments, which utilized ADP, or ATP and hexokinase, as a phosphate acceptor, indicated that the equivalent of two phosphorylation sites were not completely uncoupled by 0.1 mM DNP, since P/O ratios significantly greater than 1 were obtained with short incubation periods, even when the phosphate acceptor was not added until 10 min after the DNP. These results suggest that DNP does not 'release' respiration equally at each of the three sites of coupled phosphorylation. - In contrast to mitochondria, sonic or digitonin particles did not show ATP-Pi exchange or DNP-ATPase activity. Sonic particles coupled succinate or NADH oxidation to phosphorylation with P/O ratios between 0.2 and 0.8; the phosphorylation was inhibited by oligomycin and uncoupled by DNP. Therefore, DNP can uncouple respiration in one or more reactions that do not necessarily lead to ATP hydrolysis. Mg^{++}-ATP-ase was observed with both mitochondria and particle preparations. - At 0.4 mM, DNP caused complete inhibition of pyruvate oxidation and coupled phosphorylation with mitochondria, but did not inhibit succinate or NADH oxidation with sonic particles, although it did uncouple phosphorylation completely. (DA)

(1) adenosine triphosphate.
(2) adenosine diphosphate.
(3) inorganic phosphorus.

460 Sun, A.Y.K. EVIDENCE FOR A SOLUBLE HIGH ENERGY INTERMEDIATE OF OXIDATIVE PHOSPHORYLATION IN MITOCHONDRIA FROM BLOWFLIES. Diss. Abstr. 28, 2 (1967) 516-B.

Studies with whole mitochondrial or submitochondrial particles indicated the presence of a soluble non-phosphorylated high energy intermediate of oxidative phosphorylation. The formation of this

intermediate was dependent on the operation of the respiratory chain and some disruption of the mitochondrion released the intermediate to the incubating medium. The ability to form $AT^{32}P$ in the presence of $^{32}P_i$* and ADP or glucose-6-phosphate ^{32}P (G-6-^{32}P) when a hexokinase trap was used has been used to detect the existence and amount of the high energy intermediate as well as the activity of the transfer reaction in the supernatant fraction. The high energy intermediate released to the supernatant fraction was proteinaceous, resistant to dialysis and survived ammonium sulfate fractionation and acetone treatment. Succinic thiokinase activity was measured by observing $^{32}P_i$-ATP exchange in the presence of succinate and CoA. Attempts to separate exchange activity from the transfer activity were unsuccessful yet the difference in response of these two reactions to inhibitors indicated that the two processes were distinct. It was concluded that in the presence of hexokinase the stimulation of transfer activity by succinate and CoA was not due to thiokinase mediated activity. The succinate-CoA stimulated transfer reaction showed the following characteristics: (i) GDP cannot substitute for ADP. (ii) The rate of transfer reaction was dependent on the concentrations of Mg^{++} and P_i. (iii) Transfer activity was not inhibited by DNP, while oligomycin was slightly inhibitory as was hydroxylamine. Arsenate was the most active inhibitor observed. The high energy non-phosphorylated intermediate has been shown to energize the energy-dependent reduction of TPN^+ by DPNH coupled to the reduction of DPN^+ by succinate. The reaction required soluble fraction, sub-particles, succinate, DPN^+, TPN^+. ATP showed little effect. Arsenate inhibited the reaction probably due to the uncoupling of some of the intermediate. The further competitive effect for high energy intermediate has been shown by the addition of P_i and ADP resulting a low reaction rate in energy-dependent reaction. On the basis of experimental results obtained in this study schematic representation of the energy transfer reaction sequence and the sites of inhibitor action was proposed. It was suggested that the primary non-phosphorylated high energy intermediate acyl~X was present in the soluble fraction. Addition of CoA would lead to the formation of a secondary high energy intermediate of the enzyme bound acyl~S type. (From DA)

---

* P_i = inorganic phosphorus.

461 Treherne, J.E. "The Neurochemistry of Arthropods". Cambridge, University Press. 1966, 158 p.

The book deals with the organization of the arthropod nervous system, the water content of nervous tissues in arthropods, inorganic ions, the ionic basis of electrical activity, energy expenditure, carbohydrates, amino acids and proteins, acetylcholine, and other possible transmitter substances. Numerous studies in which radioisotopes had been used are cited in the text, particularly in the chapter on acetylcholine.

462 Van Der Geest, L.P.S., Craig, R. BIOCHEMICAL CHANGES IN THE LARVAE OF THE VARIEGATED CUTWORM, Peridroma saucia, AFTER INFECTION WITH A NUCLEAR POLYHEDROSIS VIRUS. J. invertebrate Path. 9, 1 (1967) 43-54.

Nuclear polyhedrosis virus infection causes a decrease of approx. 20-30% in the total solids content of the haemolymph of P. saucia. This decrease is partially caused by a decrease in protein concentration and in total free amino acids during the disease, although glycine is much higher in diseased larvae. Infection causes an increase in the activity of glutamic-oxalacetic acid and glutamic-pyruvic acid transaminases but not leucine-pyruvic acid transaminase which is very low in both healthy and diseased larvae (Martignoni and Milstead, J. Insect Pathol. 6: 1964, 517). Radioactive amino acids were injected into the haemolymph and the ratio of labelled keto acid to labelled amino acid was used as an index of transaminase activity in vivo. Infected larvae show a higher concentration of keto acids and the index ratio was higher in the case of glutamic acid and leucine but not glycine. (CA 66: 1967, 113400 m)

463 Winteringham, F.P.W. METABOLISM AND SIGNIFICANCE OF ACETYLCHOLINE IN THE BRAIN OF THE ADULT HOUSEFLY, Musca domestica L. J. Insect Physiol. 12 (1966) 909-924.

Methods are described for the determination of [^{14}C] acetylcholine formed in the head tissues of the adult house fly in vivo following [^{14}C] acetate injection. [2-^{14}C] anhydrous sodium acetate and [carboxy-^{14}C] acetylcholine chloride were used. Acetylcholine estimated radiometrically and that assayed pharmacologically were in good agreement. This confirms that this ester largely, if not entirely, accounts for the pharmacological activity of head extracts as assayed with the frog

rectus abdominis muscle preparation. The data indicated that the acetylcholine content of the brain is due to a steady state of synthesis and hydrolysis with a min. turnover rate of 6.1×10^{-5} µM acetylcholine/min/head. Turnover was apparently reduced in insects poisoned with acetylcholinesterase inhibitors. These and other observations are interpreted as showing that the ACh system of the brain is highly compartmentalized, synthesis from choline and intracellular acetate being controlled by the availability of choline arising from acetylcholinesterase action. No correlation was found between acetylcholine turnover in vivo and the incidence of light on the compound eye. Turnover was apparently unaffected by surgical elimination of possible nerve activity originating in the thoracic ganglion. It was, apparently, reduced during cyclopropane anaesthesia. Current problems of insect neurophysiology are critically discussed. - The effects of cyclopropane anaesthesia and/or dieldrin poisoning on [^{14}C] acetylcholine formation were also investigated.

See also, under the headings indicated:

OOGENESIS

92 Glycogen accumulation during oogenesis and its premature release by blocking of the RNA supply. (Study on Musca domestica L.) (Engels, W. et al., 1967)

146 The course of protein and carbohydrate synthesis during oogenesis in Apis mellifica L. (Engels, W., 1965)

265 Nucleic acid metabolism during oogenesis in crickets, Gryllus bimaculatus. (Durand, M. et al., 1966)

417 Oogenesis, the growth of giant cells. (Bier, K., 1967)

418 Structure and function of oocyte chromosomes and nucleoli and extra-DNA during the oogenesis of panoistic and meroistic insects. (Bier, K. et al., 1967)

EMBRYOGENESIS AND DEVELOPMENT:

281 Ribonucleinsäuren in der Embryogenese von Acheta domestica L. (Hansen-Delkeskamp, E. et al., 1967)

311 Insect embryogenesis: macromolecular synthesis during early development. (Lockshin, R.A., 1966)

131 Amino acid and protein metabolism in insect development. (Chen, P.S., 1966)

132 Studies on the haemolymph proteins of the blowfly Phormia regina - changes in ontogenetic patterns. (Chen, P.S. et al., 1966)

229 Control of a sex-limited haemolymph protein by corpora allata during ovarian development in Periplaneta americana. (Thomas, K.K. et al., 1966)

245 Structure and genetic activity of the DNA mass in evidence during germ cell development. (Bier, K. et al., 1966)

252 Synthesis of ribonucleic acid and histone change during spermatogenesis in the grasshopper Chortophaga viridifasciata. (Claypool, C.J., 1967)

278 Developmental variation in the uptake of a RNA precursor by Drosophila virilis salivary glands. (Greenberg, J.R., 1967)

297 Nucleic acid synthesis during insect development. - II. Control of DNA synthesis in the cecropia silkworm and other saturniid moths. (Krishnakumaran, A. et al., 1967)

298 Regulation of gene action in insect development. (Kroeger, H. et al., 1966)

313 Variations in metabolic activity during the larval development of Rhynchosciara. (Mattingly, E.M., 1966)

316 Study of DNase and DNA polymerase activity during Drosophila development. (Muhammed, A. et al., 1966)

317 Deoxyribonuclease and deoxyribonucleic acid polymerase activity during Drosophila development. (Muhammed, A. et al., 1967)

332 Incorporation of uridine and leucine in vitro by Cecropia silkmoth wing epidermis during diapause and development. (Reddy, S.R.R. et al., 1967)

349 RNA, protein, and uric acid content of body tissues of Periplaneta americana (L.) as influenced by corpora allata during ovarian development. (Thomas, K.K. et al., 1966)

MOULTING AND METAMORPHOSIS

79 The behaviour of radiocesium during insect metamorphosis. (Reichel, D.E., 1966)

93a Métabolisme due tréhalose et du glycogène chez le ver à soie, en relation avec la mue, le filage at les métamorphoses. (Florkin, M. et al., 1965)

124 Aspects of the flight metabolism of tsetse flies (Glossina). (Bursell, E., 1966)
170 Biochemistry and mode of action of ecdysone. (Karlson, P., 1964)
262 Larval moulting cycle and DNA synthesis in Drosophila hydei salivary glands. (Danieli, G.A. et al., 1967)
331 Nucleoprotein metabolism in salivary gland chromosomes of Sciara during pupation. (Rasch, E.M. et al., 1967)
355 DNA synthesis and hormonal control of insect metamorphosis. (Williams, C.M., 1965)
375 The biochemistry and metabolism of sterols and isoprenoids in the metamorphosis of the American silkmoth, Hyalophora cecropia (L.) (Goodfellow, R.D., 1966)
411 Organic acids in insects. III. Citrate oxidation and turnover during metamorphosis of the southern army worm Prodenia eridania. (Levenbook, L., 1966)

METABOLISM

124 Aspects of the flight metabolism of tsetse flies (Glossina). (Bursell, E., 1966)
131 Amino acid and protein metabolism in insect development. (Chen, P.S., 1966)
135 Metabolism of monocarbon fragments in insect. I. Incorporation of carbon from ^{14}C formate into certain free amino acids of the haemolymph of Acantholyda nemoralis (Thoms.). (Chmurzynska, W. et al., 1965)
313 Variations in metabolic activity during the larval development of Rhynchosciara. (Mattingly, E.M., 1966)
436 Contribution à l'étude du métabolisme des glandes séricigènes de Bombyx mori, incubées in vitro. (Prudhomme, J.C., 1966)
1738 A multiple unit radiometric respirometer for the measurement of the metabolism of ^{14}C labelled substrates. (Bourke, J.B. et al., 1967)

NUTRIENT REQUIREMENTS

175 Radioisotopes and the determination of nutrient requirements. (Kasting, R. et al., 1966)
470 Study of the nutrition of Myzodes persicae Sulzer by means of ^{32}P. (Cavalloro, R., 1961)

See also under "amino acid requirements" in Subject Index.

SALIVARY PHYSIOLOGY

192 Studies on the salivary physiology of plant-bugs: transport from haemolymph to saliva. (Miles, P.W., 1967)
193 Synthesis of a plant hormone by the salivary apparatus of plant-sucking Hemiptera. (Miles, P.W. et al., 1967)

HAEMOLYMPH CIRCULATION

432 Haemolymph circulation in the dragonfly wing and its suitability as substrate for the parasitic Arrenurus larvae (Acarina, Hydrachnellae). (Münchberg, P., 1963)
433 An illustration, by means of radiotracers, of the way in which haemolymph circulates in the body and appendages of the dragonfly. (Münchberg, P., 1965)
435 Structure of the dragonfly wing and further illustration of its blood circulation by injecting $Na_2{}^{35}SO_4$. (Münchberg, P., 1966)

MUSCLE CONTRACTURE

47 The effects of strontium and other divalent cations on potassium contracture in a locust leg muscle. (Aidley, D.J., 1965)
56 The effect of Ca^{2+} and of fibre elongation on the activation of the contractile mechanism of insect fibrillar flight muscle. (Chaplain, R.A., 1967)

VARIOUS

21 Scintillation counting of tritiated thymidine transferred to females by labelled Drosophila melanogaster males. (Trout, W.E., III., 1966)
440 Macro-autoradiographic study of the distribution and translocation of semen in the female reproductive system of silkworm (Bombyx mori). (Wan-Yuen, C. et al., 1966)

56 The effect of Ca^{2+} and of fibre elongation on the activation of the contractile mechanism of insect fibrillar flight muscle. (Chaplain, R.A., 1967)
79 The behaviour of radiocesium during insect metamorphosis. (Reichel, D.E., 1966)
92 Glycogen accumulation during oogenesis and its premature release by blocking of the RNA supply. (Study on Musca domestica L.). (Engels, W. et al., 1967)
125 The excretion of nitrogen in insects. (Bursell, E., 1967)
145 Gene activation without histone acetylation in Drosophila melanogaster. (Ellgaard, E.G., 1967)
170 Biochemistry and mode of action of ecdysone. (Karlson, P., 1964)
215 Sclerotization in the blowfly imago. (Sekeris, C.E., 1964)
276 Organization of chromosomes in higher forms. (Gay, H., 1964/1965)
285 Study on the structure and function of the lampbrush Y-chromosome in Drosophila. (Henning, W., 1967)
298 Regulation of gene action in insect development. (Kroeger, H. et al., 1966)
323 Chromosome changes induced by infections in tissues of Rhynchosciara angelae. (Pavan, C., et al., 1966)
334 Aspects of structure of polytene chromosome puffs of Drosophila buskii derived from experiments with antibiotics. (Ritossa, F.M. et al., 1963)
224 The biogenesis of leukopterin and its relation to purine metabolism. (Simon, H., 1965)
304 Induction of tissue disorders in insects by alteration of equilibrium factors of pterines-growth hormones, and mechanism of this induction. (L'Helias, C., 1966)
501 Flight range, lengths of gonotrophic cycles, and longevity of ^{32}P-labelled Anopheles stephensi mysorensis. (Quraishi, M.S. et al., 1966)
385 Changes in haemolymph lipoproteins during locust flight. (Mayer, R.J. et al., 1967)
508 Investigations on the radioactivity of honey. (Barabas, B., 1967)

For general "puffing" phenomena see Subject Index.

1.3. ECOLOGY

1.3.1. General Articles. Surveys

OMISSION. Reference should here be made to 467, erroneously listed in the wrong context.
467 Noordink, J.P.W. ENKELE TOEPASSINGEN VON RADIOACTIEVE ISOTOPEN BIJ HET OECOLOGISCH ONDERZOEK. (Some applications of radioactive isotopes in ecological research.) Ent. Ber. 25, 7 (1965) 130. (In Dutch)

See also:

39 Early developments in the use of radioisotopes in agriculture. (Comar, C.L., 1966)
45 Radioisotopes in entomology. (Kansu, A., 1964)
1536 Role of atomic energy in insect study and control. (Huque, H., 1962)

1.3.2. Behaviour

1.3.2.1. Feeding (including Mechanisms of Feeding and Transmission of Food)

464 ERRATUM: This reference should have followed ref. 61.
Espinola, H.N., Capuñay, R., Silva, I.E., da. EFFECTIVE HALF-LIFE OF ^{32}P IN THE SANDFLY Lutzomyia longipalpis (Lutz AND Neiva, 1912) (DIPTERA PSYCHODIDAE). Revta bras. Biol. 26 (1966) 175-179.

Adult L. longipalpis were tagged by rearing the sandflies from the egg stage in a medium containing 100 µCi/g ^{32}P. Two counts of radioactivity were performed to determine the ^{32}P elimination rate, one

just before adult emergence and another on the day of the adult's death. The biological half-life of ^{32}P in the males ranged from the 2nd - 4th day after adult emergence and in the females, from the 5th - 7th day. By using the effective half-life formula it was found that the half-life of ^{32}P in this species was 1.7 - 3.1 d for males and 3.7 - 4.7 d for females. From these data and previous results (cf. ref 7) on the tagging of sandflies with ^{32}P, it was concluded that the ideal dose of ^{32}P for tagging of L. longipalpis was 20 µCi when the tagging was started at the egg stage and 10 µCi when tagging was started at the 4th-larval instar. These conclusions apply only when radioactivity counts are performed with a counter of the same type used in this experiment, or with one of equivalent sensitivity. (From auth. summary)

465 ERRATUM: This reference should have followed ref. 61.
Fairbanks, L.D., Burch, G.E. TURNOVER OF RADIOSODIUM IN Drosophila melanogaster ADULTS OF DIFFERENT AGES. J. Insect Physiol. 12 (1966) 591-599.

The rate of loss of radioactivity from adults of D. melanogaster was observed both in groups and in individual flies of different initial ages ≤ 1176 h and maintained at 25°C. Flies were labelled either by rearing them from the egg stage on media containing ^{22}Na or by feeding adults ^{22}Na in the food media. Even though sufficient equilibration time on the media was allowed and the flies were not anaesthetized after once becoming labelled great variation was found in biologic half-life for flies of all ages. A small but significant association of turnover rate with age was found for the males only. The half-life decreased by 1.8 h for each 100 h of age. The difference between the mean half-life values for males (81.26 h) and females (98.24 h) of all ages combined was statistically significant. The turnover of body Na for a 24 h period was 15.5% and 18.5% for females and males respectively. (Auth.)

466 ERRATUM: This reference should have followed ref. 389.
Monroe, R.E., Hopkins, T.L., Valder, S.A. METABOLISM AND UTILIZATION OF CHOLESTEROL-4-C^{14} FOR GROWTH AND REPRODUCTION OF ASEPTICALLY REARED HOUSEFLIES, Musca domestica L. J. Insect Physiol. 13, 2 (1967) 219-233.

House fly larvae, M. domestica L., were reared aseptically on a synthetic diet containing cholesterol-4-^{14}C as the only sterol source. The uptake of cholesterol by the larvae doubled between 2 and 4 d of age reaching a maxim. of about 10 µg/larva. Cholesterol accumulated in the tissues at a rate that exceeded body weight increase, and the carry-over of larval sterols to the adults was nearly quantitative, confirming the importance of sterol storage in the larval stage. Minor losses occurred prior to pupation, possibly due to gut clearance, and at eclosion with small amounts of sterols remaining in the puparia. The adults were fed on a sterol-free diet to study the utilization of the larval sterols for oögenesis. Sterols were initially incorporated into the eggs at 0.96 µg/mg, but this concentration decreased rapidly with succeeding ovipositions. However, hatchability was not significantly affected until the concentrations reached 0.25 µg/mg. Females that survived several ovipositions lost about two-thirds of their total sterols. Esterification of sterols was very minor during larval growth, but increased appreciably in the pupae and adults and was greatest in the first batches of eggs. Dehydrogenation of cholesterol to 7-dehydrocholesterol was not significant in any stage except the reproducing females and the eggs. The steady decline of total sterols in succeeding batches of eggs was accompanied by a decrease in the percentage of sterol esters and an increase in 7-dehydrocholesterol. (Auth.)

467 ERRATUM: This reference should be in section 1.3.1.
Noordink, J.P.W. ENKELE TOEPASSINGEN VON RADIOACTIEVE ISOTOPEN BIJ HET OECOLOGISCH ONDERZOEK. (Some applications of radioactive isotopes in ecological research.) Ent. Ber. 25, 7 (1965) 130. (In Dutch)

When insects eat little or only food that cannot easily be made radioactive, labelling by ingestion becomes difficult. This problem was avoided in the labelling of the wheat-stem-gall mosquito, Haplodiplosis equestris (Wagn.) by immersing larvae in an aqueous solution of $^{22}NaCl$. After 2 weeks, the radioactivity per larva was 1000 cpm. Gradual deeper penetration of the larvae into the soil at decreasing temperatures could be traced without disturbing the soil structure by measuring the emitted γ-radiation with a normal GM counter. At a temperature of -0.2°C most larvae were found at a depth of 11 cm. Seven thousand larvae were similarly labelled with ^{22}Na, and used to investigate the dispersion of adult insects. Of 7000 larvae, 41 labelled mosquitoes were recovered in traps. Egg bundles also showed radioactivity. The immersion technique, using ^{32}P and ^{22}Na, did not work with larvae of the onion maggot (Hylemya antiqua). Treatment for only 24 h killed 80%

of the larvae. The insect can, however, be labelled very effectively by adding the isotope to a 50% honey solution. – Before the sterile male technique can be applied the population density of the insect must be investigated, a stage of research at which radioisotopes can play an important role. In experiments with Bacillus thuringiensis preparations, ^{32}P was added to the medium in order to check quantitatively the food uptake by third-instar larvae of Pieris brassicae during a certain period. The presence of several toxic substances could be demonstrated in the medium, and are shown in a graph. The inhibiting action of one toxic substance on the appetite of the larvae was also demonstrated graphically. – Finally, some examples are given of the use of a track emulsion to detect very small quantities of an isotope.

468 Pershad, S. ANALYSE DE DIFFERENTS FACTEURS CONDITIONNANT LES ECHANGES ALIMENTAIRES DANS UNE COLONIE D'ABEILLES Apis mellifica L. AU MOYEN DU RADIOISOTOPE P^{32}. Annls Abeille 10, 3 (1967) 139-197.

Les abeilles ont été marquées au ^{32}P (sous la forme $NaH_2{}^{32}PO_4$). Les auteurs ont étudié les échanges trophallactiques entre ouvrières mêmes ou entre différentes colonies et ouvrières-reines, ainsi que les facteurs âge, température, la durée des échanges, le nombre d'abeilles, le métabolisme et la localisation du phosphore.

469 Alibert, J. LA TROPHALLAXIE PROCTODEALE CHEZ Calotermes flavicollis. ETUDE DES RAPPORTS TROPHIQUES UNISSANT ROI, REINE ET LARVES, ET DE LEURS MODIFICATIONS SOUS L'INFLUENCE DE DIVERS FACTEURS. p. 79-92 of "Comptes Rendus du Ve Congrès de l'Union Internationale pour l'Etude des Insectes Sociaux. Laboratoire d'Entomologie de la Faculté des Sciences. Toulouse, France, 5-10 Jul. 1965". (In French, with English summary)

The metabolism of ^{32}P permits measurement of the global intensity of stomodeal, proctodeal and salivary exchanges as well as the determination of the role of different stages of castes in trophallaxis. ^{198}Au, which remains localized in the digestive tract, permits an evaluation of the relative importance of proctodeal exchange in the food relationship among colony members as a whole. 1. Trophic bonds were investigated in some detail. (a) Proctodeal food exchanges between the sexuals of a young colony after the 1st egg laying are frequent and are part of their natural behaviour. When the sexuals get older (3-6 yr) food exchange may be demonstrated by isolating the founder couple from the rest of the colony; however, when again in the presence of ten larvae, both male and female prefer to absorb proctodeal fluid from larvae rather than from each other. (b) In very young colonies, proctodeal exchanges between sexuals and their larvae are rapid and regular. Even though decreasing with the age of the sexuals, they persist at least during the 1st 6 years of the colony. (c) The evolution of the proctodeal feeding of the reproductive couple into one involving saliva is progressive, and depends not only on the age of the sexuals, but also on the number of surrounding larvae. - 2. The relative population density of the society modifies the rhythm of proctodeal trophallaxis as well as regulating the feeding of the couple. - Moulting has a direct influence on bucco-anal trophallaxis. The fluid contents of the rectal pouch, which is extracted when the digestive tract of an individual about to moult is emptied, is recuperated by the other members of the society, which leads to a recrudescence of proctodeal food transfer within the group. - The elimination of the introduced radioisotope by a contaminated donor is considered. The biological half-life of ^{198}Au calculated for a group of termites depends on the composition of the recipient group as well as on the physiological state of the donor larvae. The prolongation of biological half life of ^{198}Au within a group of Calotermes means an intensification of proctodeal exchanges under the influence of these two factors. (Based on auth. summary)

470 Cavalloro, R. INDAGINI CONDOTTE CON ^{32}P SULLA NUTRIZIONE DEL Myzodes persicae Sulzer. (Study on the nutrition of Myzodes persicae Sulzer by means of ^{32}P.) Presented at the "VI Congresso Nucleare. Symposium sulle Applicazioni dell'Energia Nucleare in Agricoltura. Roma, Italia, 15-16 giugno 1961". 11p. (In Italian, with English and French summaries)

The radioisotope part of the study was carried out on the sap which the two forms, the parthenogenetic virginoparous apterous female and the neanide of the exile generation, of M. persicae drawn from the attacked plant. The chemical nature of the groups of substances ingested was investigated by means of electrophoresis and autoradiography, and compared with the substances contained in the plant itself.

471 Cavalloro, R. RICERCA MEDIANTE ^{14}C DELLE CORRELAZIONI TROFICHE TRA AFIDE E PIANTA OSPITE. (Study of the tropic relation between aphids and their host plant by means of ^{14}C.) p. 155-156 of "V Congresso Nazionale di Entomologia, Milano, settembre 1963". (In Italian, with French summary)

The study was carried out on individual aphids (Myzodes persicae Sulzer), particularly on parthenogenetic virginiparaous winged females, on parthenogenetic virginiparous apterous and neanides of the exile generation. All fed on Nicotiana tabacum var. Samsun. Plants were labelled with ^{14}C by maintaining them in a ^{14}CO atmosphere, with subsequent labelling of aphids. By analysing the sap in the aphids and that contained in those parts of the plant on which they had fed various labelled substances could be identified. Particular attention was paid to sugars (polysaccharides, maltose, saccharose, ribose, glucose, mannose, fructose, sedoheptulose), amino acids (alanine, serine, threonine, valine, lysine, hystidine, proline), and organic acids (glycolytic, glyoxylic, glyceric, tartaric, malic, succinic, fumaric, ctric, and acontic). – Tabulated results were presented at the meeting.

472 Chauvin, R., Lecomte, J. ECHANGES PROTIDIQUES ENTRE FOURMILIERES DE Formica polyctena, MESURES A L'AIDE DE RADIO-ISOTOPES. Insectes soc. 13, 1 (1966) 1-4.

Une centaine de grammes de viande de boeuf crue, maigre, et hâchée ont été mélangée avec soin quelques minutes avant son emploi avec 25 mCi de ^{198}Au. Le tout a été déposé sur la fourmilière K (celle qui a donné naissance en quelques années à tout le réseau complexe de fourmilières étudiées). Les échanges de matériel protidique s'effectuent entre fourmilières de F. polyctena de la même manière que les échanges de sucre, tout en restant beaucoup moins actifs.

473 Danneel, I. WEITERGABE VON P^{32}-MARKIERTER SUBSTANZ IM KOERPER VON Aphis fabae Scop. AN IHRE LARVEN (HOMOPTERA, APHIDIDAE). (The transmission of ^{32}P-labelled material in the body of Aphis fabae Scop. (Homoptera, Aphididae) to its larvae.) Z. angew. Zool. 54, 3 (1967) 433-444. (In German)

Of the imagoes which had been ingesting radioactivity with their food for 21.5 h, half were tested while the other half were allowed to feed on non-active saccharine solution for a further 20 h. The large larvae dissected out had an average of 4.1% of the mother's radioactivity. Even after only 1 h, 0.5% was already observed, proving that material had already been transmitted to the larva. It must be remembered that the preparation and decontamination alone already took 10 min, and in addition it cannot be assumed that animals started to feed immediately, once the experiment had begun.

474 Danneel, I. KURZZEITVERSUCHE ZUR NAHRUNGSWAHL VON Aphis fabae Scop. (HOMOPTERA, APHIDIDAE). (Study on food selection of Aphis fabae Scop. (Homoptera, Aphididae) in experiments using short time intervals.) Z. angew. Zool. 54 (1967) 181-182. (In German)

^{32}P was added to the liquid medium, at a specific activity of 2 mCi/ml. At the start, a 18% saccharine solution was offered. The impulse rate was measured by killing the aphid larvae with ether, after feeding. The food was contained between two Parafilm membranes, and the aphids had to puncture the inner one in order to reach the food. Aphids were then placed singly in a precisely defined position, for measuring. For short periods of feeding (4-6 h) the aphids preferred the saccharine solution to the standard diet. For periods of 8-24 h, about equal amounts were taken up. For a 48-h-period, a marked preference was shown for the diet.

475 Duffus, J.E., Gold, A.H. RELATIONSHIP OF TRACER-MEASURED APHID FEEDING TO ACQUISITION OF BEET WESTERN YELLOWS VIRUS AND TO FEEDING INHIBITORS IN PLANT EXTRACTS. Phytopathology 57, 11 (1967) 1237-1241.

Myzus persicae was tagged with ^{32}P by using labelled phosphate, and allowing aphids to feed through natural and artificial membranes. The absorption of plant extracts, the part played by aphids in virus transmission, the significance of the type of membrane used, the colour of the extracts, the concentration of saccharose, and the age and form of the aphid were studied.

476 Ehrhardt, P. ZUR NAHRUNGSAUFNAHME VON Megoura viciae Buckt., EINER PHLOEMSAUGENDEN APHIDE (HOMOPTERA, RHYNCHOTA). (Study of food uptake by Megoura viciae Buckt., a phloem sucking aphid (Homoptera, Rhynchota).) Experientia 17 (1961) 461-462. (In German, with English summary)

The roots of young Vicia faba plants were placed in ^{32}P-labelled phosphate solution (specific activity 0.3 mCi/ml). No food was taken up by the stylets outside the phloem. The aphid stylets are able to penetrate to the phloem at the earliest 7 min after the start of a puncture. Only 3 h later, however, all aphids have reached the phloem. There is a very wide spread in the time taken to reach the phloem. The aphids appear unable to aim and, instead, arrive at the phloem more or less haphazardly. In plants not belonging to the host plants of Megoura viciae the aphid nevertheless also pierces the phloem. The course of food ingestion is studied in relation to the time of sucking, and illustrated by a graph.

477 Hajdu, E., Fairbanks, L.D., Burch, G.E. THE EFFECTS OF INJURY ON THE HUMIDITY REACTION OF Drosophila melanogaster. Physiol. Zoöl. 38, 3 (1965) 197-201.

Radioactivity measurements on flies in contact with a culture medium containing ^{22}Na show that injured individuals feed less than uninjured flies. The first individuals placed in a chamber of variable humidity have a tendency to collect in the most humid zones.

478 Hennig, E. ZUR HISTOLOGIE UND FUNKTION VON EINSTICHEN DER SCHWARZEN BOHNENLAUS (Aphis fabae Scop.) IN Vicia faba – PFLANZEN. (Study on the histology and function of feeding punctures of the black bean aphid, Aphis fabae Scop. on Vicia faba plants.) J. Insect Physiol. 12 (1966) 65-76. (In German, with English summary)

The histology of the feeding punctures of the black bean aphid, A. fabae Scop., the relation between time and depth of the punctures, and their function are investigated. V. faba plants were inserted in a solution of $NaH_2\,^{32}PO_4$ of high activity (16 mCi/ml) for 24 h. Subsequently, wingless virgin aphids were placed on them. In piercing plant tissue the stylets are almost restricted to an intercellular course. Single cells are only rarely penetrated. Such passages are discernible by the bead-like form of the salivary sheath. Near the phloem many tracks are branched. Only the maxillary stylets penetrate the phloem cells. During sap ingestion they are opened like grabs. The mandibular stylets and the salivary sheath end on the wall of the phloem cell. To reach the phloem of their host plants the aphids need 30 - 60 min on an average. Before that the puncture place is often changed once to several times. Mechanical resistance of the plant tissue or lack of room to move the stylets may be the reason for this behaviour. No sap is ingested for nutrition from epidermis or parenchyma. To what extent sap ingestion from these tissues is of importance for taste orientation has not been determined.

479 Kloft, W. RADIOÖKOLOGISCHE UNTERSUCHUNGEN AN FORMICIDEN DES WALDES. (Radioecological investigation of forest Formicidae.) Wiss. Z. tech. Hochsch. (Univ.) Dresden 16, 2 (1967) 582-583. (In German)

Applications of radioisotopes to exchanges (food and other substances) between ants are indicated briefly (by author and year but without bibliographical citation). Experiments on Formica colonies are described aimed at determining whether food exchanges take place between different nests. Total labelling of a whole nest with sufficient quantities of ^{32}P or ^{131}I administered in honey solution leads to a transfer of considerable radioactivity to a series of nests of a colony in various directions up to 200 m. In artificially placed colonies, each consisting of nests of different ant origin, it was found that the new nests became integrated within a few weeks. A colony is thus a nutrition-physiological unit. Studies on the nest-area limits of wood-destroying Camponotus ants showed that within 24 h of tracer application it had become distributed over the entire nest area. Such an area may involve up to 12 stems or an area of 130 m, with passages in the roots. The significance of such passages for further infestation is obvious. Other applications of tracers to such processes as transpiration and respiration are discussed.

480 Kollmann, R. LOCALIZATION OF THE FUNCTIONING SIEVE CELLS IN SECONDARY PHLOEM TISSUE OF Metasequoia glyptostroboides. Planta 65, 2 (1965) 173-179. (In German)

Two to 3-yr-old twigs of M. glyptostroboides on a healthy tree in the field were fed $^{14}CO_2$ in October when cambial activity had begun. Movement of labelled materials was followed by a counting-window tube applied directly to the twig 50 cm below the feeding site. Up to 5 h after feeding, the twig was cut from the tree and plunged directly into liquid N. The frozen specimen was transferred to a cold chamber that contained a microtome and 12-15 µ longitudinal and transverse sections were cut at -20°C. The frozen sections were laid on paper strips on microscope slides and covered with other

slides to which were fastened autoradiographic film. The assembly was fastened together with rubber bands and held 1 to several weeks at -20°C. Before development, the 1st slide and its paper cover were removed and the sections fixed to the film by pouring over them a quickly-hardening 10% gelatin solution. An aphid (Cinara larvicola) that prefers larch could be made to parasitize these twigs and, by the same freezing and autoradiographing technique, the puncture by the insect's stylus was followed. Radioactivity was found only in the region of the youngest phloem cells adjacent to the cambium and the aphid punctures penetrated to this region also. (CA).

481 Krafft, B. SUR UNE POSSIBILITE D'ECHANGES DE SUBSTANCE ENTRE LES INDIVIDUS CHEZ L'ARAIGNEE SOCIALE Agelena consociata Denis. C.r. hebd. Séanc. Acad. Sci. 260, 20 (1965) 5376-5378.

Une Agelena marquée au phosphore radioactif ne transmet pas cette substance à ses congénères, sauf si l'on présente à la colonie une proie neuve qui est consommée en commun. Alors le mélange des sucs digestifs à l'intérieur de la proie aboutit à l'échange indirect de matière radioactive entre l'araignée et les autres. (Aut.)

482 Lamb, K.P., Ehrhardt, P., Moericke, V. LABELLING OF APHID SALIVA WITH RUBIDIUM-86. Nature, Lond. 214 (1967) 602-605.

Results obtained here indicate that saliva production in Aphis fabae (Scop.) continues for at least 6 h at a constant rate after feeding commences, i.e. does not cease once the phloem tissue has been reached.* Adult and nymphal virginoparae of A. fabae were labelled by feeding a medium containing $^{86}RbCl$ (200-300 µCi/ml for up to 46 h), the uptake being apparently linear with time. ^{86}Rb was readily excreted in the honeydew (11-20% of total activity of aphid/drop), the exuviae (2-8%) and in the offspring (3-4%/newborn nymph). If it is assumed that the radioactivity is uniform throughout an aphid weighing 0.5 mg, the results indicate that saliva is injected into the plant at $0.7\ \mu g/h$, i.e. $0.7 \times 10^{-3}\ \mu l/h$. Because an average salivary sheath in Vicia faba leaves measures $\sim 3.7 \times 10^{-6}\ \mu l$ this suggests that additional fluid saliva is probably injected more or less continuously during feeding. The findings are important for an understanding of the transmission of circulative plant viruses.

---

* See Kloft, 1/27, for contrary findings obtained for Myzus ascalonicus with ^{32}P

483 Lange, R. DIE NAHRUNGSVERTEILUNG UNTER DEN ARBEITERINNEN DES WALDAMEISENSTAATES. (Food distribution among workers of a forest ant colony.) Habilitationsschrift, Freiburg Univ. (West Germany). Naturwissenschaftliche-Mathematische Fakultät. 1966. (In German)

Experimental data were obtained in support of the hypothesis that both honeydew (carbohydrate) and insect prey (protein) are necessary food components for the normal maintenance of the social and reproductive life of these species. ^{32}P-labelled honeydew solutions and labelled insect haemolymph were used in the experiments. (See 484)

484 Lange, R. ÜBER DIE NAHRUNGSVERTEILUNG IM WALDAMEISENSTAAT. (Food distribution in a forest ant colony.) Wiss. Z. tech. Hochsch. (Univ.) Dresden 16, 2 (1967) 594-596. (In German)

Work on Formica polyctena by means of radioisotopes is discussed. The food intake consists of honeydew and insect prey. The use of ^{32}P-labelled honeydew and radioactive haemolymph or larvae confirmed the need for both types of food, which prove not to be distributed equally. Two kinds of work, i.e. inside and outside the colony, is carried out, the functional difference between worker ants being determined by differences in oocyte development. Radioactive sugar is essentially distributed to workers with entirely or at least largely degenerated oocytes. Only considerably later will radioactivity be found in animals with well developed oocytes. - The distribution of radioactive haemolymph is very different. Labelled food in the form of a radioactive Scoliopteryx larva was given. Radioactivity was later found preferentially in stages with well-developed ovarial contents. These differences indicate differences in the pathways of carbohydrate and nitrogenous food constituents. Thus, proteins and amino acids are needed specially by the queen, the brood, and workers looking after the queen. Workers in the outer services, on the other hand, are primarily in need of energy, i.e. a supply of carbohydrates.

485 Montagner, H. LE MECANISME ET LES CONSEQUENCES DES COMPORTEMENTS TROPHALLACTIQUES CHEZ LES GUEPES DU GENRE Vespa. Thesis, Nancy Univ. (France). 1966.

The mechanism of food transmission between two wasps in their nest was studied using colloidal gold (^{198}Au) and films of high sensitivity, run at 64 frames/s. The main social implications were investigated. Details of trophallactic contacts were analysed. They follow complex stimulation and responses which give rise to tactile and olfactory inter-communication. The part played by the various stimuli which initiate trophallactic contact was investigated. The antennae of both wasps could be shown to play an important part at the moment at which mandibular contact is established between them. Visual stimuli are not very important but body scent accounts for the mutual attraction which precedes trophallaxis itself. Trophallaxis continues only if both establish and maintain suitable and co-ordinated antennal and palpal stimulation and response. Thus a soliciting worker needs to stimulate, by means of antennal activity, the tactile receptors which lie on the mouth parts of the sollicited wasp. These stimuli provoke food regurgitation, and also a reply in which the antennae of the sollicited worker closely approach the other. Continuity of trophallactic contact depends on a stimulation/response equilibrium, which is itself a function of the quantities of food stored in the crops of the two wasps, and on the evolution of "dominance". Antennal stimuli are innate, but their precision and the subsequent response require some maturity. Exchange of antennal information during trophallaxis accounts for the establishment of a dominance scale, the direction and levels being determined by the stimulation and response efficiency of each wasp. Contact dominance by the soliciting wasp is discussed. The dominance scale affects the division of labour within the nest. Because of fluctuations in this scale this division of labour is hardly ever stable and is a factor of social rather than biological age. With the new queens in autumn, the dominance scale is disturbed, involving fights and often mutilation and death. This accounts for annual colony breakdown in the autumn, when old queens may also be killed. Queens are fed passively but must solicit food in times of stress. Males, due to their anatomy and antennal morphology are not adapted to the sensory contacts of trophallaxis. They obtain food by interposing themselves between workers in trophallaxis, and they also stimulate larvae for their fluid. The social organization in a wasps' nest therefore depends mainly on the efficiency of olfactory and tactile stimuli during trophallaxis, and the establishment or disruption of a dominance equilibrium.

486 Parry, W.H., Ford, J.B. THE ARTIFICIAL FEEDING OF PHOSPHAMIDON TO Myzus persicae: I. INTRASPECIFIC DIFFERENCES EXHIBITED BY THIS APHID ON FEEDING THROUGH A PARAFILM MEMBRANE. Entomologia exp. appl. 10, 3-4 (1967) 437-452.

Strain susceptibilities were compared in conjunction with measurements of uptake over a range of phosphamidon concentrations, using ^{32}P as the feeding indicator. Batches of 20 aphids were fed for 24 h on 10% sucrose containing several concentrations of phosphamidon. Three strains of the aphid M. persicae are described which show constant differences in their ability to feed through parafilm membranes. Two of these strains fed fairly readily through the membranes, but the third fed very little. Of the two strains which fed through the membranes, one was more sensitive to the addition of neutral red and phosphamidon to the diet than the other. This sensitivity was shown by a reduction in liquid uptake which partly accounted for the high LC50 found for this strain. On the basis of the uptake methods used, sucrose was found to be phagostimulatory. An attempt at using the susceptibility of the aphids to phosphamidon as a measure of diet acceptability had a limited success.

487 Rodriguez, J.G., Singh, P., Seay, T.N., Walling, M.V. INGESTION IN THE TWO-SPOTTED SPIDER MITE, Tetranychus urticae Koch, AS INFLUENCED BY WAVELENGTH OF LIGHT. J. Insect Physiol. 13, 6 (1967) 925-932.

The influence of varying intensities and wavelengths of light on ingestion of sucrose solution by T. urticae Koch of known age was investigated. Protonymphs and teneral adult females were fed ^{32}P in sucrose solution * and the amount ingested during a 24-h period was measured. Amounts ingested under varying intensities measured through cheesecloth and wavelengths provided through coloured gelatine filters were compared statistically. Differences in ingestion under various light intensities were not significant, nor were differences under various wavelengths in mites in the protonymph stage. As teneral adults the mites ingested most under green light (533 mμ), with yellow (590 mμ), orange (605 mμ), blue (430 mμ), red (625 mμ), unfiltered white, and black (no transmission) following in that order.

* A 3% sucrose solution containing ~25 μCi ^{32}P/ml was placed on the nutrient pad

Green, yellow, orange, and blue significantly improved feeding over black; green, yellow, and orange were significantly better than red, white, and black. Mites at both stages ingested more feeding upside down in microcages than right side up in micro Petri dishes. No correlation was shown between amount of sugar solution ingested as protonymphs and attainment of the quiescent stage. (Auth.)

488 Sen-Sarma, P.K., Kloft, W. TROPHALLAXIS IN PSEUDOWORKERS OF Kalotermes flavicollis (Fabricius) (INSECTA: ISOPTERA: KALOTERMITIDAE) USING RADIOACTIVE I^{131}. Proc. zool. Soc., Calcutta, 18 (1965) 41-46.

Individual pseudo workers were fed Na ^{131}I in sodium thiosulphate solution, with a specific activity of 1 mCi/ml, through soaked filter paper. The technique is described in detail. By measuring the biological half-life of the tracer substance a high rate of trophallaxis was found to operate among members of a group. This fact seems to explain the mechanism of the "group effect".

489 Wegorek, W., Glogowski, K., Czaplicki, E. INVESTIGATION OF HIBERNATION OF Perillus bioculatus Fabr. TAGGED WITH ^{60}Co. Ekol. pol. 13A, 23 (1965) 451-462.

Investigations were carried out on hibernation in natural conditions of Canadian bug – P. bioculatus Fabr. – the natural enemy of Leptinotarsa decemlineata Say. In these investigations the insects grown in the laboratory and tagged with ^{60}Co were used. Finding of living tagged insects in the spring of 1964 proved the possibility of hibernation of this species in the climatic conditions of Poland. (Auth.)

490 Wilson, O.E., Hunt, G.L., Jr. HABITAT SELECTION BY THE QUEENS OF TWO FIELD-DWELLING SPECIES OF ANTS. Ecology 47, 3 (1966) 485-489.

The movements of queens of Lasius neoniger and Solenopsis molesta were followed visually during nuptial flights and with the aid of radioactive tracers after the flights. During and immediately after the flight, de-alated queens were collected, anaesthetised with CO_2, and marked by placing a drop of solution containing 2.5 mCi of ^{131}I as NaI in 0.5 ml of H_2O on the mesosoma and another on the gaster, care being taken to avoid the spiracles, intersegmental membranes, and appendages. The queens of both species controlled their own direction during the flights, keeping to the preferred major habitat (mowed field) with nearly perfect efficiency. When de-alated queens of L. neoniger were experimentally displaced after the flights to woodland they exhibited a higher frequency of negative geotaxis but were very inefficient at moving out of this unfavourable environment. Displaced S. molesta queens showed no behaviour different from that in the favourable habitat and hence were completely inefficient at further macrohabitat selection. On the other hand, queens of both species choose the microhabitats (the points at which the first nests are excavated) after the flights.

See also:

44 Insect nutrition. (House, H.L., 1962)
55 Data on the accumulation, distribution and elimination of ^{85}Sr, ^{131}I and ^{137}Cs in various insect species. (Cavalloro, R., 1966)
60 Experiments on the absorption and excretion of ^{131}I by Aphis fabae Scop. (Aphidae, Homoptera, Insecta). (Ehrhardt, P. et al., 1967)
144 Ecological and nutritional studies on Coleomegilla maculata: Amino acid requirements of the adults determined by the use of C^{14} labelled acetate. (Atallah, Y.H. et al., 1967)
428 Study of the structure and function of the alimentary tract of Megoura viciae Buckt. (Aphididae, Homoptera), with special reference to food uptake and honeydew excretion. (Ehrhardt, P., 1963)
452 Bidirectional translocation in sieve tubes. (Eschrich, W., 1967)
467 Some applications of radioactive isotopes in ecological research. (Noordink, J.P.W., 1965)
491 Evolution of exchanges between different daughter colonies of Formica polyctena measured by means of radioisotopes, ^{198}Au. (Chauvin, R. et al., 1965)
492 Influence du nid à couvain sur les échanges de nourriture entre ouvrières d'abeilles (Apis mellifica). (Douault, P., 1967)
493 Study of nutritional interchanges in the ant Formica polyctena by means of radioisotopes. (Lecomte, J., 1965)
494 Food transmission within the Cryptotermes brevis colony (Isoptera: Kalotermitidae). (McMahan, E.A., 1966)

526 Radionuclide tracer study of arthropod food chains in a spartina salt marsh ecosystem. (Marples, T.G., 1966)

539 A bioassay to characterize strains and preparations of Bacillus thuringiensis Berliner. (Maas Geesteranus, H.P. et al., 1967)

540 Exudates of germinating spores of Bacillus thuringiensis. (Noordink, J.P.W. et al., 1967)

541 The use of radioactivity for the assessment of dose in bioassays involving bacterial insect pathogens. (Rogers, A.H. et al., 1966)

543 Efficiency of radioisotope transfer in predator-prey systems. (Crossley, D.A., Jr., et al., 1966)

548 Radioisotope measurement of food consumption by a leaf beetle species, Chrysomela knabi Brown. (Crossley, D.A., Jr., 1966)

552 Studies by means of the tracer method of the significance of wood-destroying carpenter ants to forestry. (Kloft, W. et al., 1964)

562 Preliminary data on the elimination rate of iron from Triatoma infestans, determined by means of radioactive iron, ^{59}Fe. (Freitas, J.R. et al., 1960)

563 Quantity of blood ingested in vivo by Phlebotomus longipalpis (Psychodidae) as determined by means of radioactive iron. (Freitas, J.R. et al., 1960)

1744 An improved tube closure for biological tests. (Lippold, P.C., 1966)

1.3.2.2. General Behaviour

See:

11 Location of univoltine Aedes eggs in woodland pool areas and experimental exposure to predators. (James, H.G., 1966)

22 The use of labeled mosquitoes for studying population problems. (Vargas L., 1964)

489 Investigation of hibernation of Perillus bioculatus Fabr. tagged with ^{60}Co. (Wegorek, W. et al., 1965)

490 Habitat selection by the queens of two field-dwelling species of ants. (Wilson, O.E. et al., 1966)

1.3.2.3. Social Behaviour

491 Chauvin, R., Lecomte, J. EVOLUTION DES ECHANGES ENTRE DIFFERENTES COLONIES-FILLES DE Formica polyctena MESUREE A L'AIDE DES RADIO-ISOTOPES. (Evolution of exchanges between different daughter colonies of Formica polyctena measured by means of radioisotopes, ^{198}Au. Insectes soc. 12 (1965) 197-200.

Les auteurs ont marqué à l'aide de ^{198}Au une série de fourmilières de F. polyctena, de juin à octobre 1964. Quelques résultats avaient déjà été obtenu en 1963. Il existe une extraordinaire activité des échanges entre une fourmilière-mère et une fourmilière-fille néoformée. La relative indépendance des échanges et du nombre de fourmis présentes sur les pistes entre K (fourmilière-mère) et K_1 n'existait sans aucune circulation de fourmis nettement décelable en juillet, alors que les échanges étaient pourtant actifs. Ceci pose un problème nouveau, d'autant plus que les échanges allant de K vers K_1 en 1964, sans piste décelable, ont été bien plus actifs qu'en 1963 avec piste: l'augmentation du bruit de fond en 1964 a atteint 700% et seulement 26% en 1963 (95 CPS en K_1 contre 75). Les caractères du système d'échanges interfourmilières paraissent stable d'une année à l'autre: échanges réduits en ce qui concerne K_5 et K_7; mais les échanges $K-K_1$ paraissent en moyenne plus actifs que ceux de K vers K_4, alors qu'en 1963 la tendance était inverse.

492 Douault, P. INFLUENCE DU NID A COUVAIN SUR LES ECHANGES DE NOURRITURE ENTRE OUVRIERES D'ABEILLES (Apis mellifica). C.r. hebd. Séanc. Acad. Sci. 264, 8 (1967) 1092-1095.

Une ruche de Chauvin, d'un cadre mesurant 95 cm de large sur 85 cm de haut, a été utilisée. La population contenait environ 3000 abeilles. Pour le marquage, l'auteur a utilisé l'or 198 à cause de sa période courte (2,7 j) et de son émission γ de 0,411 MeV. La détection de la radioactivité a été faite avec un scintillateur à lecture directe S.R.T. SPP (Ann. de l'Abeille, no. 4: 1960, 317-327). Au cours de chaque expérience une seule abeille a été marquée, en lui faisant ingérer du miel contenant quelques μCi, puis elle était déposée à l'entrée de la ruche. L'évolution de la distribution de la

radioactivité a été étudiée. Après avoir diffusé sur presque toute la surface du couvain operculé, elle s'est accumulée sur une partie du nid et s'est étendue sur une aire contenant des cellules occupées par des larvae en cours d'élevage.- Les études ont montré l'influence certaine du nid à couvain sur les échanges trophallactiques entre abeilles. La présence de la reine ne semble pas jouer un rôle important dans le déterminisme de l'emplacement où ont lieu ces échanges.

493 Lecomte, J. ETUDE DES ECHANGES ALIMENTAIRES CHEZ LA FOURMI Formica polyctena AU MOYEN DE RADIOISOTOPES. (Study of nutritional interchanges in the ant Formica polyctena by means of radioisotopes.) Meded. LandbHoogesch. OpzoekStns Gent 30, 2 (1965) 1029-1034. (In French, with French and Flemish summaries)

Les échanges de nourriture entre les colonies de fourmis Formica polyctena ont été étudiés dans le but de préciser certains points de la biologie de ces insectes dont l'intérêt comme agent de lutte biologique paraît démontré. Ces recherches ont été effectuées à l'aide d'une nourriture sucrée marquée en utilisant comme traceur l'or 198. La courte période de ce radioélément et sa facile détection ont motivé son choix. Au cours des quatre années durant lesquelles des marquages ont été opérés dans le même biotope, il a été possible de faire un certain nombre de remarques. Tout d'abord les échanges n'intéressent pas que des colonies appartenant à la même espèce. A deux reprises, il a été possible d'observer des échanges entre colonies voisines mais appartenant à des espèces différentes. Ensuite, il existe, paradoxalement, une certaine indépendance entre les groupes de travail explorant des territoires différents bien qu'appartenant à la même colonie. A l'intérieur d'un complexe de colonies appartenant toutes à l'espèce F. polyctena, il est possible de constater de fortes variations dans la tendance à échanger de la nourriture et des courants préférentiels qui semblent se retrouver d'une année sur l'autre. Ces différentes observations paraissent très importantes en ce qui concerne l'utilisation des fourmis comme agents de lutte biologique: il semble important de vérifier que les échanges de nourriture animale obéissent aux mêmes lois, grâce à une technique décrite par l'auteur. (Aut.)

494 McMahan, E.A. FOOD TRANSMISSION WITHIN THE Cryptotermes brevis COLONY (ISOPTERA: KALOTERMITIDAE). Ann. ent. Soc. Am. 59, 6 (1966) 1131-1137.

Transmission of food by proctodeal feeding within artificial "colonies" of C. brevis (Walker) nymphs was studied, using ^{57}Co. Donor termites were confined for several days in small yellow-poplar cups which had been soaked in a solution of carrier-free $^{57}CoCl_2$ and dried. (^{57}Co is a γ-emitter with a characteristic radiation of 0.123 MeV and a half-life of 270 d; dosages of the cup termitaries were originally ~20 μc/termitary, and were maintained at that level.) Four different colony densities (25, 50, 100, and 200 termites) and four different intervals of exposure to a single radioactive donor (12, 24, 48, and 96 h) were tested. As expected, the larger the colony and the longer the exposure interval, the more nymphs became radioactive. In the 25-member colony showing the fastest transmission rate, colony saturation reached virtually 100% in 96 h, while the highest percentage reached by a 200-member colony for the same interval was 50%. The average amount of radioactivity per termite decreased significantly with increase in density, but appeared not to be appreciably affected by time. Pellet production by individuals declined significantly with time, but was not significantly affected by density.

495 Medler, J.T., Wagner, R.O. ISOTOPES TO ESTIMATE COLONY SIZE OF Formica cinerea Mayr (HYMENOPTERA: FORMICIDAE). J. N.Y. ent. Soc. 72, 3 (1964) 151-159.

Ants taken from a mound were dipped in 100 ml of water containing 0.1-0.2 mCi of ^{198}Au, ^{131}I, and ^{32}P and then returned to the mound. After 1-3 d ants in a recapture sample were scanned singly with an end-window Geiger-Müller tube to determine radioactive disintegration per min. The colony size was estimated by the Lincoln Index. After preliminary trials, ^{131}I was not used because of ant mortality, and ^{198}Au because of its short half-life. A satisfactory method of using ^{32}P was not developed, largely because of contamination between treated and non-treated ants, and the variable counts given by ants in the recapture sample. Experiments with dipping time, radioisotope concentrations and use of spreader-sticker additives did not materially improve the method. The variability in tagging was related to the difference in sizes of worker ants. (Auth.)

See also:

468 Analyse de différents facteurs conditionnant les échanges alimentaires dans une colonie d'abeilles Apis mellifica L. au moyen du radioisotope P^{32}. (Pershad, S., 1967)

472 Echanges protidiques entre fourmilières de Formica polyctena, mesurés à l'aide de radio-isotopes. (Chauvin, R. et al., 1966)

479 Radioecological investigation of forest Formicidae. (Kloft, W., 1967)

485 Le mécanisme et les conséquences des comportements trophallactiques chez les guêpes du genre Vespa. (Montagner, H., 1966)

552 Studies by means of the tracer method of the significance of wood-destroying carpenter ants to forestry. (Kloft, W. et al., 1964)

1.3.2.4. Dispersal and Migration

496 Battelle-Northwest, Richland, Wash. Pacific Northwest Lab. PACIFIC NORTHWEST LABORATORY MONTHLY ACTIVITIES REPORT, OCTOBER 1966, ON AEC DIVISION OF BIOLOGY AND MEDICINE PROGRAMS. BNWL-353 (Rev.), Nov. 1966, 18p.

Among the variety of studies reported are analysis of the short-term movements of a darkling beetle Pelecyphorus sp. and ^{51}Cr, ^{65}Zn, and ^{59}Fe concentrations in plankton, periphyton, caddis fly larvae, and shiners from the Columbia River.

497 D'Ascoli, A., Gómez-Núñez, J.C. NOTAS SOBRE LOS MEDIOS DE DISPERION DEL Rhodnius prolixus Stål. (Note on the means of dispersion of Rhodnius prolixus Stål.) Acta cient. venez. 17, 1 (1966) 22-25. (In Spanish, with English summary)

Field tests with improved radioisotope tagging technique provided preliminary data on the movement and means of dispersion of R. prolixus. This vector of Chagas' disease occupies two main habitats: palms and human dwellings. ^{60}Co-tagged males were released in a palm grove, in a palm 8 m away from a house, and in one house 4 m apart from another. It was found that in the first location tagged specimens dispersed through the adjacent palms, and moved to the nearby houses in the other two locations. The results suggest that, in addition to other reported means, R. prolixus is able to occupy new habitats by its own locomotion. The data also indicate that movement intensity is closely related to feeding frequency and that arachnids, small rodents and domestic fowl, are predators of R. prolixus. (Auth. summary)

498 Dlabola, J., Taimr, L. SOME RESULTS OBTAINED WITH THE APPLICATION OF THE TRACER METHOD IN INSECT MIGRATION AND DISPERSION STUDIES. Acta ent. bohemosl. 62, 6 (1965) 413-430. (In English)

The result of 4 years' investigation of laboratory and field marking experiments, in studies on the qualities and advantages of ^{32}P for migration, dispersal and other observations on insect displacement are reported. Leafhoppers (Javesella pellucida Fabr.) (in spring migration to new oat fields), bees and bumble bees (Bombus terrestris) (effectivity in the alfalfa field) and Meligethes beetles (dispersal after hibernation) in field conditions were studied. ^{32}P proved very useful throughout. Real maximum distances of displacement cannot be ascertained by radioisotopes with any degree of certainty when high dispersal occurs.

499 Jahn, E., Lippay, H., Weidinger, N., Schwach, G. UNTERSUCHUNGEN ÜBER DIE AUSBREITUNG VON NONNENFALTERN DURCH MARKIERUNG MIT SELTENEN ERDEN. (Study of the dispersal of the nun moth, Lymantria monacha L., by means of rare earths.) Anz. Schädlingsk. 39, 2 (1966) 17-22. (In German, with English, French, and Russian summaries)

The rare earths, Europium and Dysprosium, were prepared in a form which could be sprayed on the moth in the field. These stable nuclides were subsequently identified by neutron activation, a procedure which eliminates problems of contamination, biological half-life in relation to life stages, and of radiological and biological toxicity. Europium was preferred for field work as it was less rapidly eliminated, although Dysprosium is technically more suitable. Nun moths (Lymantria monacha L.) labelled with 1γ of Europium/individual by feeding or injection at the larval stage remained clearly tagged, as did pine spinners (Dendrolimus pini) treated similarly the previous year. Moth labelling proved successful in both laboratory and field trials by spraying with 10 γ Europium /individual; 10γ/individual of Dysprosium also proved effective in the laboratory. Dispersal studies showed that moths covered distances of 2 km.

500 Lindquist, A.W., Ikeshoji, T., Grab, B., Meillon, B. de, Khan, Z.H. DISPERSION STUDIES OF Culex pipiens fatigans TAGGED WITH ^{32}P IN THE KEMMENDINE AREA OF RANGOON, BURMA. Bull. Wld Hlth Org. 36 (1967) 21-37.

Methods are described for radioactive labelling of mosquitoes used in field dispersion studies. Between 60 000 and 70 000 3rd-and 4th-stage larvae were placed in sheet-iron vats (30×24×5 in.), and tap water (17.4 l) was added to each of four vats, together with ground dog biscuits for larval food. Radiophosphoric acid (^{32}P) was added at a concentration of 0.05 μCi/ml of water. It was expected that ^{32}P at this concentration would be adequate to tag various species of mosquito larvae. Preliminary tests with C. pipiens fatigans were made at this concentration as well as at 0.025 μCi/ml and 0.1 μCi/ml of water. The uptake of ^{32}P by the larvae depended on the length of time they were exposed in the water to the radioisotope, also by the number of larvae present, the amount of organic matter in the water, and the type of container used. Because the larvae were of different ages at the start, they showed a variation in the cpm values recorded on the scaler. However, the adult mosquitoes emerging from the treated larvae were tagged sufficiently to give 400 - 1900 for females and 300 - 1300 cpm for males. After release and collection at various field sites, the mosquitoes were killed and examined for radioactivity on a portable 5-decade battery-operated scaler. The scaling unit was a Type 1287 A unit (Dynatron Radio) and the G-M tube Type M X 108/01 with a window thickness of 1.5 to 2.5 mg/cm^2 located in a closed hardwood box. The radioactive tagging method described seemed to be harmless to the mosquitoes and gave excellent results. Radioactive adults emerging under normal conditions from larvae collected in the centre of the Kemmendine Experimental Area did not appear to differ in flight behaviour from radioactive adults released at one time in the centre. Mosquitoes of both sexes dispersed evenly in all directions from the release point. The method yielded valuable data on the daily mortality of adults and on the total mosquito population in the area. (NSA 22 : 1968, 17003)

501 Quraishi, M.S., Faghih, M.A., Esghi, N. FLIGHT RANGE, LENGTHS OF GONOTROPHIC CYCLES, AND LONGEVITY OF P^{32}-LABELLED Anopheles stephensi mysorensis. J. econ. Ent. 59, 1 (1966) 50-55.

Eggs were obtained from several thousand females collected in the experimental area. The emerging larvae were reared and 4th-instar larvae of uniform size and vigour were separated and labelled by placing 15 μCi of ^{32}P in 1.5 l of water containing ~750 larvae. An average count of 4000 and 5000 cpm were obtained per male and female, respectively. Unfed, labelled A. stephensi mysorensis Sweet and Rao, < 24 h old, were released. Both male and female mosquitoes were found to fly 1.8 km overnight. Tagged mosquitoes were captured up to a distance of 4.5 km. The first gonotrophic cycle was completed in 3-4 d and the 2nd in 6-8 d. No tagged mosquitoes were captured later than 9 d after release.

502 Quraishi, M.S., Faghih, M.A., Esghi, N. FLIGHT RANGE, LENGTHS OF GONOTROPHIC CYCLES, AND LONGEVITY OF ^{32}P-LABELLED Anopheles stephensi mysorensis. Archs envir. Hlth 12 (1966) 50-55.

503 Smittle, B.J., Hill, S.O., Phillips, F.M. MIGRATION AND DISPERSAL PATTERNS OF Fe^{59}-LABELLED LONE STAR TICKS. J. econ. Ent. 60, 4 (1967) 1029-1031.

Ticks were placed in a Büchner funnel and exposed to ferrous citrate-^{59}Fe solution by pouring the liquid over them. One minute later, the excess liquid was drawn by vacuum into the vacuum flask beneath the funnel. The same exposure was repeated three times with each group of ticks, using the same solution. Then the ticks were removed from the funnel, placed on absorbent paper, and collected in a test tube by a vacuum apparatus (see ref. I/363). ^{59}Fe-labelled lone star ticks, Amblyomma americanum (L.), were released 25 feet from shaded areas at four sites at Camp Bullis, Texas. The predominant direction of migration was toward and into the shaded areas. The ticks migrated as much as 75 ft in 72 h and a total of 95 ft in 11-12 weeks. A vacuum apparatus was used to handle the radioactive ticks.

504 * Taimr, L., Dlabola, J. RADIOISOTOPES AS TRACERS USED FOR MIGRATION STUDIES OF THE LEAFHOPPER SPECIES Calligypona pellucida F. Acta agron. hung. 12, 3/4 (1963) 321-334. (In English, with German and Russian summaries)

* See III/304, originally cited without abstract.

A technique for labelling with ^{32}P is described, both by immersion and feeding methods. Labelling did not affect the life span. In one experiment 17000 labelled specimens, predominantly male, were released. Migration and dispersal were studied. Larvae were found to be able to overwinter on grass weeds of cereals, and change location and host in the spring. There is apparently very considerable migration and dispersal (~1 km within one week) when the sweeping method becomes unsatisfactory.

505 Deleted.

506 Taimr, L., Šedivý, J., Bergmannová, E., Hanker, I. FURTHER EXPERIENCE OBTAINED IN STUDIES ON DISPERSAL FLIGHT OF Meligethes aeneus F., MARKED WITH P^{32} (COLEOPTERA). Acta ent. bohemosl. 64, 5 (1967) 325-332. (In English)

Dispersal flights of Meligethes were studied during the flowering period of the winter rape. The beetles were marked by the dipping method (into aqueous solution of primary $KH_2{}^{32}PO_4$ with an activity of 92 μCi/ml). This was combined with extemally contaminated rape blossoms (^{32}P, of an activity of 55 μCi/ml). The maximum distance of dispersal flights from the release points, direction of the dispersal flights, selection of host plants, and effects of insecticidal treatment on repopulation of rape fields by migratory beetles were studied. Labelled beetles could be readily detected directly on rape stands by the 10th day after release. Tagged beetles were found 2 h after their release in a meadow surrounded by forest, at 300 m from the release point; 388 beetles were recovered from 34 rape fields. Maximum dispersal flight took place during the first days following release; within 48 h, labelled beetles were found at a distance of 9650 m from the release point. The maximum distance covered was 15750 m. Dispersal flights took place in all directions and were not affected by either the terrain configuration or wind direction. Females migrated the same distance as males. Fields treated with DDT dust were repopulated already on the 2nd day after insecticidal treatment. In DDT aerosol and Melipax (toxaphene)-treated fields labelled beetles were found 6-8 d after treatment. Of the species singly admixed to the labelled Meligethes, radioactive individuals of Ceutorrhynchus assimilis Payk. were caught in the rape fields at a maximal distance of 5900 m.

See also:

4 A practical field method for the recovery of blackflies labelled with phosphorus-32. (Baldwin, W.F. et al., 1966)
5 The present state of the protection of potato against the Colorado beetle in the USSR and the problems involved. (Chigarev, G.A., 1963)
8 Labelling mosquitoes with radio-active iodine, ^{131}I. (Harby, L. et al., 1966)
18 Application of radiophosphorus for the marking of leafhoppers in the study of their migration. (Taimr, L. et al., 1965)
22 The use of labelled mosquitoes for studying population problems. (Vargas, L., 1964)
24 P^{32} tagging and recovery of black flies. (West, A.S., 1966)
30 Effects of tagging amounts of radioactive phosphorus on adults of the oriental fruit moth, Grapholitha molesta (Busck) (Lepidoptera: Tortricidae). (Dustan, G.G., 1966)
550 Activity of honey-bees marked with radioisotopes and moved to fields of lucerne (Medicago sativa). (Haragsim, O. et al., 1965)
551 Comparison of the activity of some geographical races of the honeybee (Apis mellifera L.) on lucerne. (Haragsim, O. et al., 1965)
554 Evaluation of activity of honeybee colonies moved to a lucerne seed field. (Šedivý, J. et al., 1966)
1609 Study on mass breeding and sterilisation of the Mediterranean fruit fly Ceratitis capitata Wied. (Scherney, F. et al., 1967)

1.3.3. Inter-Relations

1.3.3.1. Insect Environment
(Radioactive- and Insecticide-Contaminated Systems, including Deliberate Contamination and Fallout, and Food Chains)

507 Auerbach, S.I. RADIATION ECOLOGY. p. 61-118 of "Health Physics Division Annual Progress Report for Period Ending July 31, 1967". ORNL-4168, Oak Ridge National Lab., Tenn. Oct. 1967, 344p.

Studies were reported, amongst others, on the effects of γ-radiation on the survival of Drosophila populations; the distribution of ^{137}Cs, ^{60}Co, and ^{106}Ru in arthropod food chains in White Oak Lake; the distribution of ^{137}Cs in food chains in forest ecosystems; the distribution of stable Cs, K, and Na in food chains in forest ecosystems; the effects of body size on the metabolic rate of arthropods and insects; the metabolism of ^{134}Cs and ^{42}K in crickets; the effects of body-size and temperature on the metabolism of ^{134}Cs in spiders; and the metabolism of ^{187}W in crickets and milkweed bugs.

508 Barabas, B., Lupsan, V. INVESTIGATIONS ON THE RADIOACTIVITY OF HONEY. Ig., Buc. 16 (1967) 79-83. (In Roumanian)

Studies were conducted to determine the levels of natural and artificial radioactivity in honey collected in various localities in Roumania at various times of the year. Natural radioactivity would be expected to originate from ^{40}K, ^{14}C, and ^{226}Ra, and artificial radioactivity from the fallout nuclides ^{90}Sr and ^{137}Cs. Total activity, β and γ-activity, and ^{90}Sr levels were estimated in 1.5-kg samples of honey ashed at 600°C. For samples collected in 1964 in the following localities: Band (May - Jun.), Toplita (Jul. - Aug.), Caracal (May - Jun.), Brosteni (Jul. - Aug.), Tulghes (Jul. - Aug.), and Barasau (Jul. - Aug.), the artificial and total radioactivities were 109.8, 110.8; 78.0, 81.1; 23.4, 24.3; 490.8, 490.0; 446.2, 462.9; and 300.8, 304.8 pCi/kg fresh weight. The ^{90}Sr contents of the same samples, as pCi/kg fresh wt and pCi/g ash, respectively, for samples from these six localities were: 10.8, 27.0, 9.0, 16.6, 20.5, 30.7; 34.2, 21.4; 40.0, 20.0; and 38.0, 35.8. Thus ^{90}Sr accounted for about 10% of the artificial radioactivity of honey. Data on systematic variation of artificial radioactivity of honey with climate and geographical location must await analyses of ^{137}Cs in honey. On the assumption of a per capita dietary intake of 30 g of honey per day, the daily ingestion of radioactivity from this source would be 9 - 12 pCi/d, a figure well below the permissible limit. (NSA 22: 1968, 15011)

509 Battelle-Northwest, Richland, Wash. Pacific Northwest Lab. PACIFIC NORTHWEST LABORATORY MONTHLY ACTIVITIES REPORT, DECEMBER 1966 (ON) DIVISION OF BIOLOGY AND MEDICINE PROGRAMS. BNWL-370. Jan. 1967, 19p.

The ecology of darkling beetles (including Eleodes hispilabris) in the Hanford area has been studied, particularly the elevational distribution.

510 Bourdeau, P., Cavalloro, R., Myttenaere, C., Verfaillie, G. MOVEMENT OF FALLOUT RADIONUCLIDES IN IRRIGATED ECOSYSTEMS OF THE PO VALLEY ITALY. Hlth Phys. 11 (1965) 1429-1444.

Among insects, the highest levels of radionuclide accumulation, particularly of ^{144}Ce, were found in the adult dragonfly, Sympetrum depressiusculum Sel., which is the only terresterial form studied, the others (Dytiscus marginalis Scop., Hydrophilus piceus L., Notonecta glauca L., Ranatra linearis L.) being all aquatic. The relatively large amount of ^{54}Mn in Ranatra corresponded to a high concentration of stable Mn (0.12% of dry weight). Aquatic insects, fish and frogs had very similar levels. Mollusks had higher levels than fish and aquatic insects, particularly of ^{144}Ce. Levels in animals seemed to reflect habitat and diet. - In 1963 and 1964 in the Po Valley, ^{137}Cs, ^{90}Sr, ^{106}Ru, ^{144}Ce and ^{54}Mn increased in rice until harvest. In grains, most of the ^{144}Ce and ^{90}Sr was in the hull; ^{137}Cs was the most active nuclide in the endosperm. Activities were higher in perennial meadows. Covering flooded rice reduced ^{144}Ce in shoots by 72%, ^{90}Sr and ^{137}Cs by 23-26% and ^{54}Mn by 4%. Draining reduced ^{137}Cs by 19%, but increased ^{54}Mn by 62%. Panicles were similarly affected. Covering reduced all nuclides to a greater extent in meadow than in rice. ^{137}Cs appears to be quite available to rice from flooded soils.

511 California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology. ENVIRONMENTAL RADIATION. p. 72-89 of "Semiannual Progress Report for the Period Ending June 30, 1966". UCLA-12-595, 104p.

Progress is reported in various studies including one on Nevada Test Site radioecology and arthropods.

512 Coleman, D.C., Macfadyen, A. THE RECOLONIZATION OF GAMMA-IRRADIATED SOIL BY SMALL ARTHROPODS: A PRELIMINARY STUDY. Oikos 17 (1966) 62-70.

The reinvasion of radiosterilized soil by micro-organisms was studied, as well as the effect of irradiation on some nutrients in the soil. Cores of litter and soil were placed in polythene bags and irradiated in a ^{60}Co γ-source at either 2.5 or 5.0 Mrad. A few cores were irradiated at 5 Mrad with spent fuel. Analyses of exchangeable ammonium and nitrate were compared for newly irradiated samples, samples which had been in the field for eight weeks after irradiation and inoculation, and unirradiated fresh samples. Several-fold increases in ammonium and nitrate in irradiated cores persisted, with little change, throughout the course of the experiment. The numbers of microarthropods recolonizing irradiated cores were assessed two months after return of the cores to the field. Soil microarthropods recolonized irradiated, inoculated samples in some cases in patterns varying with different species of fungi. Respiration of cores after irradiation was at first lower than, and subsequently higher than, that of unirradiated control cores for a month afterward. The methods described are offered as tools for possible use in more detailed studies of the litter-soil ecosystem. (NSA 21: 1967, 22371)

513 Coleman, D.C. FOOD WEBS OF SMALL MYCOPHAGOUS ARTHROPODS OF A BROOMSEDGE FIELD. "New York Meeting of the Ecological Socley of America, New York, N.Y. Dec. 26-31, 1967". AED-CONF-1967. 396-002. 6p.

^{65}Zn was used to follow the movement of fungal organic matter. Special attention was paid to Geotrichum mycelia. Labelling was essentially the result of adsorption. The microarthropods studied consisted of Acaridei (Tyrophagus sp.), Mesostigmata, and Oribatei (Oppia sp.). The food web study shows that ^{65}Zn is more sensitive for samples of very small mass. No pooling of samples is required. Clearly, only a small amount of a given species of soil fungus or its decomposed portions is consumed by various small arthropods. However, two of the mite species ingested and retained ~20% of the initial fungal specific activity. Refinements of the method are discussed.

514 Crossley, D.A., Jr., Witkamp, M. SOIL BIOLOGY. FOREST SOIL MITES AND MINERAL CYCLING. Acarologia 6 (1964) 137-146. "1st International Congress of Acarology, Fort Collins, Colo., USA, 2-7 Sep. 1963".

Mites and other small arthropods in forest soil exert an influence on the forest ecosystem in several ways. Their feeding processes cause a physical breakdown of fallen leaf litter, and the material passed through their intestines is more susceptible to decay by microorganisms. Fragments of leaf litter become more intimately mixed with mineral soil and are distributed vertically by the feeding activities and vertical migrations of soil mites. The impact of these activities on maintenance of the forest may be assessed by measuring quantities which reflect the functioning of the entire ecological system. Rates of cycling of minerals from tree through litter and soil and back to tree constitute one of the functional measurements which can now be made conveniently by the use of radioactive tracer techniques. In experiments at the Oak Ridge National Laboratory, leaf litter was confined in small (1 dm^2) net bags and placed on the forest floors of pine, oak, and tulip poplar stands. Gross loss of weight and of radioactive isotopes of Cs, Ru, Sr, and Co was then measured at weekly intervals; simultaneously, the succession of soil mites in the bags was followed so that the loss of weight and of minerals could be related to arthropod activities. In other experiments naphthalene was used to exclude mites and other arthropods from experimental plots (1 m^2). Comparisons with control plots showed that, after 1 year, plots without arthropods retained 55% of their leaf litter (by weight) whereas control plots retained 40%. Retention of radioactive caesium by leaf litter was changed also. Plots without arthropods retained 16% of their initial caesium content, as compared to 7.5% in control plots. (Auth.)

515 Crossley, D.A., Jr., Shanks, M.H. ^{106}Ru ELIMINATION BY BROWN CRICKETS (Acheta domesticus). p. 72 of "Health Physics Division Annual Progress Report for Period Ending July 31, 1966". ORNL-4007, Oak Ridge National Lab., Tenn. Oct. 1966, 300p.

^{106}Ru is potentially hazardous in waste disposal areas because of its mobility when released into the environment, its relatively abundant fission yield, and its moderately long half-life. ^{106}RuCl or ^{134}CsCl were supplied to cricket colonies in drinking water for several days prior to measurement of biological half-lives. Following the accumulation phase, crickets were caged separately and counted several times daily at 3 to 6-h intervals. Results suggested similar biological half-lives for longer components of Cs and Ru elimination. Elimination rates and distribution in various tissues are discussed. ^{106}Ru was rapidly cleared from crop and gizzard. Mid- and hind-gut concentrations decreased at rates similar to the whole-body longer components. Cs is known to concentrate in the intestinal walls of orthopterans. However, it was also found distributed among muscle, fat body, and other soft tissues of insects, whereas ^{106}Ru concentrated mainly in the intestinal walls and was not detected in the fat body of Acheta (nor was either radionuclide detected in the integument).

516 Crossley, D.A., Jr. COMPARATIVE MOVEMENT OF ^{106}Ru, ^{60}Co, AND ^{137}Cs IN ARTHROPOD FOOD CHAINS. ORNL-P-3081, Oak Ridge National Lab., Tenn. 1967, 24p. "2nd National Symposium on Radioecology, Ann Arbor, Mich., USA. 15-17 May 1967".

The behaviour of radiocaesium in food chains has been relatively well documented in results of environmental studies and tracer experiments, but little information is available on food chain behaviour of ^{106}Ru. New data from a waste disposal site (White Oak Lake bed) permit comparison of ^{106}Ru and ^{60}Co with the distribution of ^{137}Cs along a terrestrial food chain consisting of soil, herbaceous vegetation, herbivorous arthropods, and predaceous arthropods. Vegetation accumulated ruthenium and cobalt more efficiently than caesium (concentration factors of 0.06 vs 0.02). Herbivores also accumulated relatively more ^{106}Ru and ^{60}Co than ^{137}Cs. Predaceous arthropods had ^{106}Ru concentrations approximately twice those of herbivores, although ^{137}Cs and ^{60}Co concentrations in herbivores and predators were similar. These distributions indicate that ^{106}Ru has a greater food chain mobility than does ^{137}Cs and ^{60}Co, with an increase in concentration of ^{106}Ru in herbivore to predator transfers. Turnover rates (biological half lives) for ^{106}Ru and ^{60}Co were compared with ^{137}Cs turnover rate in one insect species (Acheta domesticus L.), and results are reasonably consistent with the data obtained from White Oak Lake bed. (Auth.)

517 Cruz, A.A., de la, Wiegert, R.G. 32-PHOSPHORUS TRACER STUDIES OF A HORSEWEED-APHID-ANT FOOD CHAIN. Am. Midl. Nat. 77 (1967) 501-509.

Earlier studies with ^{32}P have suggested that the old field ant (Dorymyrmex pyramicus), supposedly a predator and scavenger species, was feeding on horseweed (Erigeron canadensis). This supposition was based on an unusual pattern of ^{32}P uptake in the ant population. The present investigation showed that Dorymyrmex is indeed a consumer of horseweed, accomplished not through herbivory, but instead by tending aphids present on these plants and ingesting honeydew. Ants confined for 7 d to tagged horseweed plants harbouring aphids had over four times as much radioactivity as ants confined on tagged plants without aphids. The study suggests that the rapid rise and subsequent decline of ^{32}P in the ant populations in the field is characteristic of species with this food source. It may be a result of changes in the level of ^{32}P in the phloem sap together with a bias in the sampling caused by collecting ants only from the vegetation. (Aut.)

518 Douault, P. ETUDE DE LA CONTAMINATION EXTERNE DE L'ABEILLE ET DE SON MILIEU PAR UN RADIO-ISOTOPE INTRODUIT DANS LA NOURRITURE. Annls Abeille 9 (1966) 37-45.

L'auteur étudie la pollution externe de l'abeille, celle-ci étant nourrie soit avec un aliment solide (candi à reine) soit avec un aliment liquide (sirop de sucre). Cette nourriture est marquée au moyen de phosphore-32, sous la forme de phosphate de sodium. Les résultats obtenus montrent que, contrairement à ce que l'on pensait, la contamination externe de l'abeille est faible dans les deux cas. La contamination des cagettes dans lesquelles vivent les abeilles pendant toute la durée de l'expérience est également faible. Un examen des différents organes, et en particulier des pattes, montre bien que la radioactivité est localisée à l'intérieur du corps de l'insecte. (Aut.)

519 Douault, P. AMELIORATION D'UNE TECHNIQUE DE RECHERCHE DE LA CONTAMINATION DE L'ABEILLE MARQUEE AU MOYEN D'UN RADIO-ISOTOPE. Annls Abeille 9, 2 (1966) 165-169.

L'auteur décrit une technique facilitant la disposition d'une abeille sous l'élément de comptage d'un détecteur Geiger-Müller du type cloche. Comme isotope il a choisi le phosphore 32 sous forme de phosphate monosodique facilement incorporable à la nourriture. L'abeille est introduite

dans un tube de cellophane d'un diamètre approprié. L'abeille, ne pouvant faire aucun mouvement garde pendant toute la durée du comptage, une position rigoureusement constante. Les deux extrémités du tube sont bouchées par un léger tampon de coton afin de permettre à l'abeille de respirer. A la fin du comptage, l'insecte est récuperé facilement et cette manipulation peut se répéter plusieurs fois sans inconvénient. Cette méthode s'est révelée très intéressante car elle permet d'améliorer les conditions de comptage.

520 Fazio, C. BEES AND RADIOACTIVE ANTS. NOTE. INDICATORS OF RADIOACTIVITY. Agricoltore Ital. 12, 2 (1966) 3-8. (In Italian)

521 French, N.R. REVIEW AND DISCUSSION OF BARIUM. p.557-560 of "Radioecology", New York, Reinhold Publishing Corporation and Washington, D.C., The American Institute of Biological Sciences, 1963.

Isotopes of barium account for a sizable fraction of the activity in fresh fission products. They are readily assimilated by aquatic vertebrates and by invertebrates. They are concentrated by some insects, and perhaps by certain soil invertebrates. Mammals accumulate radiobarium in all tissues, and it is fixed in the bones. Radioactive barium may provide considerable radiation doses on a short-term basis to certain facets of the ecosystem. It is concluded that these isotopes merit increased attention by the radioecologist. (Auth.)

522 Getsova, A.B., Volkova, G.A. ACCUMULATION OF INDIVIDUAL RADIOISOTOPES BY DIFFERENT AQUATIC INSECTS. p.11-16 of "Radioaktivnye izotopy v gidrobiologii i metody sanitarnoi gidrobiologii. (Radioactive Isotopes in Hydrobiology and Methods of Sanitary Hydrobiology), Moscow-Leningrad, Nauka, 1964". Translation: Ref. Zh. Biol. (1964) 24E2.

523 Hooper, F.F., Ball, R.C. BACTERIAL TRANSPORT OF RADIOPHOSPHORUS IN A STREAM ECOSYSTEM. p.535-549 of "Symposium for the Disposal of Radioactive Waste into Sea, Oceans, and Surface Water. Vienna, Austria. 17 May 1966". Vienna, International Atomic Energy Agency, Austria. 1966, 898p.

Escherichia coli cells were cultured in a phosphorus-poor medium containing 25 mCi of ^{32}P. The procedures used allowed virtually complete uptake of the radioactive phosphorus by the cells. Cells were filtered from the medium, mixed with stream water, and released into a small coldwater stream during a 33 min period. In moving downstream approx. 10% of the radioactivity diffused from the bacterial cells and appeared in the water in filterable form. Loss of radioactivity from the water appeared to be chiefly due to the fallout of labelled cells but there was also uptake by filter feeding invertebrates. A small fraction of the ^{32}P released in soluble form by the bacterial cells was taken up by periphyton and aquatic macrophytes. Among the consumer organisms in the ecosystem only four species accumulated ^{32}P that had entered the food chain by way of bacteria. These were the caddisflies (Hydropsyche and Brachycentrus), the snail (Physa), and ammocoetes of the brook lamprey (Lampetra). Other species, including fish, accumulated only small amounts of activity: the quantity was in all cases about that expected if the source had been only the soluble phosphorus released by the bacterial cells. Failure to find important concentrations of radioactivity in any part of the chain or in the environment suggests that E. coli cells effectively disperse radioactive phosphorus and minimize the transfer activity through segments of the food web leading to man. The ecological implications of the low efficiency of the endogenous system for removal of E. coli cells are discussed. (From auth.)

524 Kornberg, H.A., Davis, J.J. FOOD CHAINS IN FRESH WATER. p.383-418 of "Radioactivity and Human Diet", Russell, R.S., Ed. Oxford, Pergamon Press, 1966, 552p.

Concentration of radionuclide content in fish as the result of feeding on radioactively contaminated food is considered. Caddisfly larvae, stonefly nymphs, and chironomid larvae take part in the food chain. The article does not enter into detail over radionuclide accumulation in insects.

525 Marples, T.G. A RADIONUCLIDE TRACER STUDY OF ARTHROPOD FOOD CHAINS IN A Spartina SALT MARSH ECOSYSTEM. Diss. Abstr. 26 (1965) 2392.

The arthropods of the Spartina marsh obtain their energy either by grazing on the marsh grass or by eating the microbial-rich organic detritus that is largely derived from dead Spartina. These two energy sources were labelled with ^{32}P in separate quadrats and the subsequent build up of radioactivity followed

in the arthropod populations sampled by sweeping. Four species of insects were the dominant grazing organisms (1 Orthopteran, 2 Hemiptera, and 1 Homoptera) while two families of Diptera (Dolichopodidae and Ephydridae) included the important insects associated with the detritus complex. The spiders were important carnivores and were obtaining the food energy from both the grazing and the detritus food chains. (DA)

526 Marples, T.G. RADIONUCLIDE TRACER STUDY OF ARTHROPOD FOOD CHAINS IN A Spartina SALT MARSH ECOSYSTEM. Ecology 47 (1966) 270-277.

A study was made of passage of radionuclides through the food chain of terrestrial arthropods after labelling grass and detritus in a salt marsh. The marsh grass was principally Spartina alterniflora. The arthropods of the Spartina marsh obtain their energy either by grazing on the marsh grass or by eating the microbial-rich organic detritus that is largely derived from the dead Spartina. Radionuclides were introduced into the food chain either by ^{32}P-labelling of the living plant or the sediment. The two energy sources were labelled in separate quadrants and the subsequent buildup of radioactivity followed in the arthropod populations. A sampling programme was conducted to obtain arthropods for monitoring the presence of the tracer in the various populations. Four species of insects were dominant grazing organisms (one Orthoptera, Orchelimum fidicinum, two Hemiptera, Trigonotylus sp. and Ischnodemus badius, and one Homoptera, Prokelisia marginata), while two families of Diptera (Dolichopodidae-Chaetopsis apicalis and C. aenea, and Ephydridae) included the important insects associated with the detritus complex. The spiders were the important carnivores and obtained their energy from both the detritus and grazing foods chains.

527 Menhinick E.F. INSECT SPECIES IN THE HERB STRATUM OF A Sericea lespedeza STAND. TID-19136, Savannah River Operations Office, (AEC), Aiken, S.C. 1963, 47p.

Insects inhabiting the herb stratum of a stand of Sericea lespedeza [Lespedeza cuneata (Dumont) G. Don] on the Savannah River Plant, Aiken, S.C., were studied by the sweep sampling method. A total of 479 species were present in 39825 adult insects examined. The most numerous were Orthoptera, Hemiptera, Homoptera, Coleoptera, and Hymenoptera. Numbers of insects were low during the winter, averaging 0.43/m²; and increased to an average of 11.25/m² during the summer. - Since lespedeza is important in the successional stages of old field ecosystems, this list of the insect fauna of the community is a useful basis for other work being carried out on the Savannah River Plant by the Ecology Laboratory. These latter studies have been concerned with estimation of community metabolism by using radioactive tracers and the fate of radioisotopes experimentally introduced into old field ecosystems.

528 Nelson, D.J., Auerbach, S.I., Kevern, N.R., Blaylock, B.G., Martin, R.E., Rosenthal, G.M., Early, R.C., Griffith, N.A. CLINCH RIVER AND RELATED AQUATIC STUDIES. p.107-115 of "Health Physics Division Annual Progress Report for Period Ending June 30, 1963". ORNL-3492, Oak Ridge National Lab., Tenn. 30 Sep. 1963, 245p.

Aquatic studies continue to emphasize the fate and effects of radionuclides released to the Clinch River via White Oak Creek. The transport of ^{90}Sr from the Clinch River by emerging aquatic midges (Chironomidae) was compared with the accrual of ^{90}Sr to the river from weapons-testing fallout. Larval development of the midges occurs in the contaminated river-bottom sediments. Emerging adults were caught in insect light traps operated on the river bank at dusk. Adults in one large, composite sample contained 8.76 times as much ^{90}Sr [$(3.55 \pm 1.13) \times 10^{-6}$ μCi/g of dry weight] as did an equal quantity of river-bottom sediment from the same location. Studies elsewhere have shown that 10 g m^{-2} yr^{-1} may be contained in the emergent insect biomass. These emergent insects would transport $(3.55 \pm 1.13) \times 10^{-5}$ μCi of ^{90}Sr per square meter per year from the river bottom. The average increment of ^{90}Sr from fallout in the United States between 1959 and 1960 was 4.2×10^{-3} Ci/square mile (1.62×10^{-3} μCi/m^2). Thus, fallout entering the river directly would add 45 times as much ^{90}Sr as removed by emerging chironomids. The salivary gland chromosomes of Chironomus tentans larvae collected from White Oak Creek and from six uncontaminated areas were examined for chromosomal aberrations. White Oak Creek populations were exposed to a dose rate calculated as 230 rad/yr, or about 1000 times background. 15 different chromosomal aberrations were found in 365 larvae taken from the irradiated population as compared with five different aberrations observed in 356 larvae from six control populations, but the mean number of aberrations per larva did not differ in any of the populations. The quantitative amount of heterozygosity was essen-

tially the same in the irradiated and the control population, but there was three times the variety of chromosomal aberrations found in the irradiated area. From this evidence it was concluded that chronic low-level irradiation from radioactive waste was increasing the variability of chromosomal aberrations without significantly increasing the frequency. (from Auth.)

529 Osburn, W.S., Jr. RADIOECOLOGY OF THE COLORADO RANGE. Terminal Report. COO-1191-10, Colorado Univ., Boulder, 1964, 173p.

The removal of fallout material from pond water is discussed. The radioactivity of the pond water, always much less than that of the surface scum and snow debris, decreased rapidly during the season. Caddisflies are important primary consumers in most tundra ponds. As would be expected, their radioactivity was quite high. Their rapid drop from nearly 4000 to < 100 piCi/g dry weight during the summer was due to a number of factors. Another drop in activity occurred at pupation. No adults were found. The fact that the caddisfly (Limnephilus)peak burden of radioactivity did not correspond with the peak for water radioactivity shows that these animals obtained their fallout loads somewhat independently of the condition of the pond water. The benthic detritus feeders had a low radioactivity throughout the summer. Occasional samples of Aedes larvae and pupae showed them to be intermediate in activity between the caddisflies and the benthic species. The other free-living species, the beetle Copelatus, showed very low amounts of radioactivity. This beetle forms the highest trophic level in the pond, for it is supposedly exclusively carnivorous. In the case of the ponds studied a general decrease in activity from one trophic level to the next occurred. This was also found true for animal predators of insects (p. 59).

530 Petty, R.O., Williams, E.C., Jr. RATES AND PATTERN OF RADIOISOTOPE RELEASE FROM FRESH TREE LITTER AT THREE LEVELS OF MESIC FOREST DEVELOPMENT. COO-1006-4, Wabash Coll., Crawfordsville, Ind. Dept. of Biology. 1965. 104p.

Findings are summarized from a 4-yr study of the rates and pattern of release of certain radioactive elements from fresh tree litter at three stages of mesophytic forest development. Young saplings of various tree species were inoculated with tracer amounts of ^{137}Cs, ^{32}P, ^{86}Rb, or ^{89}Sr and the activities in leaves, twigs, adjacent soil, and leaf litter were determined after various time intervals. The ecosystems studied included an old field, an oak forest, and a beech-maple climax forest. Records of precipitation and temperature were maintained and a number of related studies were carried out, including a study of secondary uptake of radionuclides by proximal vegetation, a survey of microbial populations in the leaf litter, and the uptake of ^{32}P by insects inhabiting the forests. Ecological implications of the findings are discussed. (NSA 20: 1966, 12566)

531 Pora, E. et al. CERCETĂRI ASUPRA INCORPORĂRII ŞI ELIMINĂRII P^{32} LA UNELE ORGANISME SALMASTRA DIN LACUL AGIGEA SI EFORIE. (Investigation of ^{32}P-uptake and clearance in some brackish organisms of the Agigea and the Eforie Lakes.) Studii Cerc. Biol., Ser. zool. 17, 4 (1965) 329-337. (In Roumanian)

Investigations were carried out at the Agigea marine station, Dubruja Region, during summer 1961 on the following material: Chironomus larvae, Odonata larvae, Corixa geofroy adults, Micronecta minutissima larvae, Cladophora sp. Myriophyllum sp., Potamogeton cardium edule, Ceramium rubrum and Mytilus galloprovincialis. Among these, the most reliable detectors of brackish water radioactivity were: Cladophora sp. occurring in the Techirghiol Lake, Myriophyllus sp. in the Agigea Lake, and Cardium edule in the Eforie Lake. A very high ^{32}P accumulation rate was recorded in algae as against the organisms studied. In higher plants, intense ^{32}P uptake occurred in the assimilation organs. Ionic ratio variations of the water (ionic imbalance) increased ^{32}P uptake and clearance rate, thus allowing for the decontamination of a brackish water basin. (Roumanian Sci. Abstr.)

532 Reichle, D.E. RADIATION PROFILE OF A HERBIVOROUS INSECT. Paper presented at the "11th Annual Meeting of the Health Physics Society, Houston, Tex., USA, 27-30 June, 1966".

The responses of insect populations in irradiated landscapes are important in the function and structural re-stabilization of such natural systems. The consequences of direct radiation insult to populations, as well as secondary effects resulting from flow of radioactive materials through ecosystems depend on an array of factors. A radiation profile was established for the evergreen bagworm, Thyridopteryx ephemeraeformis. Eggs and subsequent age classes of larvae were irradiated with a ^{60}Co γ-source (at 14.4 R/sec), with subsequent determination of LD-50/20d. In addition, field colonies were

maintained in a ^{134}Cs-contaminated forest plot, as a measure of chronic background exposure effects. Radiosensitivity decreased with increasing age of embryonic development. (2-d-old eggs: no hatching after ⩾1600 rad; 12-d-old eggs: > 25 600 rad.) The lethal limits of eggs during early development was ~16 times greater than stages immediately preceding hatching (13-14 d). 1-d-old larvae were 4-fold less radiosensitive than pre-hatch eggs. Greatest sensitivity (from LD-50 values) was at 48 h of embryonic development. Sensitivity progressively decreased through embryogenesis to hatching, and thereafter larvae exhibited an inverse relationship with body size, without significant correlation with age. The ecological significance of greater egg sensitivity is enhanced by the fact that the major portion of the life cycle (October-April) of this species is passed in this state. External γ- and total internal dose delivered to diapausing eggs in contaminated plots were far below any for which effects had been observed.

533 Reichle, D.W., Crossley, D.A., Jr. TROPHIC LEVEL CONCENTRATIONS OF Cs-137, SODIUM, AND POTASSIUM IN FOREST ARTHROPODS. ORNL-P-3065, Oak Ridge National Lab., Tenn. 1967, 21p. "2nd National Symposium on Radioecology, Ann Arbor, Mich., USA. 15-17 May 1967".

In a forest ecosystem experimentally tagged with ^{137}Cs, the trophic dynamic aspects of arthropod food chains are being investigated using radio-tracer techniques. ^{137}Cs concentrations in organisms in isotopic equilibrium with food have shown progressive reduction during dispersion through food chains, although the fractional transfer between food and consumer increased with each successive trophic level. The distribution of other alkali metals in arthropod food chains varied from that of Cs. K concentrations in primary consumers (saprovores) were a factor of 3.5 higher than in detritus, although they decreased (similar to ^{137}Cs) by a factor of 0.5 from primary consumers to predators. Na concentrations in primary consumers increased by a factor of 17 above leaf litter, and by an additional factor of 1.5 in predators. There were no significant differences in ^{137}Cs to K ratios between arthropod trophic levels. Changing elemental composition of litter during decay, nutrient availability and assimilation efficiency by arthropods, and biological half-lives of each element were parameters affecting absolute concentrations and ^{137}Cs to K ratios in each trophic level. - Oral dosing solutions for biological half-life determinations consisted of the chloride salts of ^{134}Cs, ^{42}K, or ^{24}Na dissolved in HCl diluted to 10 μCi/ml in distilled water and neutralized with $CaCO_3$. Young adult crickets, Acheta domesticus, were kept at 27°C during retention experiments.

534 Stern, V.M., Dailey, E.F., Jr. Nevada Test Site - Radioecology - Arthropods. p.86-87 of "Semiannual Progress Report for the Period Ending Dec. 31, 1966". UCLA-12-612, California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology. 105p.

An interim report on research activities is given. Seasonal variations in population density and behavioural patterns are being analysed in studies now being continued on the effects of irradiation on arthropods in the four 20-acre test plots at Rock Valley (Nevada Test Site). - Continuous recordings of soil surface temperature and at 6 and 9 in. below ground level were recorded at Rock Valley as well as wind speed at the 1-ft.-level. Techniques were continued in marking Eleodes armata and several other species. Previously (1965) marked specimens were recaptured in 1966. Studies were also initiated to develop techniques for tagging small arthropods with fluorescent pigments. Intestinal tracts of lizards are being accumulated to give a better understanding of the seasonal role played by arthropods in desert food chains.

535 Wegorek, W., Glogowski, K., Czaplicki, E. POSSIBILITY OF CONTAMINATION OF INSECTIVOROUS GAME BIRDS DURING ECOLOGICAL INVESTIGATIONS USING INSECTS LABELED WITH ^{60}Co. Ochr. Rost. 5, 2 (1963) 19-28. (In Polish)

An evaluation was made of the extent to which various tissues of game birds incorporate radiocobalt from eating insects contaminated with the radionuclide. Muscle, liver, heart, stomach, and blood of pheasants (Phasianus mongolicus) fed Colorado beetles (Leptinotarsa decemlineata) containing ^{60}Co were examined. The birds were fed with different amounts (from 13.0 - 25.0 μCi) of ^{60}Co contained in the insects, and were killed on 6th day after the last feeding. The pheasants excreted about 95% of the fed radioactivity in 3 d, beginning from the time of the last feeding of ^{60}Co-containing insects. The total max. radioactivity per pheasant was 0.084 μCi/kg, and most ^{60}Co was present in liver, heart, and stomach. The specific radioactivity of liver, heart, and stomach greatly exceeded specific activity of trunk, limb, and wing muscles. The results show that treating Colorado beetles with $^{60}Co(NO_3)_2$ for ecological investigations does not contaminate the muscles of game bird in excess of acceptable doses when appropriate measures are observed. (NSA 21: 1967, 6471)

See also:

63 Distribution and effective half-life of cobalt-58 in Habrobracon. (Grosch, D.S., 1965)
68 The uptake of strontium 90 by Chironomus varus. (Jones, T.H., 1967)
83 Effect of EDTA on coefficients of accumulation of various radioisotopes from water solution, by sweet-water hydrobionts. (Timofeeva-Resovskaya, E.A. et al., 1965)
496 Pacific Northwest Laboratory Monthly Activities Report, October 1966, on AEC Division of Biology and Medicine Programs. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab., 1966)
556 Forb-Arthropod food chains in a one-year experimental field. (Wiegert, R.G. et al., 1967)
661 The cycling of Cl-36 labelled DDT in marsh ecosystem. (Meeks, R.L. et al., 1967)
761 Water translocation of diazinon-^{14}C and parathion-^{35}S off a model cranberry bog and subsequent occurrence in fish and mussels. (Miller, C.W. et al., 1966)

1.3.3.2. Insect - Microorganism

536 Corbel, J.C. REMARQUES SUR L'INCORPORATION DE ^{35}S PAR UNE GREGARINE INTESTINALE D'INSECTE ORTHOPTERE. C.r. hebd. Séanc. Acad. Sci., Paris 261, 18 (1965) 3669-3671.

L'étude de la nutrition de Gregarina gamhami Canning (Sporozoaire grégarinomorphe) parasite de Locusta migratoria L. est entreprise à l'aide d'injections de méthionine et cystéine ^{35}S à l'hôte et par l'incubation de Grégariens dans un milieu de survie contenant ces acides aminés. Les mesures de radioactivité sont, après broyage, effectuées sur deux fractions: l'une acidosoluble, l'autre précipitable par l'aide trichlor-acétique. On trouve: (1e) La diffusion de la méthionine dans G. garnhami est rapide. Par contre, l'incorporation de cet acid aminé, ou du ^{35}S dont il était porteur, dans une macromoléeule est relativement lente. (2e) La distribution des zones radioactives des Grégarines après injection du métabolite à l'hôte, est en accord avec celle des radicaux sulfhydriles et disulfures des protéines révélés par les méthodes histochimiques usuelles. (3e) Les stades jeunes incorporent le ^{35}S plus rapidement que les stades âgés. (4e) L'épimérite ne semble pas jouer un rôle primordial dans l'incorporation du soufre. (5e) La fixation du soufre issu de la cystéine est plus intense chez les gamontes femelles que chez les mâles.

537 Donnellan, J.F., Kilby, B.A. URIC ACID METABOLISM BY SYMBIOTIC BACTERIA FROM THE FAT BODY OF Periplaneta americana. Comp. Biochem. Physiol. 22, 1 (1967) 235-252.

Na (1-^{14}C) glyoxylate, (1-^{14}C) glycerate, (2-^{14}C) allantoin, and Na (2-^{14}C) urate were used in the study. The symbiotic bacteria from the fat body of the cockroach were grown on urate in vitro. Uric acid was shown to be degraded through allantoin, allantoic acid, ureidoglycolate, glyoxylic acid, tartronic semialdehyde to glycerate and then through pyruvate and the tricarboxylic acid cycle. The bacteria also contained urease and malate synthetase. Fat body from the desert locust, Schistocerca gregaria, degrades uric acid only to allantoin. This tissue is devoid of symbionts. The significance of urate metabolism by the symbionts is discussed briefly.

538 Halkka, O., Heinonen, L. CHROMOSOME BREAKAGE ASSOCIATED WITH INFECTION. II. STAINED SECTIONS. Hereditas 58, 1-2 (1967) 253-261.

Specimens of the house cricket, Acheta domesticus, and the water scorpion, Nepa rubra, were investigated for chromosome damage caused by certain infecting microbes. The spread of a microbial infection in the spermatogonia and spermatocytes of Acheta and Nepa was investigated, with special reference to cytogenetically significant changes in the chromosomes. Whole testes or ovaries were fixed, stained with Feulgen, embedded and sectioned. A similar procedure was used for thymidine radioautography. Depending on the size of the specimen, 2-5 µl of the ^{3}H-thymidine solution (1 mCi/ml, specific activity 11.9 Ci/mM) was injected into the abdomen. In the case of intracellular infection, host and microbe labels are not easy to tell apart. Radioactivity in the nucleus and even in or at the chromosomes is not necessarily chromosomal. The initial experimental autoradiographic programme involved the use of very variable intervals between injection and fixing: 12, 18, 24, 30, ... 90, 96, and 102 h. Present results are merely preliminary. The metabolic events of spermiohistogenesis are also almost unaffected despite heavy chromosome damage. Sperm nuclei of variable size and deformed, presumably sterile sperm are formed. Cytogenetically most interesting are minor changes

in the chromosomes which follow mild infection ensuing at a late stage of spermatogenesis. Chromatin bridges and laggard chromosomes are common in the anaphases. Nondisjunction of bivalents and chromosomes, formation of tetrapolar cells and cell division without chromosome division occur in the infected cells. In some of the anaphases, partial despiralization of the chromosomes is visible. Such despiralization may indicate defectiveness in the histone component of the chromosomes.
The infective agent, which probably has a DNA genome, does not induce the formation of any diffusible toxins able to inhibit the DNA synthesis of the host. The importance of intracellular microbes as mutagenic agents is stressed. In fact, a considerable proportion of the "spontaneous mutations" may be due to intracellular parasitism. The chromosomal changes observed in Acheta are discussed with reference to the action of an oncogenic virus in Drosophila. Since the microbe responsible in Acheta is probably a rickettsia, the mechanism of chromosomal changes is discussed against the background formed by knowledge of the biochemistry of the action of a related microbe, Mycoplasma.

539 Maas Geesteranus, H. P., Noordink, J. P. W., Van den Anker, C. A. A BIOASSAY TO CHARACTERIZE STRAINS AND PREPARATIONS OF Bacillus thuringiensis Berliner. p. 302-306 of "Insect Pathology and Microbial Control". Van der Laan, P. A., Ed. Amsterdam, North-Holland Publishing Co. 1967, 360p. "Proceedings of the International Colloquium on Insect Pathology and Microbial Control. Wageningen, The Netherlands. 5-10 Sept. 1966".

The authors state that since the cessation of feeding caused in 3rd-instar larvae of P. brassicae by B. thuringiensis occurs when the infected food reaches either the pharynx or the midgut, depending on the preparation used, it is possible, by incorporating ^{32}P into a bacterial preparation and determining the amount of radioactivity in each larva (and hereby the amount of food consumed) after a given period of feeding on leaves treated with progressive concentrations, to obtain information on the composition of the preparation used, and describe the results obtained when this method was applied to three preparations of B. thuringiensis, E (Etalon 61 from the Pasteur Institute), T (Thuricide DS 11412-C) and N (Biotrol BTB 670-048).(From RAE-56:1968, ref. 11)

540 Noordink, J. P. W., Maas Geesteranus, H. P., Van den Anker, C. A. EXUDATES OF GERMINATING SPORES OF Bacillus thuringeiensis. p. 249-250 of "Insect Pathology and Microbial Control". Van der Laan, P. A., Ed. Amsterdam, North-Holland Publishing Co. 1967, 360p. "Proceedings of the International Colloquium on Insect Pathology and Microbial Control. Wageningen, The Netherlands. 5-10 Sept. 1966".

The authors report that in work with 3rd-instar larvae of P. brassicae, germinating spores of B. thuringiensis (of a strain corresponding to serotype I) appeared to produce exudates that caused a marked difference in larval food consumption, and briefly describe paper chromatographic investigations of the exudates carried out with radioactive spores obtained by the use of a culture medium labelled with ^{14}C. (RAE-A 56:1968, ref. 11)

541 Rogers, A. H., White, A. G., Wolf, J., Gibson, N. H. E. THE USE OF RADIOACTIVITY FOR THE ASSESSMENT OF DOSE IN BIOASSAYS INVOLVING BACTERIAL INSECT PATHOGENS. p. 296-302 of "Insect Pathology and Microbial Control". Van der Laan, P. A., Ed. Amsterdam, North-Holland Publishing Co. 1967, 360p. "Proceedings of the International Colloquium on Insect Pathology and Microbial Control. Wageningen, The Netherlands. 5-10 Sept. 1966".

The authors describe a technique for determining the amount of a pathogen actually ingested by a test insect, either individually or in groups, in which a measured quantity of a radioisotope (^{32}P being particularly suitable) is added to a known volume of the preparation of the pathogen, which is then mixed with the insect food, the radioactivity of the latter being determined before and after ingestion by the insect, and give details of the application of this method to the ingestion of spores and crystals of B. thuringiensis by Pieris brassicae, emphasising that the method is also applicable to other insect species, with certain modifications in the case of those that are not leaf-feeders. (From RAE-A 56:1968, ref. 11)

See also:

467 Some applications of radioactive isotopes in ecological research. (Noordink, J. P. W., 1965)
475 Relationship of tracer-measured aphid feeding to acquisition of beet western yellows virus and to feeding inhibitors in plant extracts. (Duffus, J. E. et al., 1967)

1.3.3.3. Insect - Animal
(including Parasite and Predator Relationships)

542 Berendyayeva, E. L. et al. EXPERIENCE OF STUDYING CONTACTS WITHIN A POPULATION OF ALTAI MARMOTS BY MEANS OF RADIOACTIVE TAGGING. Zool. Zh. 45, 3 (1966) 430-435.

Contacts among Marmota m. baibacina were traced by counting tagged fleas from untagged marmots after 30-42 d.

543 Crossley, D. A., Jr., Shanks, M. H. EFFICIENCY OF RADIOISOTOPE TRANSFER IN PREDATOR-PREY SYSTEMS. p. 71-72 of "Health Physics Division Annual Progress Report for Period Ending July 31, 1966". ORNL-4007, Oak Ridge National Lab., Tenn. Oct. 1966, 300p.

Work is reported on the evaluation of food chain transfers of radioisotopes such as ^{137}Cs and ^{90}Sr. Radioisotopes of Cs have been employed to estimate rates of dry-matter movement and energy flow in plant-to-insect transfers. Additional laboratory experiments were initiated to analyse the efficiencies of radiocaesium transfer in predator-prey trophic exchanges. The brown cricket, Acheta domesticus, served as prey species. A laboratory colony received $^{134}CsCl$ in drinking water (1.4 μCi/ml); after 1 week, individuals were removed and offered to predator cages singly. After feeding, radiocaesium accumulation in predators was evaluated by the relation

$$Cs_p = Cs_h - Cs_r - Cs_u$$

where Cs_p = radio-Cs accumulated by predator during a single feeding
Cs_h = radio-Cs in prey at initiation of feeding trial
Cs_r = radio-Cs in uneaten residues after feeding, and
Cs_u = radio-Cs unaccounted for.

Gross predatory efficiencies from the ratio $(Cs_h - Cs_r)/Cs_h$ were tabulated for Tenodera, Otocryptops, and Lycosidae. The mantis, Tenodera sinensis, accumulated ~98% of both weight and radio-Cs. Lycosid spiders were least efficient. A highly efficient accumulation of radio-Cs by predators could be demonstrated.

544 Crossley, D. A., Jr. RADIOACTIVE TRACER MEASUREMENTS OF PREDATION BY ARTHROPODS. Bull. ecol. Soc. Am. 48, 2 (1967) 64-65. Abstr.

Methods previously developed for studying herbivore-plant transfers were applied to arthropod predators and their prey in field areas tagged with ^{137}Cs. Arthropods feeding on prey tagged with radioisotopes reached an equilibrium body burden which was a function of the rate of intake and the biological half-life of the chemical element in the predator. Laboratory experiments demonstrated that predators ingested 90-100% of the radiocaesium in their prey, at least in those transfers where weight ingestion was similarly high. Turnover rates (biological half-lives) measured for predators in the laboratory were used to estimate probable food consumption rates in the tagged field areas. Results show that predaceous arthropods consume a much larger amount of the arthropod herbivore biomass than do predaceous vertebrates in an herbaceous ecosystem. For a small tagged forest stand, data are less conclusive but still suggest that predation by arthropods exceeds predation by vertebrates. (Abstr.)

545 James, H. G. INSECT PREDATORS OF UNIVOLTINE MOSQUITOES IN WOODLAND POOLS OF THE PRE-CAMBRIAN SHIELD IN ONTARIO. Can. Ent. 98, 5 (1966) 550-555.

Mosquito larvae tagged with ^{32}P were released in woodland pools to identify their predators. Large numbers of 2nd- and 3rd-instar larvae of Aedes communis (Deh.), A. stimulands (Walk.), and A. trichurus (Dyar) were collected from each of the pools and put into plastic-coated metal tanks containing 75 l of strained pond water. The isotope, as $H_3{}^{32}PO_4$, was added, to give 0.3 μCi/ml. Fourteen of 38 species of aquatic insects collected had ingested tagged Aedes. The leading predators were Dytiscidae and one species each of Gyrinus, Gerris, Callicorixa, and Asynarchus. Records are new for Asynarchus sp., Callicorixa audeni Hung., Dytiscus sp., Gerris buenoi Kirk., and Ilybius discedens Shp. The mosquito predator fauna at Cordova Mines and that of previously studied pools at Chatterton, Ontario, are compared.

546 Komeyev, G. A. THE NATURE OF (?) USE OF GREAT GERBIL COLONIES BY MIDDAY GERBILS DETERMINED BY RADIOACTIVE TAGGING. Nauch. Dokl. vŷssh. Shk., Biol. Nauk. No. 1 (1967) 26-30. (In Russian, with English summary)

No close epizootic contact was found, on studying Xenopsylla gerbilli.

547 Mook, L. J., Davies, D. M. THE EUROPEAN PRAYING MANTIS (Mantis religiosa L.) AS A PREDATOR OF THE RED-LEGGED GRASSHOPPER (Melanoplus femurrubrum (De Geer)). Can. Ent. 98, 9 (1966) 913-918.

Grasshoppers were made radioactive by feeding them leaves of dandelion (Taraxacum) and alfalfa (Medicago), sprayed with a ^{32}P-solution; ~50-100 μCi ^{32}P were used for 300-400 grasshoppers and about half of this was ingested during the feeding period. Normal food was withheld from 12-24 h before radioactive food was offered for a 24-h feeding period. Grasshoppers had been fed on non-radioactive food for 48 h prior to their being given ^{32}P-food. An assessment was made of the number of M. femurrubrum eaten by M. religiosa under seminatural conditions. The predator showed a functional response to changing prey densities with a continuously lowered increase in the number of prey removed from the population.

See also:

11 Location of univoltine Aedes eggs in woodland pool areas and experimental exposure to predators. (James, H. G., 1966)
13 A method of P^{32} labeling of the armored and soft scale predator Chilocorus bipustulatus L. (Peleg, B. A. et al., 1966)
432 Haemolymph circulation in the dragonfly wing and its suitability as substrate for the parasitic Arrenurus larvae (Acarina, Hydrachnellae). (Münchberg, P., 1963)
489 Investigation of hibernation of Perillus bioculatus Fabr. tagged with ^{60}Co. (Wegorek, W. et al., 1965)
516 Comparative movement of ^{106}Ru, ^{60}Co, and ^{137}Cs in arthropod food chains. (Crossley, D. A., Jr., 1967)
517 32-phosphorus tracer studies of a horseweed-aphid-ant food chain. (Cruy, A. A., de la et al., 1967)
529 Radioecology of the Colorado range; Terminal Report. (Osburn, W. S., Jr., 1964)
535 Possibility of contamination of insectivorous game birds during ecological investigations using insects labeled with ^{60}Co. (Wegorek, W. et al., 1963)
566 Ectoparasitic contacts between some mammalian species in great gerbil colonies. (Korneyev, G. A., 1967)
567 A quantitative estimate of the possibilities of a territorial advance of a plague epizooty in a population of great gerbils (Northern Kyzyl-kum). (Rudenchik, V. et al., 1967)

1.3.3.4. Insect - Plant (including Pollination, and Forest Infestation)

548 Crossley, D. A., Jr. RADIOISOTOPE MEASUREMENT OF FOOD CONSUMPTION BY A LEAF BEETLE SPECIES, Chrysomela knabi Brown. Ecology 47 (1966) 1-8 and ORNL-P-257, Oak Ridge National Lab., Tenn.

A radioisotope method was used previously for estimating vegetation consumption by a community of about 400 species of insects living on an area contaminated with radioactive waste effluents, the White Oak Lake bed at Oak Ridge, Tenn. Insects feeding on radioactive plants accumulated radiocaesium and reached a steady-state equilibrium concentration, in which intake of ^{137}Cs was balanced by its elimination of ^{137}Cs. Information on biological half-lives (elimination rates) for caesium provided the means for estimating ^{137}Cs intake. A study was undertaken to evaluate such a radioisotope technique by using a single insect species, for which the rate of food consumption could be measured both by radioactive tracer methods and by weighing the food in controlled experiments. Thus the uptake of ^{137}Cs was investigated for beetle larvae (C. knabi) feeding on willows in the White Oak Lake bed. Food intake rates were estimated from radiocaesium intake rates by measuring ^{137}Cs concentrations in willow leaves. Food intake rates estimated by this method for field areas were 7-16 mg dry weight of plant/

larva/d. Lab measurements of food consumption rates, by comparison, were about 9-10 mg/larva/d for larvae of similar size. Influences of temperature on biological half-lives were also studied, but no correction was applied to the field estimates since mean field temperatures were close to those used in lab experiments. The good agreement between lab and field measurements supports the validity of previous applications to entire communities of plant-feeding insects. The method would be equally useful with predaceous animals as with herbivores (NSA 20:1966, 35210)

549 Ehrhardt, P. ÜBER DIE BEZIEHUNG DER LATENZLARVEN VON Chaetophoria xanthomelas Koch (APHIDIDAE, HOMOPTERA) ZU IHRER WIRTSPFLANZE. (Studies on the relationship between the aestivating larvae of Chaetophoria xanthomelas Koch (Aphididae, Homoptera) and their host plant.) Z. angew. Zool. 54 (1967) 21-36. (In German, with English summary)

Contrary to the prevailing knowledge it was shown that the aestivating larvae of Ch. xanthomelas do not remain inactive in stiffness on the underside of the leaves of Acer platanoides. The gregarious larvae are quite mobile, leaving their position in the characteristically composed colony when disturbed, but returning to the same spot after a while. The aestivating larvae produce honeydew. The amount of honeydew excreted in 1 h in the average is equivalent to 10% of the larval body wt. This is consistent with the honeydew production of aphids sucking in sieve tubes. Resting in the colony or walking on the epidermis the aestivating larvae show the feeding behaviour which is typical for other aphids sucking in the phloem. Usually the stylets are intercellularly inserted in the plant tissue ending inside of a conducting bundle in the area of the phloem. In any case the nerves are punctured laterally; the stylets are never exclusively introduced into the leave tissues in vertical direction. The ejection of saliva is vigorous; inside of a conducting bundle there are frequently numerous cells completely filled with saliva. The larvae take up ^{32}P out of leaves marked with this tracer. In the beginning the radioactivity of the insects is increasing considerably, reaching a max. after 2 d, and showing no significant alteration after this time. The increase of radioactivity in the honeydew is only slight but continuous. The count-rate of the honeydew amounts to 41% of the larval radioactivity after a sucking time of 10 h and to about 25% after 48-64 h. This suggests that the aestivating larvae assimilate less phosphate than do other phloem sucking aphids developing without a diapause. The desiccation of the larvae by loss of water due to transpiration is prevented by a continuous uptake of sieve tube sap. In addition to this fact it is possible to hold up the reduced metabolism by resorption of nutrients. (Auth.)

550 Haragsim, O., Veselý, V., Šedivý, J., Taimr, L., Dočkal, J., Balcar, J. ACTIVITY OF HONEY-BEES MARKED WITH RADIOISOTOPES AND MOVED TO FIELDS OF LUCERNE (Medicago sativa). p. 1-3 of "Apimondia. 20th International Beekeeping Jubilee Congress. Bucharest, Roumania, 26-31 Aug., 1965". II/4. (In English)

Colonies of Apis mellifera caucasica were labelled with ^{32}P via mono-sodium phosphate of a specific activity of 480 µCi/ml per colony. Colonies of local hybrids (A. m. mellifica X A. m. carnica) were labelled with colloid gold (^{198}Au) (435 µCi/ml per colony). The differentiation of the differently labelled bees was effected by an absorption method, using a combination of two aluminium filters of 1058 and 405 mh/cm^2, respectively. The reliability of detection was checked on the basis of a biometrical comparison of proboscis lengths of each of the two races. Differences in flight distribution, the number of flowers visited, and the frequency of lucerne pollen masses were analysed for statistical significance. A statistically significant difference was only found between the size of the masses of lucerne pollen collected by the different species. Caucasian bees did, however, dispatch fewer foraging bees than the local hybrids. They tended to change their orientation during flight to other sources of food. There was a predominance of Melilotus sp. pollen. Contaminated flowers which had been visited by radioactive bees belonged mostly to those of compositae (Cirsium, Lappa sp.) and Convulvulus vulgaris. Radioactivity was concentrated on nectaries or in their vicinity. The significance of the glandular secretion involved during the feeding is discussed. Contaminated flowers were concentrated on the borders of the field. The advantage of moving colonies to lucerne fields for more perfect pollination has been confirmed.

551 Haragsim, O., Veselý, V., Šedivý, J., Taimr, L., Dočkal, J., Balcar, J. POROVNANI CINNOSTI NEKTERYCH GEOGRAFICKYCH RAS VCELY MEDONOSNE (Apis mellifera L.) NA VOJTESCE SETE. (Comparison of the activity of some geographical races of the honeybee (Apis mellifera L.) on luceme.) Sb. čsl. Akad. zeměd. Věd 11 (1965) 861-872. (In Czech, with Russian, English, and German summaries)

The activity of bee colonies of local origin (A. m. carnica X A. m. mellifera) and of bee colonies of the Caucasian race (A. m. caucasica) moved to pastures was compared with the activity of bees from

neighbouring apiaries. Bee colonies labelled with radioisotopes (^{32}P and ^{198}Au, respectively) when moved to a lucerne field, oriented themselves towards the flowers of lucerne. The flight of marked bees was most intensive in the immediate proximity of the locality of the hives, and decreased with distance. Flowers contamined by the bees were found up to a distance of 1 km. An effective range of flight for the practical requirements of pollination and migration of hives must be considered to be up to 500 m. The number of flowers visited by the bees of the migratory colonies and the percentage of flowers opened per minute compared with the activity of bees from neighbouring apiaries proved statistically insignificant. In all Caucasian bees caught on flowers of lucerne the pollen grains were found on the lower side of the head, and in local bees in 86.6% of cases, which is statistically different. Under the conditions of the experiment no superior pollinating activity of Caucasian bees was proved. On the basis of the observations the moving of local acclimatized colonies directly to the field proved to be a suitable measure particularly in cold, rainy years, when bees visit only plants in the immediate proximity of the hives.

552 Kloft, W., Gösswald, K. UNTERSUCHUNGEN ZUR FORSTLICHEN BEDEUTUNG DER HOLZ-ZERSTÖRENDEN ROSSAMEISEN UNTER VERWENDUNG DER TRACER-METHODE. (Studies by means of the tracer method of the significance of wood-destroying carpenter ants to forestry.) Anz. Schädlingsk. 37, 11 (1964) 163-169. (In German)

Carpenter ants of the genus Camponotus are well known as wood-destroying insects in the forests of northern and southern Europe. They have also been known to cause significant damage in Central Europe as has been illustrated in a forest in northern Bavaria, at 340 m above the sea level. Whereas individual infested stems may be found throughout the entire forest area, a high percentage of infested stems was found in sunny and warm marginal zones. The ants appear to prefer Norway spruce but also settle in pine and occasionally in oak, beech or birch. The actual damage proved to be caused by Camponotus herculeanus L. which is more arborical than C. ligniperda Latr. Knowing the pronounced tendency to regurgitate ^{131}I was fed in a diluted honey solution, to determine the precise nest area of Camponotus colonies. The nesting area of a single colony could be demonstrated to cover several stems and to be much more extensive than might be gauged from the damage visible externally.

553 Petty, R.O., Williams, E.C., Jr. RATES AND PATTERN OF RADIOISOTOPE RELEASE FROM FRESH TREE LITTER AT THREE LEVELS OF MESIC FOREST DEVELOPMENT. COO-1006-4, Wabash Coll., Crawfordsville, Ind. Dept. of Biology. 1965, 104p.

Findings are summarized from a 4 yr study of the rates and pattern of release of certain radioactive elements from fresh tree litter at three stages of mesophytic forest development. Young saplings of various tree species were inoculated with tracer amounts of ^{137}Cs, ^{32}P, ^{86}Rb, or ^{85}Sr and the activities in leaves, twigs, adjacent soil, and leaf litter were determined after various time intervals. The ecosystems studied included an old field, an oak forest, and a beech-maple climax forest. Records of precipitation and temperature were maintained and a number of related studies were carried out, including a study of secondary uptake of radionuclides by proximal vegetation, a survey of microbal populations in the leaf litter, and the uptake of ^{32}P by insects inhabiting the forests. Ecological implications of the findings are discussed. (NSA 20:1966, 12566)

554 Šedivý, J., Taimr, L., Veselý, V., Haragsim, O., Dočkal, J., Balcar, J. EVALUATION OF ACTIVITY OF HONEYBEE COLONIES MOVED TO A LUCERNE SEED FIELD. Acta. ent. bohemosl. 63. 1 (1966) 1-9. (In English)

Activity of bees moved to a lucerne seed field was studied. The bees were marked with ^{32}P and ^{198}Au. On the lucerne stand, 83.8 bees worked per 100 m^2, of which 39% were labelled bees. The percentage of marked bees decreases with increasing distance from their hives; at a distance of 200 m, there were 47%; at 500 m only 28% of labelled bees. Of the bees from neighbouring apiaries located in a radius of 2.5 km, 7.5% participated in the pollination work. Lucerne pollen masses lodged in the proboscis fossae were more frequently found in marked bees. The labelled and non-labelled bees did not differ in their activity, visiting 15 flowers/min on an average but tripping only 1.2% of the flowers visited. The percentual occurrence of labelled bees in the field was higher during early morning and late afternoon. The farthest distance from the hive covered by labelled bees was 1 km. Certain plant species were contaminated by the bees.

555 Taimr, L., Diribek, J. VYMEZENÍ OKRUHU HOSTITELSKÝCH ROSTLIN BZUNKY JEČNÉ (Oscinella frit L.) POMOCÍ P^{32} V POTRAVĚ HMYZU. (Definition of the range of host plants of the frit fly (Oscinella frit L.) by means of ^{32}P in the feeds of the insects.) Věd. Pr. výzk. Úst. rostl. Výroby Prace-Ruzyni 12 (1967) 29-36. (In Czech, with Russian, English, and German summaries)

By means of radio-phosphorus administered in the feed to imagines of the frit fly (Oscinella frit L.) the grass species most attractive for this pest were determined. They are: Arrhenatherum elatius (L.) Presl, Dactylis glomerata L., Festuca pratensis Huds., Lolium perenne L. and Phleum pratense L. Poa pratensis L. and Lolium multiflorum Lam. stand between the frequented and less frequented grass species. Less attractive species were found to be: Festuca ovina L., Trisetum flavescens (L.), P. Beauv., Festuca rubra L., Alopecurus pratensis L., and Agrostis stolonifera L. Attractiveness was estimated, on the one hand, according to the number of laid radioactive eggs, and, on the other hand, according to the length of the stay of the pest on the plant determined according to the quantity of radioactive droplets of excrements. The results obtained by means of this method conformed to the results obtained in field tests. (Auth.)

556 Wiegert, R. G., Odum, E. P., Schnell, J. H. FORB-ARTHROPOD FOOD CHAINS IN A ONE-YEAR EXPERIMENTAL FIELD. Ecology 48, 1 (1967) 75-83.

^{32}P-tracer studies of plant-arthropod food chains showed a significant difference in both consumer diversity and grazing pressure between the two dominant plant species on a 1st-yr weed field in South Carolina. Where Heterotheca subaxillaris was the labelled plant, ^{32}P was transferred readily to a number of phytophagous insects and secondarily to the predator fauna. Where only the plant Erigeron canadensis was tagged, there was little transfer of the isotope to the consumer populations, with the exceptions of the ant Dorymyrmex and the tree cricket Oecanthus. Dorymyrmex is a predator-scavenger, but also tends the aphids present on Erigeron; this latter habit accounted for the high uptake and unusual retention pattern of ^{32}P by this ant where Erigeron was tagged. Oecanthus was primarily an herbivore, but the data suggest some predation on aphids from Erigeron plants. Very little ^{32}P was transferred to the detritus eaters during the 43-d period of the study. Further support is given for the use of radioisotope to study trophic position of organisms as well as grazing pressure and food chain diversity associated with single species of terrestrial primary producers. The classification of the 28 frequent and dominant species or groups for which trophic transfer indices were calculated is given in the following checklist:

Insecta

Orthoptera:	Melanoplus femur-rubrum and M. biliteratus: grasshopper	
	Oecanthus celerinictus*: tree cricket	
	Gryllus firmus: field cricket	
Hemiptera:	Nysius raphanus: plant bug	
	Harmostes reflexulus: grass bug	
Homoptera:	Aceratagallia sanguinolenta	leafhoppers
	Empoasca sp.	leafhoppers
	Cuerna costalis	leafhoppers
	Carneocephala flaviceps	leafhoppers
	Scaphytopius acutus:	leafhoppers
	Clastoptera xanthocephala: spittlebug	
	Pissonotus delicatus	plant hoppers
	Delphacodes sp.	plant hoppers
Coleoptera:	Triplectrus rusticus: ground beetle	
	Selenophorus palliatus: ground beetle	
	S. ellipticus: ground beetle	
	Conoderus vespertinus: click beetle (or tobacco wireworm)	
	Olibrus sp.:	flower beetles
	Mordellistena sp.	flower beetles
	Altica marvegans: leaf beetle (flea beetle)	
	Apion sp.: snout beetle	

* About 8% of the tree crickets were later found to be O. quadripunctatus.

Lepidoptera: (grouped):		moths
Diptera: (grouped):		flies
Hymenoptera:	Dorymyrmex pyramicus:	pyramid ant.
other than ants: (grouped):		bees and wasps
		Arachnida
Araneida (grouped):		spiders

See also:

23 Insect labelling with rare earths for studying forest pests. (Weldinger, N. et al., 1966)
470 Study on the nutrition of Myzodes persicae Sulzer by means of ^{32}P. (Cavalloro, R., 1961)
471 Study of the tropic relation between aphids and their host plant by means of ^{14}C. (Cavalloro, R., 1963)
480 Localization of the functioning sieve cells in secondary phloem tissue of Metasequoia glyptostroboides. (Kollmann, R., 1965)

1.3.4. Population Dynamics

557 Raimundo, A. C., Roda Santos, M. L. COMBATE AOS INSECTOS. I. A MARCAÇÃO DA MOSCA DA FRUTA (Ceratitis capitata Wied.) COM FÓSFORO RADIOACTIVO P^{32} NO MÉTODO DOS MACHOS ESTERILIZADOS. (Insect control. I. Labelling the fruit fly (C. capitata) with radioactive phosphorus for the sterile-male method.) Garcia de Orta 13, 3 (1965) 351-358. (In Portuguese, with English and French summaries)

In preparation for studies on the possible eradication of C. capitata (Wied.) from Portugal by the use of the sterile-male technique, preliminary investigations were carried out on the labelling of adults with ^{32}P for population studies. Larvae were reared from the time of hatching on an artificial medium to which ^{32}P was added at rates of 0.1, 0.3, 0.5 or 1 μCi/g. The radioactivity of the resulting adults was determined 0, 1, 2, 3 and 4 weeks after emergence, and it is concluded that, when labelled flies are to be recaptured within less than a week of their release, the lowest rate, 0.1 μCi/g of larval medium, is adequate to ensure the recognition of radioactive adults, though higher doses are necessary for longer periods between release and recapture.(RAE-A 56:1968, ref. 659)

558 El-Miniawi, S. F., Hassanein, M. E. RADIOPHOSPHORUS IN LABELLING THE DESERT LOCUST FOR POPULATION ESTIMATION. Bull. Soc. ent. Egypte 48 (1964) 27-36.

Quantitative estimates were made of populations of 4th- and 5th-instar hoppers, adults, and of populations undergoing metamorphosis. Schistocerca gregaria Forsk were labelled with ^{32}P by ingestion. Activities ranged from 0.125-4 μCi/g wheat bran. Labelled wet or dry wheat bran baits were fed. Undesirable fermentation of the wet bait was controlled and mortality was reduced to a rate similar to that occurring when using green diet. The technique followed for estimating a population, density and composition, at a given interval is described, and its efficiency was tested by two statistical procedures. The method gave rise to a procedure for estimating the mortality rate in a given population. The number of percentage of hoppers emerging as adults within a given time were determined.

559 International Atomic Energy Agency, Vienna (Austria). DETERMINATION OF POPULATION DYNAMICS OF THE MEDITERRANEAN FRUIT FLY UNDER VARIOUS CONDITIONS IN TUNISIA BY MEANS OF RADIOISOTOPES; PART OF A CO-ORDINATED PROGRAMME OF INSECT CONTROL USING RADIATION. Research contract 168. p. 76-78 of "IAEA Research Contracts. Seventh Annual Report". Technical Reports Series No. 74. Vienna, International Atomic Energy Agency, 1967, 223p. STI/DOC/74.

Research Institution: Laboratory of Entomology, Tunisian National Institute of Agronomic Research, Ariana, Tunisia.
Principal scientific investigator: F. Soria.
Period of contract: 27 Dec. 1962 - 26 Dec. 1965.

1.4. ARTHROPODS AS DISEASE VECTORS

560 Broadbent, L. THE USE OF RADIOISOTOPES TO STUDY THE SPREAD OF PLANT PARASITES. p. 1-7 of "Isotopes and Radiation in Plant Pathology" Technical Reports Series No. 66. Vienna, International Atomic Energy Agency. 1966, 94p. STI/DOC/10/66.

Work with radioisotopes on pathogenic viruses, bacteria and fungi, and parasitic animals (e.g. nematodes, mites, and insect) is described. One section is devoted to studies on virus transmission by arthropods which include work on Myzus persicae, M. ascalonicus, Aphis fabae, Macrosteles fascifrons, and Orosius argentatus. Local or systemic toxicoses caused by insects are also considered as carried by M. persicae and Lygus oblineatus.

561 Dobyns, B.M. A STUDY OF THE PHYSIOLOGICAL FUNCTION AND HISTOLOGICAL CHANGES IN THYROIDS IRRADIATED WITH RADIOACTIVE IODINE. Annual Report, June 1, 1965-June 1, 1966. TID-23228, Western Reserve Univ., Cleveland, Ohio. Dept. of Biochemistry. 1 Jul. 1966, 8p.

Progress in clinical and experimental studies of the effects of radiation on the thyroid is reported. Experimental data were also collected on rats administered ^{131}I and were concerned with DNA synthesis in irradiated and antithyroid-drug stimulated rats and with nuclear changes at the time of neoplasm formation in rat thyroids. The role of fleas in transmitting Pasteurella pestis was studied.

562 Freitas, J.R., Campos, M. DADOS PRELIMINARES SOBRE O RITMO DE ELIMINACAO DO FERRO EM Triatoma infestans DETERMINADO PELO FERRO RADIOATIVO (Fe-59). (Preliminary data on the elimination rate of iron from Triatoma infestans, determined by means of radioactive iron, ^{59}Fe.) Cienc. Cult., Maracaibo 12, 3/4 (1960) 164-165. (In Portuguese)

T. infestans is a vector of Chagas' disease. Chickens were used as hosts. They were injected with ^{59}Fe in citrate solution. T. infestans was allowed to feed 2-3 d after injection. Samples of chicken blood were taken 1 h before and after feeding of T. infestans. A special scintillation counter was used to determine the quantity of blood ingested and the quantity of Fe involved. Iron elimination from T. infestans was determined. Triatoma did not eliminate Fe in the urine or in the plasma excreted a few hours after feeding. On the 6th day after feeding, adults (a) and 5th-instar nymphs (n-5) had eliminated nearly 4% of the ingested Fe whereas the remaining 50% of nymphs had not eliminated anything. By the 7th and 36th day, (a) had eliminated 43 and 71%, (n-5) 18 and 48%. Thirteen of 15 (n-1) had eliminated nothing. The quantity of faeces eliminated at the time of feeding is linked with the fasting history of the insect, the phase in its life cycle and the time for digestion. With less blood ingestion, Fe was eliminated more quickly. (a) ingested less than (n-5) and showed a more rapid digestion initially. At least 1 (a) retained ~2% Fe as it eliminated faeces without Fe.

563 Freitas, J.R., Mayrink, W., Mansur Neto, E. QUANTIDADE DE SANGUE INGERIDA IN NATURA POR Phlebotomus longipalpis (PSYCHODIDAE) DETERMINADA PELO FERRO RADIOATIVO (Fe^{59}). (Quantity of blood ingested in vivo by Phlebotomus longipalpis (Psychodidae) as determined by means of radioactive iron.) Cienc. Cult., Maracaibo 12, 3/4 (1960) 164. (In Portuguese)

In order to determine feeding rate, young cocks were injected with labelled iron citrate solution. The average blood volume was determined from the radioactivity acquired by feeding mosquitoes on the cocks. Phlebotomus longipalpis is the vector of leishmaniosis. The experiments were carried out with 100 mosquitoes originating from two captures. The average volume of blood ingested was 0.60±0.14 mg, with max. and min. values of 0.95 and 0.33 mg. They were tested in 38 batches of five mosquitoes each. The method is suitable for even smaller amounts ingested.

564 Jenkins, D.W. RADIOISOTOPES IN ENTOMOLOGICAL STUDIES OF ENDEMIC AND TROPICAL DISEASES. AD-636896, Army Biological Labs, Frederick, Md. 1960, 33p.

For abstract, see II/481.

565 Jenkins, D.W. RADIOISOTOPES IN ENTOMOLOGY AND TROPICAL MEDICINE. Science, N.Y. 133 (1961) 1836.

Two international symposia * were held recently on the present state of research and the current uses of radiation and radioisotopes in medicine and entomology. New uses are described, as the behaviour of labelled insecticides in plants and animals, insect control, use of lethal genes for control studies.

---

* 1. see "Radioisotopes and Radiation in Entomology". Proceedings of a Symposium. Bombay, 5-9 Dec. 1960. STI/PUB/38. Proceedings Series. Vienna, Austria, International Atomic Energy Agency. 1962, 307p.

2. see "Radioisotopes in Tropical Medicine". Proceedings of a Symposium. Bangkok, 12-16 Dec. 1960. STI/PUB/31. Proceedings Series. Vienna, Austria, International Atomic Energy Agency. 1962, 379p.

566 Korneyev, G. A. ECTOPARASITIC CONTACTS BETWEEN SOME MAMMALIAN SPECIES IN GREAT GERBIL COLONIES. Parazitologiya 1, 3 (1967) 233-237.

Fleas (Xenopsylla gerbilli) were shown to be transmitted by gerbils and weasels by using radioisotopes for labelling.

567 Rudenchik, Y. V. et al. A QUANTITATIVE ESTIMATE OF THE POSSIBILITIES OF A TERRITORIAL ADVANCE OF A PLAGUE EPIZOOTY IN A POPULATION OF GREAT GERBILS (NORTHERN KYZYL-KUM). Zool. Zh. 46, 1 (1967) 117-123. (In Russian, with English translation?)

Epizootic spread was found to be favoured in the spring and autumn when Xenopsylla gerbilli are most active. The fleas were tagged with radioisotopes.

568 Sonenshine, D. E. USE OF RADIOISOTOPES FOR STUDIES ON THE ECOLOGY OF TICK VECTORS OF DISEASE. Progress Report, April 1, 1966-January 1, 1967. ORO-3514-1, Old Dominion Coll., Norfolk, Va. 12 Dec. 1966, 60p.

Techniques for labelling immature ticks were developed, and a comparison of the relative usefulness of different radioisotopes made (^{32}P, ^{3}H-glycine, ^{90}Sr, ^{137}Cs, ^{144}Ce in solution). Except for ^{144}Ce- and ^{32}P-treated ticks, most of the inoculated ticks laid eggs. The incorporation of radioisotopes into eggs and larvae is in some way related to (1) the period of oviposition, and (2) the activity originally inoculated into the parent. There is a lethal activity level above which hatching does not occur. Apart from inoculation, immersion and dusting techniques were tested. Samples of 100 larval ticks in 0.2 cc aqueous solution containing 2 μCi/cc ^{144}Ce, or a similar solution in which 10% dimethyl sulphoxide had been incorporated was used. Immersion was repeated using a 1 cc solution (2 μCi/cc) and a vacuum pump for rapid drying. For dusting, larvae were allowed to crawl across previously treated Sudan III powder. The efficiency of the inoculation technique, efficiency of transovarial transmission of radioisotopes, the calculation of dosage, and the biological effects of radiolabelling were studied, also the applicability of methods to other tick species. Engorged female ticks (Dermacentor variabilis, Dermacentor andersoni, and Amblyomma americanum) were inoculated with ^{14}C-glucose or ^{14}C-glycine during varying oviposit periods. Progeny of those inoculated during the late oviposit period were unsuitable because of the low radioactivity levels. A more uniform yield was obtained in the 1-5 d oviposit periods. Large populations of labelled progeny were produced. The results of field trials with radioactive larvae demonstrated the feasibility of recapture of radioactive individuals on hosts. It was concluded that mass labelling by inoculation of suitable radioactive materials can be used in field studies on the ecology of ticks. (NSA 21:1967, 6469)

569 Tatchell, R. J. SALIVARY SECRETION IN THE CATTLE TICK AS A MEANS OF WATER ELIMINATION. Nature, Lond. 213 (1967) 940-941.

During engorgement large amounts of water which have passed across the gut epithelium into the haemolymph are returned to the host in the salivary secretion of the tick. Experiments were carried out on eight ticks (Boophilus microplus (Canestrini)), each 5-6 mm in length and already attached to a calf. They were each injected with 4.4 μl (5 Ci/ml) of ^{3}H-water. From this and other experiments it would appear that in B. microplus and probably other Ixodidae the blood meal is concentrated, and electrolytic and osmotic imbalance avoided by a remarkable adaptation of the salivary secretion.

See also:

22 The use of labeled mosquitoes for studying population problems. (Vargas L., 1964)
475 Relationship of tracer-measured aphid feeding to acquisiton of beet western yellows virus and to feeding inhibitors in plant extracts. (Duffus, J. E. et al., 1967)
739 The application of radioisotopes to study the mode of action of pesticides used against plant viruses and their insect vectors. Research contract 236. (International Atomic Energy Agency, Vienna, Austria, 1967)

1.5. CHEMICAL CONTROL MEASURES

1.5.1. General Articles, Surveys

570 Costa, J.J. PENETRATION AND TRANSLOCATION OF A LABELED SYSTEMIC INSECTICIDE. p. 128-130 of "Actas de la Reunión Latino-americana de Fitotecnia. Paper presented at the 6th Latinamerican Meeting on Crop Farming. 1964". Published 1965. (In Spanish)

571 Dedek, W. RADIOAKTIVE NUKLIDE IN DER CHEMIE DER PESTIZIDE. III. (Radioactive nuclides and pesticide chemistry. III.) Atompraxis 13 (1967) 202-208. (In German)

A bibliography of 505 references, divided into sections on ^{14}C-labelled insecticides (including general reviews, phosphoric acid esters, halogenated hydrocarbons, carbamates and pyrethrins), herbicides (reviews, phenoxyacids, derivatives of benzoic acid and of aliphatic acids, carbamates, "-uron" compounds, triazine, derivatives of pyridine, miscellaneous, auxines and purines), ^{3}H-labelled insecticides, and variously labelled metals and metal compounds.

572 Disney, R. W. RADIOMETRIC DETECTION OF EXPOSURE TO INSECTICIDES. Am. J. med. Electron. 4, 2 (1965) 70-72.

The principles of the new radiometric method for the assay of cholinesterase activity in small samples of human blood are explained and the apparatus used for field assays illustrated. The advantage of this method is the use of a low substrate concentration and minimal sample dilution, which makes the method significantly more sensitive to inhibition by carbamate insecticides than conventional methods. The employment of simple microtechniques and a portable, thin end window Geiger-Müller counter enables the method to be used under field conditions. (Auth.)

573 Finlayson, D. G., McCarthy, H. R. THE MOVEMENT AND PERSISTENCE OF INSECTICIDES IN PLANT TISSUE. Res. Rev. 9 (1965) 114-152.

Comprehensive review article. It is divided into two main parts. One deals with insecticide movement in plants (foliar, fruit, root, seed, and stem absorption; translocation of systemic, residual and contaminant insecticides; metabolism; and the effects on plants). The other part deals with insecticide persistence in plant tissue (efficacy; residues). Throughout, much of the supporting data cited is drawn from studies in which radioisotopes had been used (cf. three preceding volumes of the bibliography).

574 French, A. L., Hoopingarner, R. ABSORPTION AND METABOLISM OF INSECTICIDES IN Escherichia coli. Bull. ent. Soc. Am. 12 (1966) 266. Abstr. 65. "Portland Meeting, Portland, Oreg., USA, 28 Nov.-1 Dec. 1966".

Aerobic and anerobic uptake and metabolism of ^{14}C-labelled insecticides were studied using E. coli, strain B. The insecticides and metabolites were monitored using gas chromatography and liquid scintillation counting. The adsorption and metabolism varied significantly depending upon the metabolic state of the bacteria. (Abstr.)

575 Hartisch, J. UNTERSUCHUNGEN ÜBER DAS VERHALTEN VON PFLANZENSCHUTZMITTELN IN DER PFLANZE UND IM PARASITEN UNTER VERWENDUNG MARKIERTER ATOME. (Study on the fate of plant protectants in the plant and parasites by using labelled atoms.) NachrBl. dt. PflSchutzdienst, Stuttg. 14 (1960) 26-32. (In German)

The present state of the art in the application of radioisotopes to research on plant protection is reviewed. The various methods used for testing the action and fate of fungicides, insecticides, and herbicides are described.

576 Helbig, W., Beer, M., Kuhn, E. DISTRIBUTION MEASUREMENTS FOR TESTING NEW DEVICES OF INSECTICIDE AND FUNGICIDE SPREADING. Isotopenpraxis 3 (1967) 334-338. (In German)

For testing the homogeneity of distributions of sprayed and atomized pesticides spread from air-borne or car-borne devices, new techniques of labelling with ^{198}Au were developed. Leaves of the plants or blank films exposed on the area to be investigated were measured using an automatic counting device. The method is part of testing new devices for pesticide spreading. (Auth.)

577 International Atomic Energy Agency, Vienna (Austria). RADIOISOTOPES IN THE DETECTION OF PESTICIDE RESIDUES. "Radioisotopes in the Detection of Pesticide Residues. Proceedings of a Panel. Vienna, 12-16 Apr. 1965". STI/PUB/123. Vienna, 1966. 118p.

The following topics were discussed at the panel meeting: historical background; use of radioisotopes in the detection of residues in meat and milk; the retention of triphenyltin and dieldrin, and its relevance to the toxic effects of multiple dosing; determination of rogor and cidial by the isotope dilution method; metabolism of triazine and 2,4-D herbicides, and problems with their residues in soils and plants; metabolism of chlorinated insecticides; isolation and identification of metabolites of some chlorinated insecticides and their detection by analytical methods; chemical and physical nature of plant cuticles in relation to the deposition and penetration of pesticides; development of double isotope derivative assays for measurement of pesticide residues; potential of neutron activation analysis of pesticides and metabolites; method of activation analysis for mercury in the biosphere and in foods; labeled reagents and substrates in pesticide analysis; advantages and disadvantages of conventional pesticide determination methods; problems in FAO on human and animal intoxication; problems in WHO on pesticide residues; the joint FAO/WHO programme on the toxicity of pesticide residues in food; the development and application of pesticide analysis methods.

578 Linskens, H.F., Heinen, W., Stoffers, A.L. CUTICULA OF LEAVES AND THE RESIDUE PROBLEM. Res. Rev. 8 (1965) 136-178.

This review is deliberately confined to the purely botanical problems of the physiology and pathology of the cuticular layers, including a discussion of the cuticula as a place to encounter residues. Some work in which radioisotopes were used is cited, e.g. in studies on the penetration of labelled pesticides through cuticular membranes.

579 Lisk, D.J. DETECTION AND MEASUREMENT OF PESTICIDE RESIDUES. Science, N.Y. 154 (1966) 93-98.

General article on residue sampling, extraction and isolation, spectrophotometric methods, gas chromatographic procedures, and other methods. The use of neutron activation analysis in residue analysis is mentioned (see ref. 633). Cl, Br, I, and Hg have been determined as elemental residue fractions in various samples. The method is sensitive in the part-per-billion range and often quite rapid, but will not distinguish between an element in inorganic or organic combination, and the equipment is expensive. The frequent use of ^{3}H, ^{14}C, ^{36}Cl, and ^{32}P in laboratory residue studies is pointed out.

580 Metcalf, R.L. ABSORPTION AND TRANSLOCATION OF SYSTEMIC INSECTICIDES. Agrochimica 11, 2 (1967) 105-123. (With German, French, Spanish, and Italian summaries)

The present status of systemic insecticides in agricultural pest control is reviewed. Systemic activity is determined by ability of the insecticide to penetrate roots, leaves, stem, or fruits; by optimum water solubility to permit translocation; and by sufficient stability in the plant environment. The influence of chemical structure on these factors has been evaluated using radiotracer molecules. Metabolism studies of systemic insecticides have shown the importance of the delay factor which permits the insecticides to be translocated in a relatively stable form and subsequently converted by in situ oxidation to a highly reactive and toxic molecule. This information can be utilised in the design of new systemic molecules. (Auth.)

581 Mussokin, A. P., Wladimirowa, T. M., Inkowa, J. N., Ossipow, W. A. PROBLEMS IN SYNTHESISING LABELLED COMPOUNDS. Radiochimiya No. 6 (1959) 734-737. (In Russian)

Glass apparatus with interchangeable components is described which permits the elimination and transfer of radioactive substance from one vessel to another. An improved method for synthesising $K^{14}CN$ from ^{14}C-citric acid is given.

OMISSION. Reference should here be made to 899, erroneously listed in the wrong context.

899 O'Brien, R. D. TARGET ENZYMES AND INSECTICIDAL ACTION. p. 35-39 of "Research in Pesticides". Proceedings of the "Conference on Research Needs and Approaches to the Use of Agricultural Chemicals from a Public Health Viewpoint. Davis, Calif., USA, 1-3 Oct. 1964." Chichester, C. O., Ed. New York, Academic Press. 1965. 380p.

582 O'Brien, R. D. MODE OF ACTION OF INSECTICIDES. A. Rev. Ent. 11 (1966) 369-402.

Selected areas of the field are reviewed in critical detail. The following are discussed specifically: botanicals (rotenone, nicotine); organophosphates (Ruelene®, Imidan®, Bayer 22408, Colep®, dimethoate, dichlorvos, Bidrin. Reaction with cholinesterase is discussed in some detail, also synergism and demyelination, and some objections to the "mutant aliesterase" theory in connection with resistance). Death is still considered to be caused by cholinesterase inhibition from organophosphate inhibition); and DDT (complexity of mode of action, importance of degradation by reductive dechlorination, breakdown in various systems). Other aspects considered are selective toxicity and penetration of insecticides.

583 O'Brien, R. D. "Insecticides; Action and Metabolism". New York, Academic Press. 1967. 332p.

Textbook dealing with physical toxicants, organophosphates (chemistry and inhibitory activity, action, therapy, and metabolism), carbamates, DDT and related compounds, cyclodienes, nicotinoids, rotenoids, pyrethroids, fluorine compounds, lindane and other hexachlorocyclohexanes, synergism, antagonism, and other reactions, resistance, selectivity, penetration, and environmental health problems. A number of studies in which radioisotopes had been used are mentioned in the text.

584 Parke, D. V. RADIOISOTOPES IN THE STUDY OF THE METABOLISM OF FOREIGN COMPOUNDS. Isotopes exp. Pharmac. (1965) 315-342.

A review on the metabolism of compounds labelled with ^{3}H, ^{14}C, ^{35}S, and ^{36}Cl, including industrial chemicals and solvents, food additives, drugs, and pesticides. (CA 68:1968, 20623 n)

585 Perry, A. S. BIOCHEMISTRY OF INSECTICIDE RESISTANCE IN MOSQUITOES. Mosquito News 26, 3 (1966) 301-309.

The development of insecticide resistance has been particularly noticeable in mosquitoes. The author considers resistance to DDT-type compounds, organophosphorus and carbamate insecticides, available data being discussed. In numerous studies radioisotopes had been used. (Some unpublished work by the author is cited. Thus, only ^{14}C-dieldrin was found as a product of ^{14}C-aldrin metabolism by dieldrin-resistant Aedes aegypti and Anopheles quadrimaculatus.)

586 Peterle, T. J. THE USE OF ISOTOPES TO STUDY PESTICIDE TRANSLOCATION IN NATURAL ENVIRONMENTS. p. 181-191 of "Pesticides in the Environment and their Effects on Wildlife". Proceedings of an Advanced Study Institute sponsored by the North Atlantic Treaty Organization, Monks Wood, Experimental Station, England. 1-14 July 1965. Moore, N. W., Ed. J. appl. Ecol. 3, Suppl. (1966) 311p.

Tracer techniques are useful in studying the translocation and bioaccumulation of pesticides in natural environments. Sophistication of radioassay systems requires a relatively high initial cost for equipment but savings in personnel costs should more than offset these investments over a period of time. Satisfactory, labelled pesticidal compounds are available commercially at reasonable cost. Neutron activation analysis, autoradiography, and isotope dilution methods are also potential techniques for studying pesticide residues. Parallel development of techniques for studying radioactive fallout products in natural systems is discussed. Experimental data from two field experiments involving ^{35}S-malathion and ^{36}Cl-DDT are presented as examples of the isotope tracer technique. Preliminary estimates of standard deviations

and coefficients of variation suggest a relative constancy of variability for biological specimens. (Auth. summary)

587 Schütte, H. R. "Organisch-präparative Methoden. Band 3. Radioaktive Isotope in der organischen Chemie und Biochemie". Kirsten, W., Ed. Berlin, Deutscher Verlag der Wissenschaften. 1966, 689p.

The author of this book on radioactive isotopes in organic chemistry and biochemistry gives full details and general principles of syntheses with radioisotopes. The literature includes the beginning of 1965. A very valuable appendix consists of tabulated data on the synthesis of labelled organic compounds, table 2 (p. 270-546) listing ^{14}C-compounds, giving the formula, structural formula, and starting product for each compound. A total of 1921 references, many of which fall within the scope of this bibliography are given. A similar, but of necessity much shorter table on the synthesis of ^{32}P-labelled organic compounds (p. 594-608) gives 147 references (p. 609-612), some of which are relevant. Tables on ^{35}S, ^{131}I- and ^{85}Br-labelled compounds proved not relevant. The final table on ^{36}Cl-labelled compounds (p. 674-679), with its bibliography of 35 references (p. 680) contains a few pertinent references.

588 Winteringham, F. P. W. ACTION AND INACTION OF INSECTICIDES. The Fernhurst Lecture. Jl R. Soc. Arts 110 (1962) 719-740.

Review. The review discusses the need for more selective insecticides, the problem of insecticide resistance, the incidence of resistant insects in the field, behaviouristic and physiological resistance, detoxication as a mechanism of insect resistance, mechanisms of resistance not involving enzymic detoxication, cross-resistance, and the action of insecticides. The author finally considers current trends and prospects, better use of existing insecticides, and novel methods of chemical insect control. - Radioisotopes had been used in numerous of the studies cited.

589 Winteringham, F. P. W., Disney, R. W. A RADIOMETRIC METHOD FOR ESTIMATING BLOOD CHOLINESTERASE IN THE FIELD. Bull. Wld Hlth Org. 30 (1964) 119-125.

The increasing use of anticholinesterase insecticides such as organophosphates and carbamates against agricultural pests and disease vectors has emphasized the need for effective methods of detecting exposure in man. Estimation of blood cholinesterase activity provides an index of exposure to organophosphorus compounds. Therefore, a new, radiometric method was developed which provides for the simple and rapid measurement of human blood cholinesterase under field conditions. It involves minimal dilution of samples and use of very low substrate concentrations, and is thus more sensitive to cholinesterase inhibition by reversible anticholinesterases such as carbamates than the conventional manometric or change-in-pH methods. A 20-µl sample of haemolyzed whole blood is mixed with ^{14}C-labelled acetylcholine on a cavity microscope slide. After 0.5 - 3 min the mixture is acidified and dried. Under these conditions radioactive acetate liberated enzymatically is completely volatile while the radioactive unhydrolyzed substrate is not. The loss of radioactivity on acidification and drying is therefore a direct measure of the acetylcholinesterase activity. The levels of radioactivity employed are far below those likely to present any significant health hazard or to require special lab conditions. Although the method requires a labelled substrate, a single preparation is sufficient for several hundred thousand enzyme assays. (NSA 18:64, 29572)

590 Winteringham, F. P. W. COMPARATIVE METABOLISM AND TOXICOLOGY OF ORGANIC INSECTICIDES. Studies comp. Biochem. (1965) 107-151.

A review comparing the metabolic pathways of insecticides including the DDT group, the nitrophenol group, the hexachlorocyclohexane isomers and the halogenated benzenes, those derived from the cyclodienes and their related compounds, those of botanical origin including pyrethroids, nicotine, rotenone, the organic P compounds, carbamates, and their synthetic analogues. The toxicological significance of metabolism in vivo involving the synergism and antagonism of insecticides by non-specific inhibitors and structural analogues is also discussed. Mechanisms of enzymic detoxication and their inhibition is also mentioned. (CA 65:1966, 4576f)

591 Winteringham, F. P. W. COMPARATIVE METABOLISM AND THE TOXICOLOGY OF ORGANIC INSECTICIDES. p. - ? of "Studies in Comparative Biochemistry. Proceedings of a Symposium of the Biochemical Society. Munday, M. A., Ed." Int. Ser. Monographs pure appl. Zool. Div. 23 (1967) 208p.

See also:

67 Response of insects to radiation. (Hungate, F.P., 1966)
838 Sterilisation chimique des insectes nuisibles. (Rukavishnikov, B., 1967)
1730 Potential of neutron activation analysis of pesticides and metabolites. (Bogner, R.L., 1966)
1732 Les applications de l'analyse par activation aux produits agricoles et alimentaires. (Fourcy, A., 1965)
1733 Biology and neutron radiation: agronomical applications of radioactivation analysis. (Fourcy, A., 1967)
1750 A method for collecting $^{14}CO_2$ from a hydrogen flame detector. (Robbins, J.D. et al., 1967)
1753 Determination of the suitability of a microdoser for topical application of insecticides to the Colorado potato beetle. (Taimr, L. et al., 1967)
1757 Radioactive nuclides in pesticide chemistry. II. (Dedek, W., 1967)
1791 "Proceedings of FAO/IAEA Training Course on Use of Radioisotopes in Entomology, Gainesville, Fla., 4 Oct.-26 Nov. 1965". (IAEA, 1965)

1.5.2. Fumigants

502 Abrol, Y.P., Conn, E.E. CYANIDE METABOLISM IN Lotus arabicus AND Lotus tenuis. Phytochemistry 5, 2 (1966) 237-242.

L-valine-U-^{14}C and L-isoleucine-U-^{14}C served, respectively, as effective precursors of the aglycon moieties of the 2 cyanogenic glycosides, linamarin (α-hydroxyisobutyronitrile β-D-glucoside) and lotaustralin (α-hydroxy-α-methylbutyronitrile β-D-glucoside), which occur in L. arabicus and L. tenuis. ^{14}C-labelled asparagine isolated from the tops of etiolated seedlings of these species which had been fed ^{14}C-labelled HCN was degraded, and the distribution of radioactivity was measured; the amide C atom of asparagine was derived from the nitrile C. In plants fed L-valine-U-^{14}C, the occurrence and distribution of radioactivity in ^{14}C-labelled asparagine suggested that radioactive linamarin formed from valine breaks down slowly to ^{14}C-labelled HCN which in turn is incorporated into asparagine. (CA 64:1966, 16293a)

503 Binning, A., Darby, F.J., Heenan, M.P., Smith, J.N. THE CONJUGATION OF PHENOLS WITH PHOSPHATE IN GRASS GRUBS AND FLIES. Biochem. J. 103, 1 (1967) 42-48.

House flies (Musca domestica), insecticide-susceptible blowflies (Lucilia sericata) and New Zealand grass grubs (Costelytra zealandica) were tested. They were dosed with 1-naphthol, 2-naphthol or p-nitrophenol. The corresponding monoaryl phosphates were identified in extracts of insects or excreta along with the β-glucosides and ethereal sulphates of the phenols. No diaryl phosphates or glucosiduronates were detected but an unidentified metabolite of [^{14}C] 1-naphthol was present in extracts of flies dosed with [^{14}C] 1-naphthol.

504 Boose, R.B., Terriere, L.C. QUANTITATIVE ASPECTS OF THE DETOXICATION OF NAPHTHALENE BY RESISTANT AND SUSCEPTIBLE HOUSE FLIES. J. econ. Ent. 60, 2 (1967) 580-586.

The rate of metabolism and excretion of naphthalene-1-^{14}C and 1-naphthol-1-^{14}C by resistant and susceptible strains of house flies, Musca domestica L., has been studied by means of injection and feeding experiments. Combustion of insects given single doses of the radioactive drugs has shown that both are rapidly eliminated; approximately 80% of an injected dose is excreted within 7 h and 90% in 24 h. When fed up to 0.4% 1-naphthol in sugar, the flies excrete naphthol metabolites at the rate of approximately 3 to 5 μg/d/insect. Males of both strains excrete the metabolized drug about 50% more rapidly than females. About 23 to 68% of the excreted drug is in the form of 1-naphthyl glucoside and about 8 to 17% as 1-naphthyl sulfate. Relatively more glucoside is produced by young females but the absolute amount produced by the sexes is approximately the same. Although R- and S-insects were compared both quantitatively and qualitatively for naphthol metabolism, no differences either in rate of metabolite production or in relative levels of metabolites could be seen. (Auth.)

505 Bos, B.G., van den, Aten, A.H.W., Jr. THE SYNTHESIS AND PYROLYSIS OF RADIO-ACTIVE ETHYL FORMATE ($H^{14}COOC_2H_5$). Recl Trav. chim. Pays-Bas Belg. 70 (1951) 495-498. (In English)

First, $BaCO_3$ was converted into sodium cyanide.

$$Ba^{14}CO_3 + 5\,NaN_3 \rightarrow BaO + 7\,N_2 + 2Na_2O + Na^{14}CN$$

A mixture of 100 mg of radioactive $BaCO_3$, 1 g of sodium azide and 2 g of NaCl was heated to red heat in a pyrex test tube into which a slow current of N_2 was being blown. Heating was continued for 10 min after the decomposition of the azide was finished. Then the contents of the tube were allowed to cool and water was added. The mixture was transferred to a distilling flask, which already contained 100 mg of inactive NaCN. H_2SO_4 was added and the hydrocyanic acid was distilled into ice-water. For the saponification of hydrocyanic acid a solution of NaCN in a very small volume of water is needed. Therefore the hydrocyanic acid was precipitated with silver nitrate and after filtration the silver cyanide was put into a Carius tube and mixed with 0.5 ml of water. To this suspension the equivalent quantity of a concentrated solution of NaS was added, giving solid silver sulphide and a solution of $Na^{14}CN$. The tube and its contents were first cooled in ice and salt and then an excess of concentrated hydrochloric acid was added. The tube was sealed and kept for 8 h in a water bath at 75°C to effect the saponification:

$$H^{14}CN + H^+ + 2H_2O \rightarrow H^{14}COOH + NH_4^+$$

The contents of the tube were filtered and neutralized with NaOH. The subsequent preparation of ethyl formate from the solution containing formate and chloride is described. The method of pyrolysis (heating the quartz tube containing the pumice on which the ethyl formate was decomposed to 500° C in an electric furnace) is described in detail.

596 Darby, F.J., Heenan, M.P., Smith, J.N. THE ABSENCE OF GLUCURONIDE CONJUGATES FROM 1-NAPHTHOL DOSED FLIES AND GRASS GRUBS; DETECTION OF 1-NAPHTHYLPHOSPHATE. Life Sci. 5, 16 (1966) 1499-1502.

Phenols are detoxified in most insects by formation of phenyl-β-glucosides or phenyl sulphates but the biosynthesis of glucosiduronates in flies has also been reported. The metabolism of 1-naphthol in flies (Musca domestica and Lucilia sericata) and the New Zealand grass grub (Costelytra Zealandica larvae) was reinvestigated. Radioautographs of paper chromatograms prepared from extracts of flies or grubs dosed with [^{14}C] 1-naphthol (1 mCi/mM) showed spots coinciding with the positions of 1-naphthol, 1-naphthylglucoside, 1-naphthylsulphate, and 1-naphthylphosphate but no 1-naphthyl-glucosiduronate could be detected. Dilution analyses were carried out on extracts of grass grubs which had received [^{14}C] 1-naphthol in which added 1-naphthol was reisolated and crystallised. No glucosiduronate was detected although both the glucoside and sulphate of naphthol were found. All three species produced substantial amounts of 1-naphthyl dihydrogenphosphate.

597 Levi, G., Amaducci, L. CEREBRAL AMINO ACID TRANSPORT IN VITRO: EFFECT OF HYPOXIA INDUCED BY CYANIDE IN VIVO. Life Sci. 6, 18. Pt. II. (1967) 1935-1944.

Amino acid transport was studied in brain slices from rats acutely intoxicated with cyanide. In short time experiments (3 min) the slices were preincubated for 20 min in a regular medium containing no amino acid, then ^{14}C-amino acid containing medium was added, to give a final amino acid concentration of 2mM. In exit experiments the slices were preincubated for 30 min in a ^{14}C-amino acid containing medium. Amino acid concentrations were calculated by knowing the specific activity of the medium and the radioactivity of the tissue. The amino acids used were D-glutamate, α-aminoisobutyrate, and L-lysine. No difference from controls was found when slices were incubated in a glucose-containing medium. The inhibition of amino acid accumulation and the stimulation of amino acid exit observed in control slices when a glucose-free medium was used, were significantly diminished in slices from treated animals. The significance of the finding is discussed briefly.

598 MacDiarmid, A.G., Hall, N.F. THE PREPARATION OF $NaC^{14}N$ AND $NaCN^{15}$. J. Am. chem. Soc. 75 (1953) 4850-4851.

Many methods of preparing $Na^{14}CN$ from $Ba^{14}CO_3$ have been described. The present modification of Adamson's method has as its special feature that only ordinary laboratory apparatus is used, and no special pumping or heating arrangements are necessary. Although the yields are not quite as high as those obtained in some of the methods involving more complicated apparatus (see Can. J. Res. 28B: 1950, 345), the simple procedure described is excellent for rapid preparation. - $NaC^{15}N$ was prepared from potassium phthalimide containing ^{15}N. Four preparations were carried out using ordinary potassium phthalimide; yields of 97-100% were obtained in each case.

599 Outram, L. FACTORS AFFECTING THE RESISTANCE OF INSECT EGGS TO SULPHURYL FLUORIDE I. THE UPTAKE OF SULPHURYL-^{35}S FLUORIDE BY INSECT EGGS. J. stored Prod. Res. 3, 3 (1967) 255-260.

Investigation of the uptake of sulphuryl fluoride (labelled with ^{35}S) by eggs of Schistocerca gregaria (Forsk.) and Tenebrio molitor L. showed that penetration is mainly through the micropylar complex in the locust eggs and also through the general surface of the chorion in the eggs of T. molitor. Fumigant taken up by the eggs can be divided into recoverable and irrecoverable fractions. The uptake curve for the eggs of S. gregaria shows an initial delay in uptake but is otherwise similar to that found for T. molitor, in which uptake is rapid. Susceptible eggs take up and retain more fumigant per unit time than resistant eggs. The amount of fumigant taken up varies with the stage of embryonic development, and susceptible stages contain more irrecoverable fumigant than resistant stages. (From auth.)

600 Outram, L. FACTORS AFFECTING THE RESISTANCE OF INSECT EGGS TO SULPHURYL FLUORIDE. II. THE DISTRIBUTION OF SULPHURYL-^{35}S FLUORIDE IN INSECT EGGS AFTER FUMIGATION. J. stored Prod. Res. 3, 4 (1967) 353-358.

Investigation of the distribution of sulphuryl fluoride labelled with ^{35}S in fumigated eggs of Schistocerca gregaria (Forsk.) and Tenebrio molitor L. showed that labelled sulphur was found predominantly in the chorion and the hydrolysed protein fraction of the eggs of S. gregaria. In the more susceptible eggs of T. molitor, between 20 and 40% of the labelled sulphur was found in the protein hydrolysate, and up to 75% in the trichloroacetic acid extract. Only a very small amount of the sulphur was found in the ether extracts and the residual materials. It is suggested that resistance to this fumigant is due mainly to the impermeability of the egg shell, most of the fumigant being chemically held by the proteinaceous shell and epembryonic membranes. (From RAE-A 56:1968, ref. 1078)

601 Outram, L., Call, F. APPARATUS FOR THE SYNTHESIS AND APPLICATION OF RADIOACTIVE SULPHURYL FLUORIDE TO INSECT EGGS. J. stored Prod. Res. 3, 1 (1967) 71-74.

The sulphuryl-^{35}S fluoride was synthesised from sulphuryl-^{35}S chloride by repeated passage over potassium fluoride heated to 400°C in a closed evacuated system, the exchange reaction being $SO_2Cl_2 + 2\,KF \rightarrow SO_2F_2 + 2\,KCl$. The product was transferred to a storage reservoir on the vacuum manifold, whence it could be transferred to a dosing apparatus for application to eggs. The apparatus used for exposing the insects to the labelled fumigant is described and illustrated. It consisted of a gas pipette (8.70 ml volume) above an insect chamber (22 ml). A known amount of fumigant was introduced into the fumigation chamber. Full details of the procedure are given. Hatching tests showed that eggs were not damaged by short exposures at low pressure.

602 Schuching, S. von, Enns, T. LOW PRESSURE REDUCTION OF CARBON^{14}-LABELED BARIUM CARBONATE TO CYANIDE. J. Am. chem. Soc. 78 (1956) 4255.

The conditions of reducing ^{14}C-labelled $BaCO_3$ to ^{14}C-labelled cyanide with zinc were investigated. A low pressure steel reaction vessel which allowed control of all variables was constructed and gave reproducible high yields of cyanide. (Auth.)

603 Seawright, A. A., McLean, A. E. M. THE EFFECT OF DIET ON CARBON TETRACHLORIDE METABOLISM. J. Biochem. 105, 3 (1967) 1055-1060.

Blood and liver concentrations of CCl_4 were measured, at intervals after an oral dose, in rats given stock and protein-free diets. The values did not correlate with the resistance to poisoning found in the rats on protein-free diets. The metabolism of CCl_4 to CO_2 in vivo and in liver microsomal preparations was depressed in animals given protein-free diets. Rats given a single dose of DDT were highly sensitive to CCl_4 poisoning. The livers of such animals had an increased microsomal protein content and greatly increased microsomal activity in the demethylation of Pyramidon (aminopyrine) and in the conversion of $^{14}CCl_4$ into $^{14}CO_2$. The incorporation of ^{14}C-leucine into protein by liver slices was depressed by CCl_4. This effect was decreased by addition of SKF 525A (2-diethylaminoethyl 2,2-diphenyl-2-propylacetate) and in slices from rats given protein-free diets. It is suggested that the toxicity of CCl_4 is closely linked to its metabolism. (Auth.)

604 Sixma, F. L. J., Hendriks, H., Helle, K., Hollstein, U. MICRO-SYNTHESIS OF CYANIDE FROM BARIUM CARBONATE. Recl Trav. chim. Pays-Bas Belg. 73 (1954) 161-166. (In English)

A new and very simple micro-synthesis of $H^{14}CN$ from $BaCO_3$, ammonium chloride, and potassium is described. Yields of 94±1.5% were obtained. Experiences with some other simple and fast methods described in the literature are reported as well. (Auth.)

605 Vaughan, W.R., McCane, D.I. A CONVENIENT TRANSFORMATION OF RADIOACTIVE CARBON DIOXIDE INTO RADIOACTIVE CYANIDE. J. Am. chem. Soc. 76 (1954) 2504-2505.

This paper reports a procedure which compares favourably with that of Belleau and Heard (J. Am. chem. Soc. 72:1950, 4268) with respect to yield, simplicity of manipulation and rapidity. The chief advantage of the present method over the other is the conversion of the acid to the nitrile in one step. The over-all yield obtainable for the conversion of barium carbonate to NaCN is 67-85%. The synthesis steps are (1) phenylacetic acid-1-^{14}C, to (2) phenylacetonitrile-1-^{14}C, to (3) $K^{14}CN$. The preparation of labelled cuprous cyanide is also described.

606 Voroshtsov, N.N., Koptyug, V.A. DEHYDROGENATION OF ALPHA-TETRALON BY SELENIUM, AND THE SYNTHESIS OF 1-NAPHTHOL-1-^{14}C. Zh. obshch. Khim. 28 (1958) 2981-2987. (In Russian)

On heating α-tetralon with selenium to 330°C for 10 h it was converted to asymmetric dinaphtho-(1',2' : 2,3; 1'',2'' : 4,5)-furan, with a 12.2% yield) and simultaneously dehydrogenated to form 1-naphthol (with a 31% yield). Triethylamine was used in the separation of HBr from 2-bromine-1-keto-1,2,3,4-tetrahydronaphthalene, and to effect the formation of 1-naphthol with a much greater (75-76%) yield than in the case of diethylaniline. 1-naphthol-1-^{14}C was synthesised from 1-keto-1,2,3,4-tetrahydronaphthalene-1-^{14}C, with a 63.5% yield.

607 Balazs, T., Kupfer, D. EFFECT OF DDT ON THE METABOLISM AND PRODUCTION RATE OF CORTISOL IN THE GUINEA PIG. Toxic. appl. Pharmac. 9, 1 (1966) 40-43.

The effects of a technical grade and a recrystallized sample of p,p'-DDT on the metabolism and production rate of cortisol in guinea pigs were investigated (cortisol-^{14}C). Daily oral administration of 150 mg/kg of technical grade DDT stimulated the formation of urinary polar cortisol metabolites within 1 week. Recrystallized p,p'-DDT did not induce such an alteration of cortisol metabolism. The production rate of cortisol was not altered significantly during the period investigated. (Nucl. Med.)

608 Barker, P.S., Morrison, F.O. THE BASIS OF DDT TOLERANCE IN THE LABORATORY MOUSE. Can. J. Zool. 44, 5 (1966) 879-887.

DDT tolerance in the Macdonald strain of the laboratory mouse is shown to be related to lipid content. Relatively large amounts of sesame oil injected into DDT-treated mice, either with the DDT or up until the symptoms of poisoning appeared, protected the recipients from severe symptoms and death. DDT-tolerant mice excreted ^{14}C-labelled DDT or its metabolites in the urine, at a significantly lower rate than the normal mice. DDT-susceptible mice excreted 8-10% of the injected dose of DDT within 12 d. DDT tolerance could not be related to the production of DDE or TDE. (Nucl. Med.)

609 Bogner, R.L. DEVELOPMENT OF DOUBLE ISOTOPE DERIVATIVE ASSAYS FOR MEASUREMENT OF PESTICIDE RESIDUES. p.67-77 of "Radioisotopes in the Detection of Pesticide Residues. Proceedings of a Panel, Vienna, Austria, 12-16 Apr, 1965". STI/PUB/123, International Atomic Energy Agency, Vienna (Austria). 1966, 118p.

Double isotope derivative assay methods are capable of providing a high degree of accuracy, precision, sensitivity and specificity for the microanalysis of pesticide chemical residues. Quantitative analysis is thus possible without quantitative separation, provided that qualitative isolation of the component of interest in high purity is possible. The procedures also serve as a confirmatory test of structure, and are therefore more selective and discerning than rapid gas chromatographic routines. Double-labelled $^{3}H/^{14}C$ TNDDTA [the dianilide form of TNDDT, the tetranitrated derivative of DDT, 1,1,1-trichloro-2,2-bis(4-chloro-3,5-dinitrophenyl)ethane] was prepared for the early stages of the work during which the paper and column chromatographic behaviours of ^{14}C-DDT, ^{3}H-aniline, ^{14}C-TNDDT and the double-labelled derivative were investigated. A method was devised for the double isotope derivative dilution analysis for DDT. The ratio of $^{3}H/^{14}C$ was determined by liquid scintillation spectrometry. The amount of non-radioactive DDT in each sample was calculated by the formula

$$\mu g\ DDT = \frac{x\,(R_2 - R_1)}{R_1}$$

where x = μg of ^{14}C-DDT added to each sample, R_1 = ^{3}H/^{14}C ratio of the standard derivative, and R_2 = ^{3}H/^{14}C of the sample derivative. A double isotope derivative analysis may be used for simultaneously determining DDT and DDE. – Dieldrin was also amenable to analysis which involving derivatization of ^{14}C-dieldrin with acetic-^{3}H anhydride and purification of the double-labelled derivative by multiple recrystallizations with carrier. (The double-labelled ^{3}H/^{14}C DBA (6-acetoxy-7-bromo-6,7-dehydroaldrin) was prepared by microsynthesis from dieldrin-^{14}C and acetic-^{3}H anhydride. Multiple recrystallizations with DBA carrier from methanol-water and finally methanol proved to be the only way in which a theoretical ratio of ^{3}H/^{14}C of the reaction product could be obtained. - The preparation of a stable derivative was not successful with diazinon.

610 Bracha, P., O'Brien, R.D. THE RELATION BETWEEN PHYSICAL PROPERTIES AND UPTAKE OF INSECTICIDES BY EGGS OF THE LARGE MILKWEED BUG. J. econ. Ent. 59, 5 (1966) 1255-64.

Eggs of the large milkweed bug, Oncopeltus fasciatus (Dallas), were exposed to vapours of ^{3}H- or ^{14}C-labelled insecticides, including organophosphates, carbamates, and chlorinated hydrocarbons. 1,1,1-trichloro-2,2-bis(p-chloro-^{14}C-phenyl) ethane (^{14}C-DDT) in benzene solution at 4.35 mCi/mM; 1,2,3,4-^{14}C-dieldrin in benzene solution at 9.4 mCi/mM; diisopropyl-1-^{3}H-phosphorofluoridate (^{3}H-DFP, 1 Ci/mM); S-[1,2-bis(ethoxycarbonyl)ethyl-1,2-^{14}C] O,O-dimethyl phosphorodithioate (^{14}C-malathion, 2.87 mCi/mM); o-(isopropoxy-1,3-^{14}C) phenyl methylcarbamate (10.2 mCi/mM) (^{14}C-Baygon®); 2,2-dichlororovinyl dimethyl phosphate (^{14}C-dichlorvos, 1.8 mCi/mM); O,O-dimethyl O-[p-(dimethylsulfamoyl)-^{3}H-phenyl] phosphorothioate (^{3}H-famphur, 78.3 mCi/mM); ^{3}H-O,O-dimethyl S-(N-methylcarbamoylmethyl) phosphorothioate (^{3}H-dimethoate, 50 mCi/mM); and ^{3}H-1-naphthyl methylcarbamate (^{3}H-carbaryl, 2.5 mCi/mM) and ^{3}H-3,5-diisopropylphenyl N-methylcarbamate (^{3}H-DIP, 7.4 mCi/mM) both labelled on their aromatic nucleus, were used. The amount of the compound picked up by the egg from the vapour phase and subsequently reaching the embryo was governed by the combined effects of the compound's vapour pressure and its partition coefficient, measured in an olive oil-water system. The egg's relative insensitivity to parathion as compared with dichlorvos was due to a large uptake of the latter by the embryo. Upon exposure of the eggs to compounds of similar partition coefficients the uptake was a linear function of the vapour pressure. Similarly, with compounds having a vapour pressure lower than a threshold value, uptake was directly proportional to their partition coefficient. True ovicidal action was observed only with those compounds which had a markedly high vapour pressure coupled with little lipophilic character: dichlorvos, DFP (diisopropyl phosphorofluoridate), and, at high doses, o-isopropoxyphenyl methycarbamate (Baygon®).

611 Brooks, G.T. PROGRESS IN METABOLIC STUDIES OF THE CYCLODIENE INSECTICIDES AND ITS RELEVANCE TO STRUCTURE-ACTIVITY CORRELATIONS. Wld Rev. Pest Control 5, 2 (1966) 62-84.

Review article. Since the emergence of insect resistance to cyclodiene insecticides and in view of pesticide resistance problems, the fate of these compounds in living organisms has come under close scrutiny. A summary of the present status of these investigations and a correlation between some of the findings with observed toxicities are attempted. – In vivo and in vitro studies of the commercially important cyclodiene insecticides and of cyclodiene analogues of intermediate or low toxicity are reviewed. Extensive use has been made of radioisotopes in many of the studies cited. Structure-activity considerations are also dealt with in some detail.

612 Brower, G.R. OZONATION REACTIONS OF SELECTED PESTICIDES FOR WATER POLLUTION ABATEMENT. Diss. Abstr. 28, 2 (1967) 722-B.

Saturated solutions of the pesticide aldrin were chemically oxidized by ozone. The results of gas chromatographic analyses showed that 95% of the aldrin was degraded to other compounds within 5 min. The ozonation to this extent only required about 3.7 mg/l ozone but even after prolonged ozonation, which amounted to 23.8 mg/l, there was still aldrin present. The rate of aldrin degradation reached a plateau beyond which little or no degradation occurred. The reaction in each case failed to go to completion. A ^{14}C-labelled sample of aldrin showed that no physical stripping occurred through the ozonation procedure. The characterization methods showed that the aldrin molecule was not degraded to simple inorganic molecules of the most oxidized form. Instead, indications were that half of the atoms of the original molecules were still intact after oxidation. These were the atoms on the chlorinated side of the molecule. The carbon-carbon double bond and all the chlorine atoms were probably still present. The physiological tests indicated that a saturated

solution of aldrin dissolved in a water supply can be rendered less toxic by ozonation. The ozonated products of aldrin oxidation were shown to be less toxic than aldrin to bluegill fingerlings. (From DA)

613 Chung, R.A., Huang, I.L., Brown, R.W. STUDIES OF DNA, RNA, AND PROTEIN SYNTHESIS IN HELA S CELLS EXPOSED TO DDT AND DIELDRIN. J. agric. Fd Chem. 15, 3 (1967) 497-500.

HeLa S cells were cultured in the presence of different levels of DDT and dieldrin. In the first (second) set of experiments using DDT (dieldrin) the cultures were incubated at 36°C for 24 h (48 h) following the addition of 0.1 μCi of L-leucine-^{14}C, 0.5 (0.25) μCi of thymine-^{14}C, or 0.5 (0.25) μCi of uridine-^{14}C. The total cell count decreased as DDT concentration in the culture medium was increased from 0-0.5 ppm, and this decrease became progressively less towards 50 ppm despite the lack of change in total protein content. When DDT and dieldrin concentrations were increased to 0.5 ppm ^{14}C-leucine incorporation into cellular protein increased but decreased as the DDT and dieldrin concentrations were increased to 10 and 50 ppm. The degree of change with dieldrin was less than with DDT. The changes in RNA synthesis at different DDT levels were similar to those at different dieldrin levels but dieldrin had a greater effect. At 10- and 50-ppm DDT and dieldrin levels, DNA synthesis changed very little.

614 Clark, A.G., Hitchcock, M., Smith, J.N. METABOLISM OF GAMMEXANE IN FLIES, TICKS AND LOCUSTS. Nature, Lond. 209 (1966) 103.

Gas chromatographic analyses of cattle ticks (Boophilus decoloratus) kept at 35°C overnight showed that only 77% (64-96%) of a 10 μg topical dose of gammexane was recoverable unchanged. In similar experiments with ^{14}C-gammexane 28% (8-30%) of the dose was found in the water-soluble fraction after partitioning the homogenized ticks between water and xylene. Enzymatic experiments were carried out with homogenates of cattle ticks, house flies, or locust fat body containing 5 mM glutathione at pH values between 5 and 8 and with sufficient ^{14}C-gammexane to give a concentration of 5 mM. Water-soluble radioactive products were only formed when both glutathione and enzyme were present. — The major metabolic product in all three arthropods proved to be an aromatized molecule, apparently identical with S-(2,4-dichlorphenyl)glutathione. The metabolism of gammexane is discussed.

615 Cline, R.E., Pearce, G.W. SIMILAR EFFECTS OF DDT AND CONVULSIVE HYDRAZIDES ON HOUSEFLY METABOLISM. J. Insect Physiol. 12 (1966) 153-162.

Thiocarbohydrazide (TCH) was the most toxic of numerous convulsants tested in house flies and was as toxic to a DDT-resistant strain as to a susceptible strain. The LD 50 values ranged from 0.3 μg/fly for injected aqueous TCH to 1 μg/fly for TCH dissolved in dimethylsulphoxide and benzene and applied topically. The in vivo tracer studies with formate-^{14}C revealed that both DDT and TCH increased the labelling of purines while reducing the content of radioproline. Both toxicants stimulated the production of $^{14}CO_2$ from ^{14}C-labelled proline and sugars, the increase from glucose-1-^{14}C being almost double that from glucose-6-^{14}C. D-glucosamine-1-^{14}C, D-glucose-1-^{14}C, -6-^{14}C, -U-^{14}C, DL-proline-5-^{14}C, and L-proline-U-^{14}C were used. Other similar effects of the toxicants involve the metabolism of 1-carbon compounds in the presence of azaserine and urea production from arginine. The following labelled compounds were used in this series of experiments: L-alanine-1-^{14}C; γ-aminobutyric acid-1-^{14}C; L-arginine, guanidino-^{14}C; DL-aspartic acid-3-^{14}C; n-butyric acid, sodium-3-^{14}C; caproic acid, sodium-1-^{14}C; L-citrulline, ureido-^{14}C; L-glutamic acid-U-^{14}C; L-glutamine-U-^{14}C; glycine-1-^{14}C; glycine-2-^{14}C; hydroxyproline-2-^{14}C; α-ketoglutaric acid, sodium-5-^{14}C; L-leucine-1-^{14}C; octanoate, sodium-1-^{14}C; DL-ornithine-5-^{14}C; L-phenylalanine-1-^{14}C; pyruvate-3-^{14}C; sarcosine, methyl-^{14}C; thymine, methyl-^{14}C; and DL-tryptophane-3-^{14}C. Inverse metabolic effects exerted by DDT in the susceptible and resistant strains are discussed.

616 Cope, O.B. AGRICULTURAL CHEMICALS AND FRESH-WATER ECOLOGICAL SYSTEMS. p.115-127 of "Research in Pesticides. Proceedings of the Conference on Research Needs and Approaches to the Use of Agricultural Chemicals from a Public Health Viewpoint, Davis, Calif., USA, 1-3 Oct. 1964". Chichester, C.O., Ed. New York, Academic Press. 1965, 380p.

— — — A microenvironment at Denver with ^{14}C-labelled DDT was studied to learn about the fate of 20 bbp of the insecticide in each of four aquaria containing mud, vegetation, soil, bluegill sunfish, and snails of the genus Ampullaria (unpublished data, Fish-Pesticide Research Laboratory). After 14 d, the water contained 0.42 bbp, the soil 6 bbp, and the vegetation 15 600 bbp. Two weeks

after the fish were added, they contained 1000 bbp; the snails built up to 160 bbp in two weeks. Here, the entire environment apparently contributed to the decline of the DDT in the water. – – – (Cited verbatim, on p. 125)

617 Crosby, D.G. et al. CHEMISTRY AND TOXICOLOGY OF NON-METABOLIC DECOMPOSITION PRODUCTS OF PESTICIDES. Univ. Calif. Food Protect. and Toxicol. Ctr. Ann. Rpt. (1966) 48-50.

Products of dieldrin and aldrin formed by exposure to sunlight, ultraviolet and irradiation have been studied.

618 Dedek, W., Koch, H., Wenzel, K.D. ZUR DARSTELLUNG VON ^{3}H-MARKIERTEM CHLORAL. (Regarding the preparation of ^{3}H-labelled Chloral.) Atompraxis 13, 6 (1967) 256-257. (In German, with English and French summaries)

Chloral (trichloracetaldehyde) has become important as a step in the production of certain insecticides (DDT, trichlorphon, DDVP). The preparation and purification of ^{3}H-Chloral by the Wilzbach method is described. The specific activity of the purified product is 1.5 mCi/g ≈ 0.25 mCi/mM. Other methods for direct labelling by ^{3}H proved unsatisfactory.

619 Deema, P., Thompson, E., Ware, G.W. METABOLISM, STORAGE, AND EXCRETION OF C^{14}-ENDOSULFAN IN THE MOUSE. J. econ. Ent. 59 (1966) 546-550.

A portion of endosulfan, when fed to the laboratory mouse in single or multiple doses, is oxidized to the cyclic sulfate and stored in the body fat. No endosulfan per se, or any of the known metabolites are found in tissues or organs except the liver and kidney, both of which are involved in the metabolism and excretion. Purified endosulfan is not completely absorbed from the gastrointestinal tract, and is eliminated in the faeces with two metabolites, the diol and sulfate. A metabolite appearing in the urine of mice fed either endosulfan, the sulfate, the diol, or the ether is believed to be the diol. The relative activities of organs and excreta of mice sacrificed 24 h after ingesting ^{14}C-endosulfan were: faeces > visceral fat > urine > liver > small intestine plus contents > kidney > brain > respiratory CO_2 > blood. The endosulfan had a specific activity of 0.577 μCi/mg and was labelled in the hexachlorocyclodiene ring at carbons 5 and 6.

620 Dindal, D.L. KINETICS OF Cl^{36} DDT IN WILD WATERFOWL. Diss. Abstr. 28, 3 (1967) 1267-8.

The ingestion rate, metabolism, storage, and excretion of radio-labelled ^{36}Cl-DDT in wild mallard ducks Anas platyrhynchos and lesser scaup ducks Aythya affinis was investigated for two years. A single application of the tagged pesticide was applied to a marsh at the rate of 0.2 lb/A, a level used for mosquito control. A total of 112 ducks was introduced, exposed to the DDT, and collected after various exposure periods. Twenty-three tissues and organs per duck were assayed for DDT residues using liquid scintillation spectrometry, electron capture gas chromatography, thin-layer chromatography, and microautoradiography analysis methods. Liquid scintillation spectrometry was the most reliable quantitative analysis method. A total of 3840 samples were processed by all of these methods. Residues of DDT were found at some time in all tissues tested, except the testes of lesser scaup. Lesser scaup thyroids, spleen, testes, and ovaries contained no detectable residues during the 2nd year. The compounds DDE, DDD, and DDT were most common, but DDE was the predominant metabolite found throughout the 2-yr period. DDMU was recovered from the liver and brain of both species. Metabolite concentrations are given for all tissues sampled. Definite relationships exist between the quality of food ingested (plant or animal) and the kinetics of DDT residues. This is reflected in the residue level differences between mallards and lesser scaup. Levels in all scaup tissues were generally higher than those of mallard tissues. In both species some of the highest residue concentrations were found in leg and neck fat, uropygial glands, and adrenal glands. Dynamics of equilibrium storage and excretion of DDT residues were also observed. (DA)

621 Duffy, J.R.H. THE SYNTHESES OF ETHANE-LABELLED DDT AND o-Cl-DDT AND THEIR METABOLISM IN LARVAL Aedes aegypti. Diss. Abstr. 25, 3 (1964) 1562-1563.

The compounds DDT-1-^{14}C, DDT-2-^{14}C, o-Cl-DDT-1-^{14}C and o-Cl-DDT-2-^{14}C were synthesised and their metabolism studied in larvae of the yellow fever mosquito, Aedes aegypti. The ethylenic derivatives of the above compounds were also synthesised and used as reference standards for radiochromatography of the metabolic products. As a source of radiocarbon, barium carbonate-^{14}C was employed. Carbon-dioxide-^{14}C was generated and reduced to methanol-^{14}C, using lithium alu-

minium hydride. Methanol-^{14}C was converted to methyl-^{14}C iodide with hydrogen iodide. The Grignard reagent, methyl-^{14}C magnesium iodide was made and reacted with p-chlorobenzaldehyde to form 1-(p-chlorophenyl)-ethanol-2-^{14}C. This alcohol was oxidized to 4-chloroacetophenone-2-^{14}C with chromic acid. The ketone was chlorinated at 210° with elemental chlorine to yield 2,2,2,4'-tetrachloroacetophenone-2-^{14}C, which was reduced to 1-(p-chlorophenyl)-2,2,2-trichloroethanol-2-^{14}C with lithium aluminium hydride. This alcohol was condensed with chlorobenzene, in the presence of sulfuric acid, to give DDT-1-^{14}C. Another portion of the same alcohol was condensed with m-dichlorobenzene to give o-Cl-DDT-1-^{14}C. DDE-1-^{14}C and p-Cl-DDE-1-^{14}C were prepared by the dehydrochlorination of DDT-1-^{14}C and o-Cl-DDT-1-^{14}C. DDT-2-^{14}C and o-Cl-DDT-2-^{14}C were also synthesised starting with barium carbonate-^{14}C. Carbon dioxide-^{14}C was generated and reacted with p-chlorophenylmagnesium bromide to yield p-chlorobenzoic-carboxy-^{14}C acid, which was converted to the acid chloride with thionyl chloride. The acid chloride was then condensed with ethyleneimine to give N-(p-chlorobenzoyl-carbonyl-^{14}C)-aziridine. This was reduced with lithium aluminum hydride to form p-chlorobenzaldehyde-formyl-^{14}C. Chloroform was added to this aldehyde in the presence of potassium hydroxide, dissolved in ethylene glycol monoethyl ether, to yield 1-(p-chlorophenyl)-2,2,2-trichloroethanol-1-^{14}C. A portion of the alcohol was condensed with chlorobenzene to give DDT-2-^{14}C. Another portion of the same alcohol was condensed with m-dichlorobenzene to yield o-Cl-DDT-2-^{14}C. The corresponding ethylene derivatives were prepared as previously described. In larval A. aegypti, as in adult house flies, DDE proved to be the only detectable metabolite of DDT. Thus, the radiochromatography confirmed the results previously reported by Abedi and Brown, who used ring-labelled DDT. No water-soluble metabolites in the insect bodies or in the excreta were detected. In the larvae of A. aegypti, o-Cl-DDE proved to be the only detectable metabolite of o-Cl-DDT. Resistant mosquito strains were able to dehydrochlorinate o-Cl-DDT only slightly more than susceptible strains and at a lower rate than that at which they dehydrochlorinated DDT. No water-soluble metabolites of o-Cl-DDT were found in the insect bodies or excreta. DMC proved to be synergistic with DDT and o-Cl-DDT for resistant, but not for susceptible strains of mosquito larvae. The production of DDE and o-Cl-DDE by resistant strains was reduced by DMC, which also appeared to have the effect of reducing the absorption of DDT and o-Cl-DDT. (DA)

622 Eaton, J.L. TEMPERATURE AND THE ACTION OF DDT ON THE COCKROACH NERVOUS SYSTEM. Diss. Abstr. 27, 11 (1967) 4097-B - 4098-B.

Studies were made to locate the site responsible for the negative temperature coefficient of toxicity indicated by the visible symptoms of poisoning in DDT-treated insects, and to determine the role of DDT in the negative temperature coefficient of toxicity. Experiments using ^{14}C-DDT have shown that the patterns of activity observed in abdominal central nervous system (CNS) of DDT-treated cockroaches are not directly related to the amount of ^{14}C-DDT in the CNS. High levels of afferent activity appear to be more important than is the amount of DDT present, for the production of high levels of activity in the CNS. It is concluded that impaired synaptic transmission is the cause of the negative temperature coefficient of toxicity in DDT-treated insects. It appears that DDT does not act directly to cause this impairment. A suggestion is made that high afferent activity at low temperatures causes the DDT-toxin or a chemical transmitter to accumulate at the synapse, and ultimately a concentration of toxin or transmitter is reached which causes synaptic impairment and conduction block.

623 Eaton, J.L., Sternburg, J.G. UPTAKE OF DDT BY THE AMERICAN COCKROACH CENTRAL NERVOUS SYSTEM. J. econ. Ent. 60, 6 (1967) 1699-1703.

Experiments using ^{14}C-DDT to relate the DDT content of the central nervous system (CNS) to frequency of appearance of DDT-induced trains indicate that the DDT content of the CNS is not directly related to the levels of nerve activity observed. After either small injected dosages of ^{14}C-DDT or large topical dosages of ^{14}C-DDT applied to the cerci, a larger number of DDT-induced trains appear in the abdominal CNS of the topically treated cockroaches. In contrast, the ^{14}C-DDT content of the abdominal CNS of the topically treated American cockroach, Periplaneta americana (L.), is actually less than the amount in the abdominal CNS of the cockroaches treated by injection. Thus, it seems that high levels of afferent activity are more important than the amount of DDT in the abdominal CNS for the production of high levels of activity in the abdominal CNS. When 0.107 ng of DDT in suspension is injected into the sixth abdominal ganglion no DDT trains are produced. When ten times this dosage is injected into the sixth abdominal ganglion DDT trains are produced in the

abdominal CNS. Observation of the frequency of appearance of DDT-induced trains at different temperatures reveals a relationship identical to that found in sensory nerves. That is, as temperature is increased, the frequency of appearance of DDT-induced trains in the abdominal CNS is also increased. Thus when the effect of DDT in the abdominal CNS is studied in the absence of high levels of afferent input, the relationship between the effect of DDT on nerve and temperature is the direct relationship which is obtained with sensory nerves, and not the inverse relation to temperature found in vivo with afferent input intact but subject to the action of DDT. (Auth.)

624 El Basheir, S. CAUSE OF RESISTANCE TO DDT IN A DIAZINON-SELECTED AND A DDT-SELECTED STRAIN OF HOUSE FLIES. Entomologia exp. appl. 10 (1967) 111-126.

The causes of resistance to DDT in a DDT-selected (F58W) and a diazinon-selected (SKA) strain of house flies differed. Small (1 μg DDT/fly) topically applied doses penetrated more slowly into the SKA than into the F58W or susceptible strains. Large doses (32 μg/fly) penetrated equally fast into all strains. The two resistant strains metabolised DDT rapidly and the susceptible strain slowly. The only metabolite identified was DDE. WARF anti-resistant is a powerful synergist for DDT in the F58W strain, and prevents the formation of DDE. WARF anti-resistant is not such a good synergist in the SKA strain which possesses other mechanisms for merabolising DDT and also DDE. DDT or its decomposition products seem to interact strongly with the tissues of SKA flies from which they are not readily extracted. The radioactive DDT used in some experiments was labelled in the benzene ring with ^{36}Cl, and had a specific activity of 120 μCi/g.

625 Fine, B.C., Letelier, M.E., Agosin, M. EFFECT OF VARIOUS SYNERGISTS ON TOXICITY AND IN VIVO METABOLISM OF DDT IN Triatoma infestans NYMPHS. Expl Parasit. 19, 3 (1966) 304-309.

Piperonyl butoxide and Sesoxane were the most effective synergists of DDT against T. infestans nymphs. They increased the toxicity of DDT by a factor of >20. The synergists inhibited the oxidative detoxication of ^{14}C-labelled DDT to more polar metabolites. Neither N, N-dibutyl-p-chlorobenzenesulfonamide (Warf-antiresistant, WARF) nor 2,2-bis(p-chlorophenyl)ethanol inhibited the conversion of DDT to 2,2-bis(p-chlorophenyl)-1,1-dichloroethylene (DDE). (CA 66: 1967, 85035a)

626 Forman, S.E., Graham, J.R. AUTORADIOLYSIS OF 6,7,8,9,10,10-HEXACHLORO-1,5,5a,6,9,9a-HEXAHYDRO-6,9-METHANO-2,4,3-BENZODIOXATHIEPINE 3-OXIDE-5a,9a-C^{14}. J. org. Chem. 29 (1964) 233-235.

The autoradiolysis behaviour of ^{14}C-labelled samples of the insecticide Thiodan is reported. The spectra of radio-Thiodan showed the presence of Thiodan ether only after 2.5-yr storage. Infrared spectral analysis indicated that the ratio of higher melting to lower melting Thiodan isomers in the radioactive samples increased from the ratio that was present shortly after preparation. The possible mechanism of autoradiolysis of Thiodan is discussed. (NSA 18: 1964, 8414)

627 Fumarola, D., Giordano, D., Pantaleo, R. QUANTITATIVE STUDY OF THE DISTRIBUTION OF Au^{198} DURING EXPERIMENTAL PLASMOCYTOSIS FROM DDT. Medna exp. 10, 4 (1964) 245-259.

An investigation was carried out as to whether an experimental plasmocytic state of the RES induced in albino rats and rabbits by the administration of DDT, could reflect quantitatively on the functional activity of this system studied by means of the uptake of ^{198}Au. The results obtained provided evidence that the quantitative distribution of radio-gold examined in the various tissues showed significant differences between normal animals and animals with plasmocytosis from DDT. In the tissues with marked plasmocytosis (spleen in the rabbit, thymus and bone marrow in the rat) the phagocytic activity against radio-gold was very reduced. There was a correlation between the plasmocytic change of the RES and the modification of the storage capacity of the ^{198}Au. (Nucl. Med.)

628 Fumarola, D., Giordano, D., Pantaleo, R. QUANTITATIVE STUDY OF THE DISTRIBUTION OF ^{198}Au DURING EXPERIMENTAL PLASMOCYTOSES FROM DDT. Sangre, Barcelona 9, 1 (1964) 127-130.

Significant differences in radio-gold uptake were found between normal animals and animals with plasmocytosis from DDT. There appeared to be a correlation between the state of the RES and

modification of the storage capacity of the ^{198}Au. The modification or morphological and functional state of the RES determined by this experimental condition and its capacity of reversibility with the cessation of the administration of the determinant substance, again demonstrates the great adaptability of this system to different agents. (Nucl. Med.)

629 Gakstatter, J.H. THE UPTAKE FROM WATER BY SEVERAL SPECIES OF FRESH-WATER FISH OF p, p'-DDT, DIELDREN AND LINDANE: THEIR TISSUE DISTRIBUTION AND ELIMINATION RATE. Diss. Abstr. 27, 11 (1967) 3820-B.

The uptake from water, tissue distribution and elimination rate of p,p'-DDT, dieldren and lindane by several species of fresh-water fish was investigated, using ^{14}C-labelled insecticides of known specific activities. Bluegills (Lepomis macrochirus), goldfish (Carassius auratus), redears (Lepomis microlophus) and white catfish (Ictalurus catus) were exposed to sub-lethal concentrations of the above insecticides and were then allowed to recover over periods up to 41 d. Insecticide concentrations in the tissues were determined by direct dissolution in 0.4 N NCS followed by liquid scintillation counting. The rate of removal of insecticide from water by fish was in the decreasing order of DDT, dieldren and lindane. The differences were attributed to the relative degrees of solubility in water of the three compounds. The need for the use of continuous renewal bioassay systems was emphasised. DDT, dieldren and lindane were distributed in varying amounts to all tissues during short sub-lethal exposures. Insecticide concentrations in the visceral fat greatly exceeded those in any other tissues. Muscle concentrations were low. High concentrations in the liver, gall bladder, pyloric caeca and intestine were related to excretion by this route. In the first 24 h during recovery from a sub-lethal exposure, a general redistribution occurred which resulted in higher visceral fat and generally lower concentrations in other tissues. Mature goldfish ovaries were not found to act like fat in their accumulative capacity. Greater accumulations of DDT were noted in the testes rather than the ovaries of goldfish. Significant differences were found in the elimination rates of DDT, dieldren and lindane from fish. More than 90% of the accumulated lindane was eliminated from the fish after 2 d of recovery from a sub-lethal exposure, >90% of the accumulated dieldren within 16 d, whereas < 50% of DDT was eliminated within 32 d. DDT, dieldren and lindane were found to be readily transferred from contaminated to uncontaminated fish in the recovery aquaria. This may account in part for the residues of DDT which are found in aquatic organisms from areas with no past history of DDT use. (From DA)

630 Gakstatter, J.H., Weiss, C.M. THE ELIMINATION OF DDT-^{14}C DIELDRIN-^{14}C, AND LINDANE-^{14}C FROM FISH FOLLOWING A SINGLE SUBLETHAL EXPOSURE IN AQUARIA. Trans. Am. Fish. Soc. 96, 3 (1967) 301-307.

Groups of 60-70 small bluegills (Lepomis macrochirus) and goldfish (Carassius auratus) were exposed in polyethylene tanks to 0.03 ppm of DDT-^{14}C, dieldrin-^{14}C, or lindane-^{14}C for periods ranging from 5-19 h. Following the exposure, the fish were rinsed and placed with unexposed fish 145-ℓ aquaria in which the water was continuously renewed at the rate of 2.5 changes per day. The initial lindane-^{14}C was eliminated by both species of exposed fish within 2 d. More than 90% of the initial dieldrin-^{14}C was eliminated in the first two weeks of recovery. Less than 50% of the DDT-^{14}C was eliminated after 32 d of recovery. Labelled DDT and dieldrin were readily transferred from contaminated fish to uncontaminated fish in the recovery aquaria. (CA 67: 1967, 90043b)

631 Grant, C.D., Brown, A.W.A. DEVELOPMENT OF DDT RESISTANCE IN CERTAIN MAYFLIES IN NEW BRUNSWICK. Can. Ent. 99, 10 (1967) 1040-1050.

Populations of the mayfly Heptagenia hebe McDunnough in areas of New Brunswick were air-sprayed with DDT for budworm control for 8 successive years. When tested as nymphs taken from the streams, they showed LC50 levels three times as high as those in untreated areas. Populations surviving an air-spray in 1965 proved to be 12-40 times as DDT-resistant as the normal. Pre-spray populations of Stenonema fuscum (Clemens) showed a 5-fold resistance, and post-spray populations of S. interpunctatum (Say) showed a 10-fold DDT resistance when those from treated areas were compared with those from untreated. The uptake and metabolism of ^{14}C-DDT was studied by exposing nymphs to 0.2 ppm ^{14}C-DDT for 18.5 h, and then grinding them with sand and sodium sulphate. For assessment of uptake, the ground tissues were extracted with petroleum ether, and transferred to a 6 in. x 0.5in. chromatographic column of Woelm alumina: the absorbed ^{14}C-DDT was then eluted. The separation of ^{14}C-DDE is also described. The DDT-resistant nymphs of H. hebe detoxified DDT to DDE 15 times

faster than the normal nymphs; DDE was also the metabolite in S. interpunctatum. In both these species the DDT-resistant nymphs absorbed roughly twice as much DDT as the normal.

632 Guenzi, W.D., Beard, W.E. ANAEROBIC BIODEGRADATION OF DDT TO DDD IN SOIL. Science, N.Y. 156 (1967) 1116-1117.

^{14}C-DDT was added to soil and the mixture incubated anaerobically for 2 weeks and 4 weeks. DDT and seven possible decomposition products were separated by thin-layer chromatography, and the radioactivity of material from individual spots was determined by liquid scintillation. The DDT was dechlorinated by soil microorganisms to DDD, and only traces of other degradation products were detected. No degradation of DDT was detected in sterile soil. (Essentially auth.)

633 Gunther, F.A., Hylin, J.W., Spenger, R.E. NATURE OF CHLORINE INTERFERENCES IN TOTAL HALOGEN METHODS OF ANALYSIS OF ORGANOCHLORINE PESTICIDE RESIDUES IN PLANTS. J. agric. Fd Chem. 14, 5 (1966) 515-519.

The source of a widely distributed background-organochlorine compound, which interferes with the determination of organochlorine pesticide residues in plant parts by any total halogen methods, has been tentatively identified as being due to quaternary chloride salts of lecithins. The degree and extent of interference vary from species to species of plant, among samples of the same species, and among parts of the same plant. These differences are due largely to variations in concentrations of certain plant constituents at the time of sampling but, also, reflect some effects due to sample storage and processing procedures that may cause lecithin degradation. — $Ca^{36}Cl$ was injected into developing roots of beet plants. Data are tabulated on hexane-extractable Cl in some wild and cultivated plants (determined by combustion and by neutron activation); the distribution of ^{36}Cl in extracts of table beet tops, and in eluates from silicic acid chromatography of hexane extracts of beet leaves; on the phospholipid contents of eluates from silicic acid chromatography of beet leaves; the extraction of hexane-soluble ^{36}Cl by several reagents; the release of hexane-soluble ^{36}Cl by phospholipase D; and on the partial analysis of plant constituents extracted by hexane.

634 Harvey, J.M. EXCRETION OF DDT BY MIGRATORY BIRDS. Can. J. Zool. 45, 5 (1967) 629-633.

Juvenile starlings were fed peas containing a total of 4.75 mg DDT (a mixture of ^{14}C-labelled and carrier DDT) each day for 5 d. After this time, two birds were killed every other day for 12 d and then every 3rd day for 6 d. The brain, liver, and remaining carcass of each bird were extracted separately for fat-soluble pesticide. The concentration of the insecticide remained high in the body and liver for one week after the feeding period, but decreased more quickly in the brain. After 10 d, less than 10% of the ingested DDT remained in the bird. (CA 67: 1967, 116098q)

635 Hatanaka, A., Hilton, B.D., O'Brien, R.D. THE APPARENT BINDING OF DDT TO TISSUE COMPONENTS. J. agric. Fd Chem. 15, 5 (1967) 854-857.

Sephadex chromatography of tissue homogenates incubated with ^{14}C-DDT provided apparent evidence of binding of DDT with cockroach nerve cord and rat liver, muscle, and brain. Binding was not localized in any particular subcellular fraction of brain. The non-toxic analogues DDE and 1,1,1,2-tetrachloro-2,2-bis(p-chlorophenyl) ethane were equally effective in such binding. Triton X-100 was more effective than tissue homogenates in permitting passage of DDT through Sephadex. Electrophoresis of brain preparations showed no migration of DDT with any fraction. Apparently, evidence for binding based on Sephadex is inadequate in the case of DDT and related compounds. (Auth.)

636 Hathway, D.E., Moss, J.A., Rose, J.A., Williams, D.J.M. TRANSPORT OF DIELDRIN FROM MOTHER TO BLASTOCYST AND FROM MOTHER TO FETUS IN PREGNANT RABBITS. Eur. J. Pharmac. 1, 2 (1967) 167-175.

Investigations were made concerning the problem of transport of an insecticide, dieldrin (I) from mother rabbits to young in utero when the blastocyst was lying free in the uterine cavity (blastogenesis) after implantation, when the development of the main layers and organs was taking place (embryogenesis), and during foetogenesis. Previously the distribution of I was measured between erythrocytes and plasma lipoproteins and proteins in vivo and in vitro. Binding of insecticide to lipoprotein and certain other proteins of the plasma had occurred, free permeability of the erythrocyte

surface to the insecticide was evident, and a very rapid initial rate of removal of I from blood occurred by a roughly logarithmic rate of removal. After single i.v. administration of I-^{14}C to pregnant rabbits, a very small uptake of I by the free blastocysts occurred, followed by equilibration with maternal blood and clearance from the blastocyst. The amount of radioactivity in each blastocyst was equally distributed between embryoplus membranes and the fluid. The rate of I uptake by blastocysts from maternal blood was significantly lower after implantation. I was secreted from the endometria of treated animals irrespective of pregnancy. During the 2nd half of pregnancy, passage of I from mother to foetus was transplacental, allantoic and amniotic fluids being free from ^{14}C. There was a significant interaction between the concentration of I in maternal blood and that in foetal tissues in 16-d pregnant rabbits. The distribution of I between the foetal blood and tissues in 24-d pregnant treated dose was consistent with withdrawal of insectide into foetal liver and fatty tissues. The presence of I in the blood of 24-d pregnant rabbits and non-injected foetuses after injection of a single foetus belonging to each doe afforded unequivocal evidence for 2-d transplacental transport of I. Anesthetization of treated rabbits with Et_2O or fluothane caused a significant increase in I concentration in peripheral blood. (CA 67: 1967, 20963c)

637 Hayashi, M., Matsumura, F. INTERACTIONS OF DDT WITH THE NERVOUS SYSTEM OF THE RESISTANT AND SUSCEPTIBLE GERMAN COCKROACHES. Nature, Lond. 215 (1967) 1510-1512.

A hypothesis has recently been proposed to explain the mode of action of DDT on the basis of charge-transfer complex formation of nerve components with DDT. The strains of Blattella germanica L. used were the CSMA susceptible and the Fort Rucker strain (both LC 50 at 0.0032%), and the London (LC 50 at 0.06%) and the VPI strain (LC 50 at 2%), respectively. ^{14}C-DDT was used. The resistant particulate components proved to have less binding capacity with DDT than do the susceptible components, which is in agreement with the view that a binding difference should exist between the strains at a specific binding site which is related to susceptibility, if such a site is actively engaged in the process of attaining a high level of DDT resistance by the roaches. Resistant roaches could be utilizing this vital process for their advantage. Whether this binding substance can play an indispensable part in DDT poisoning is not yet clear.

638 Hayashi, M., Matsumura, F. INSECTICIDE MODE OF ACTION. EFFECT OF DIELDRIN ON ION MOVEMENT IN THE NERVOUS SYSTEM OF Periplaneta americana AND Blattella germanica COCKROACHES. J. agric. Fd Chem. 15, 4 (1967) 622-627.

Dieldrin initially increased the rate of all ion exchange processes in the nervous tissues of adult males of both American and German cockroaches. ^{22}Na-containing saline was used. After this initial excitation period, sodium ions accumulated in the dieldrin-treated nerve cells while the potassium ion influx decreased. The situation superficially resembles that of DDT poisoning. By means of ^{45}Ca it could be shown that dieldrin also caused a mild condition of hypocalcemia at the late stage of poisoning. This phenomenon, however, does not seem to be causally related to the mode of dieldrin resistance in the German cockroach strains.

639 Heath, D.F. THE RETENTION OF TRIPHENYLTIN AND DIELDRIN, AND ITS RELEVANCE TO THE TOXIC EFFECTS OF MULTIPLE DOSING. p. 18-26 of "Radioisotopes in the Detection of Pesticide Residues. Proceedings of a Panel. Vienna, 12-16 Apr. 1965". STI/PUB/123, International Atomic Energy Agency, Vienna (Austria), 1966, 118p.

The dynamics of the behaviour of dieldrin in rats can be shown to lead to a plausible explanation of the toxic effects observed. ^{36}Cl-dieldrin was slowly infused into rats, to give a total dose of 8-16 mg/kg. Rats showed ample biochemical capacity to metabolise dieldrin, the half-life even with high doses being 11 d after the 1st week. Metabolism is slow because dieldrin is held in fat, which is harmless unless it is released as a consequence of fat mobilization. Toxic effects are related to the amount of dieldrin mobilized. There is no evidence that dieldrin causes an irreversible lesion of the central nervous system. Only preliminary experiments have been carried out with triphenyltin. ^{113}Sn-triphenyltin (specific activity 500 μCi/g) was tested in rats and guinea pigs. In both ^{113}Sn appeared in brain after oral or intraperitoneal dosing, and disappeared fairly slowly. ^{113}Sn would appear to be lost from brain rather faster after i.p. than after oral injection. In both rats and guinea pigs ^{113}Sn persists in brain with "half-lives" of several days. In guinea pigs ^{113}Sn does not appear to be in the form of free stannic ions but it is not necessarily present as triphenyltin. Some of the technical problems involved in isotope dilution experiments on brain extracts from rats are discussed.

640 Jumar, A., Sieber, K., Held, P. INVESTIGATIONS OF THE INSECTICIDE TOXAPHENE USING THE RADIOACTIVE NUCLIDE, ^{36}Cl. Paper presented at the "Radiochemistry Conference, Bratislava, CSSR. 1966, 61p."

A method is reported for semi-micro synthesis of toxaphene (I) labelled with ^{36}Cl, for which a $Na^{36}Cl$-camphene mixture serves as starting material. I thus prepared contains 68% Cl and has a specific activity 50 μCi/g. (CA 68: 1968, 28746a)

641 Jumar, A., Sieber, K. RESIDUE STUDIES IN RAPESEED OIL AND HONEY WITH TOXAPHENE-^{36}Cl. Z. Lebensmittelunters. u. - Forsch. 133, 6 (1967) 357-364. (In German)

Possible hazards in use of toxaphene (I) in rapeseed production would involve residue in the seed oil (used as food oil) or in honey produced by bees in the vicinity. The distribution of the toxaphene was studied using practical applications of toxaphene-^{36}Cl. The oil produced contained 0.3-1.5 mg/kg, and the honey <0.01 mg of I/kg. (CA 67: 1967, 99051k)

1.5.3. Halogenated and other Hydrocarbons

642 Kallman, B.J., Andrews, A.K. REDUCTIVE DECHLORINATION OF DDT TO DDD BY YEAST. Science, N.Y. 141 (1963) 1050-1051.

Labelled DDD [1,1-dichloro-2, 2-bis (p - chlorophenyl) -ethane] was formed from ^{14}C-DDT in the presence of yeast. The formation of DDD from DDE [1,1-dichloro-2,2-bis (p - chlorophenyl) - ethylene] was not observed, indicating that a reductive dechlorination of DDT occurs. (Auth.)

643 Kimura, T., Keegan, H.L., Haberkorn, T. DEHYDROCHLORINATION OF DDT BY ASIAN BLOOD-SUCKING LEECHES. Am. J. trop. Med. 16, 5 (1967) 688-690.

The toxicity of DDT for Southeast Asian buffalo leeches, Hirudinaria manillensis, was tested with a modification of the standard WHO procedures for determining susceptibility-resistance of mosquito larvae to insecticides. Specimens of H. manillensis from Bangkok, Thailand, and Kuala Lumpur, Malaysia, showed a high degree of tolerance. LC 50 values after 120 h continuous exposure were 100 ppm for leeches from Kuala Lumpur and 60 ppm for specimens from Bangkok. The absorption of DDT by specimens of Hirudo nipponia from Japan and of H. manillensis from Malaysia was determined by radioactive assessment of chloroform extracts of leeches that had been exposed for 24 h in aqueous solution containing 7.1 ppm of ring-labelled ^{14}C-DDT. Results showed that 16% of exposed DDT was recovered from H. nipponia, and 17.4% from H. manillensis. After assessment of absorption of DDT by the leeches, the chloroform extracts were evaporated to dryness, taken up in acetone, and chromatographed. The chromatogram of H. nipponia extract showed that 49% of the absorbed DDT had been converted to the nontoxic DDE. Chromatograms of extracts by H. manillensis showed neither production of DDE nor other metabolites of DDT analogues. This, as far as could be determined, was the 1st demonstration of dehydrochlorination of DDT by an annelid. (Auth. summary)

644 Klein, W. Qualitas Pl. Mater. veg. 1967. (In press)

This review article deals with the fate of chlorinated hydrocarbons in insects, other animals, plants and microorganisms, and in soils and water. The insecticides considered particularly are p, p'-DDT, lindane, aldrin, dieldrin, endrin, chlordane, Telodrin, heptachlor, and 3 - dihydroheptachlor. The extensive bibliography of 125 references contains numerous references to studies in which radioisotopes had been used, not always pointed out in the text. - Some unpublished work by Klein, Korte and colleagues is reported on the detoxication of endrin in warm-blooded animals where it takes place very quickly. After intravenous injection of ^{14}C-endrin into rats only hydrophilic metabolites were eliminated in the faeces. Retention 48 h after injection amounted to 65% in males, 78% in females. With daily oral application (30 μg/kg) a saturation level is reached in rats after only 10 d; after 12 d, only 15% of the total activity is retained. The decay curve, after application has ceased, has a half-life of only 2 d. With oral administration, the rate of metabolization is 65-80%.

645 Kochen, W. ISOLIERUNG UND IDENTIFIZIERUNG VON METABOLITEN DES ALDRIN-^{14}C AUS EXKREMENTEN VON KANINCHEN. (Isolation and identification of aldrin-^{14}C metabolites in rabbit excrements.) Thesis, Bonn Univ. (West Germany). 1965, 65 p. (In German)

Rats: - Following intravenous (i.v.) injection of ^{14}C-aldrin, large amounts of hydrophilic metabolites were detected in the excrements, which could be separated by paper- or thin-layer chromatography. The distribution, metabolism and excretion of the labelled insecticide by the rat organism after 48 h was determined. 0.08-0.60% of the injected dose was recovered in the various organs (60-90% of dieldrin). The hydrophilic products occurred in all the organs examined; small amounts of unchanged aldrin were identified. Within 48 h, >18% of the injected dose were eliminated (95% as hydrophilic metabolites) in the excrements. After a single dose of ~20 γ ^{14}C-aldrin, ~55% were eliminated in the faeces within the following 3 weeks. - Rabbits: - Sublethal i.v. dose (~40 mg/rabbit) were largely eliminated in the urine, not in the faeces. Ten male rabbits were given a total of 460 mg ^{14}C-aldrin; within 135 d, 47% had been eliminated in the urine. At least eight metabolites were isolated and partly identified by column and thin-layer chromatography. They are listed below, in order of increasing hydrophilia. Their percentage was determined from column chromatography separation.

Metabolite I - 4%; from infra-red spectrum and R_f value identical with (IF, $R_f \rightarrow$) dieldrin.

Metabolite II - 5%; m.p. 138-139 °C; $C_{12}H_8OCl_6$; IR, $R_f \rightarrow$ 1,2,3,4,10,10, hexachloro-1,4,endo, 5,8, exo dimethano-1,4,4a,5,8,8a,octahydro-7on-naphthaline.

III - 14%; m.p. 161 °C; $C_{15}H_{14}O_4Cl_6$; mol. wt 483; hydrolysis → VII; IF, $R_f \rightarrow$ diacetate of 6,7, transaldrindiol.

IV - 22%; hydrolysis → VII; one OH-group of the trans-6,7, aldrindiol is esterified with anacyl remnant.

V - 4%; not identified.

VI - 3%; m.p. 212 °C; $C_{14}H_{10}O_2Cl_6$; mol. wt 399; OH-groups as cis-isomers.

VII - 43% (and main metabolite); m.p. 131.5 °C; mol. wt 399; $C_{12}H_{10}O_2Cl_6$; optically active (-13.5); IF, $R_f \rightarrow$ synthetic 6,7, trans-aldrindiol.

VIII - 5%; not identified. Two components shown by thin-layer chromatography.

646 Korte, F. METABOLISM OF CHLORINATED INSECTICIDES. p.38-48 of "Radioisotopes in the Detection of Pesticide Residues. Proceedings of a Panel, Vienna, 12-16 Apr. 1965". STI/PUB/123, International Atomic Energy Agency, Vienna (Austria). 1966, 118 p.

In order to study the metabolism of some drin-insecticides in living organisms under comparable conditions, ^{14}C-labelled insecticides of high specific activity needed to be synthesised. Starting with ^{14}C-labelled barium carbonate, ^{14}C-endrin (labelled in the cyclopentene ring), -telodrin (in the 1,3-position), and ^{14}C-aldrin, -dieldrin, -heptachlor, -dihydroheptachlor, and -chlordane (all labelled statistically in the hexachlorocyclopentene ring system) were synthesised. The fate of these insecticides was investigated in three biological organisms: fungi (Aspergillus niger, Penicillium notatum), mosquito (Aedes aegypti) larvae, and mammals (mice, rats). All three proved capable of metabolising them. A fairly large number of metabolites, characterized chromatographically, have so far been isolated. All of them were more hydrophilic than the starting material. Some of them, particularly the main products, are identical, regardless of the organism. Sex differences in metabolism rate, though not in the metabolism product, were observed. In long feeding experiments with rats a saturation level was observed after a certain time, the amount of insecticide remaining in the animal body being excreted after termination of oral application, with a biological half-life period of ~ 11 d for males and 100 d for females.

647 Korte, F., Kochen, W. INSEKTIZIDE IM STOFFWECHSEL. XI. AUSSCHEIDUNG, VERTEILUNG UND UMWANDLUNG VON ALDRIN-^{14}C UND DIELDRIN-^{14}C IN DER RATTE. (Insecticides and metabolism. XI. Elimination, distribution and metabolism of aldrin-^{14}C and dieldrin-^{14}C in the rat.) Med. Pharmacol. exp. 15 (1966) 404-408. (In German, with French and English summaries)

Labelled insecticides were injected intravenously. A steady increase in radioactivity was observed on passing from the liver to the duodenum, intestine, and faeces. The percentage of so-called hydrophilic metabolites increased similarly. This transition was much less noticeable in organs.

648 Korte, F., Kochen, W. INSEKTIZIDE IM STOFFWECHSEL. XII. ISOLIERUNG UND IDENTIFIZIERUNG VON METABOLITEN DES ALDRIN-^{14}C AUS DEM URIN VON KANINCHEN. (Insecticides and metabolism. XII. Isolation and identification in rabbit urine of metabolites of aldrin-^{14}C.) Med. Pharmacol. exp. 15 (1966) 409-414. (In German, with English and French summaries)

After intravenous injection of ^{14}C-aldrin into male rabbits, the major part of the radioactivity is eliminated in the urine rather than the faeces. Column and thin-layer chromatography allowed eight metabolites to be isolated from the urine, some of which could be identified. Trans-6,7-aldrin-diol (metabolite VII), with 43%, is the main breakdown product. Two other metabolites, III and IV, derived from this diol by acylation, were also isolated. In addition to the trans form, a less hydrophilic aldrin-diol (VI) of unknown structure was isolated; it is not identical, however, with the cis-6, 7-aldrin-diol obtained from aldrin and KMnO. (Auth.)

649 Kroczyński, J., Drygas, M. WSTEPNE BADANIA NAD OZNACZANIEM POZOSTAŁOSCI DDT ZNACZONEGO WEGLEM AKTYWNYM. (Preliminary investigation on the determination of the residues of DDT labelled with C-14.) Poznan Inst. Ochron. Rost. Biul. 32 (1965) 57-64. (In Polish, with English summary)

Microplots of potatoes were used, and experiments carried out with ^{14}C-DDT. A single application of DDT (series I: 0.8932 g p,p'-DDT-^{14}C of specific activity 1.45 mCi/g giving a total activity of 1 mCi, mixed with 1.6068 g of unlabelled DDT and made up to 50 ml) gave 1.2 ppm of residue in the soil. A double application (series II: 0.4466 g p,p'-DDT-^{14}C of specific activity 1.45 mCi/g giving a total activity of 0.5 mCi when mixed with 4.5534 g of unlabelled DDT and made up to 50 ml) gave 2.0 ppm of residue in the soil. In two experimental series no residues of <0.026 ppm were found for series I, and none <0.07 for series II. Spraying took place 113 d before harvesting (single); 113 and 71 d before harvesting (double); and 71 d before harvesting (single). Single application of DDT (series I) gave 1.2 ppm of residue in the soil; a double application of DDT (series II) gave 2.0 ppm.

650 Kulikova, M.N., Strongin, G.M., Khokhlova, L.F. DETERMINATION OF THE γ-ISOMER IN HEXACHLORAN DUST BY THE METHOD OF ISOTOPIC DILUTION. Trudy Khim. Khim. Tekhnol. No.2 (1964) 288-292. (In Russian)

The method of isotopic dilution was developed for the determination of the content of γ-isomer in dusts on the basis of hexachloran. The γ-isomer was separated by extraction and precipitation; the melting temperature range was 113.2-114.0°C. The average absolute error of the method was 0.07%, the average relative error 5.3%. Examples for the application of the method, e.g. with talcum, are given. (CA 63: 1965, 8983e)

651 Lage, G.L., Oeth, D., Spratt, J.L. EFFECT OF CHLORDANE AND DDT PRETREATMENT ON THE METABOLISM OF DIGOXIN-^{3}H BY MONKEY HEART AND LIVER TISSUE IN VITRO. Archs int. Pharmacodyn. Thér. 169, 2 (1967) 255-281.

The in vitro hepatic metabolism of ^{3}H-labelled digoxin (I) was studied in the squirrel monkey. The effect of common insecticides on I metabolism was also studied. Chlordane and DDT were each injected intraperitoneally at 10 mg/kg daily for 7 d. A significant decrease in recoverable digoxigenin was observed upon incubation of tritiated I for 5 h under O with non-treated monkey liver slices. The only detectable effect of chlordane pretreatment was a 100 or 60% increase in the alcohol-soluble fraction for both the heart and liver slices, respectively. DDT did not affect the metabolism of I under the conditions studied. Control heart slices did not metabolise I. Control liver slices metabolised I to a lesser extent than did those previously reported for the rat. (CA 68: 1968, 2213z)

652 Lawler, P.D., Rogers, L.J. BIOCHEMICAL INVESTIGATIONS INTO THE EFFECT OF DDT ON BARLEY. Biochem. J. 103, 2 (1967) 44P. Also presented at "469th Meeting of the Biochemical Society. Proceedings. Dublin, 20-22 Mar. 1967".

Studies were confined to one susceptible (Rika) and one resistant (Proctor) variety of barley. Manometric studies of gas exchange in DDT-treated barleys were made. It appeared that DDT affected a photosynthetic process in the susceptible barley. Studies of distribution of radioactivity amongst the soluble products of photosynthesis showed no qualitative difference between sprayed and un-

sprayed susceptible and resistant varieties. However, the proportion of the leaf material extractable with ethanol from Rika seedlings 8 d after DDT treatment was increased ~ 40% compared to DDT-treated Proctor. On the evidence available it is suggested that in susceptible barley varieties DDT affects the light reaction in photosynthesis.

653 Laws, E.R., Jr. ROUTE OF ABSORPTION OF DDVP AFTER ORAL ADMINISTRATION TO RATS. Toxic. appl. Pharmac. 8, 2 (1966) 193-196.

Ten rats were infused by stomach tube with radioactive DDVP while timed samples of portal blood, systemic venous blood, and chyle were taken. Levels of DDVP were detected in all samples and were much higher in portal blood than in either systemic blood or chyle. They were slightly higher in systemic blood than in chyle. These findings support the hypothesis that, in the rat, DDVP taken orally is absorbed primarily if not exclusively by the hepatic portal venous system, and, therefore, is routed through the detoxification processes of the liver before reaching the systemic circulation. (CA 64: 1966, 13327h)

654 Ludwig, G. ISOLATION AND IDENTIFICATION OF METABOLITES OF SOME CHLORINATED INSECTICIDES, AND THEIR DETECTION BY ANALYTICAL METHODS. p.49-58 of "Radioisotopes in the Detection of Pesticide Residues. Proceedings of a Panel. Vienna, Austria, 12-16 Apr. 1965". STI/PUB/123, International Atomic Energy Agency, Vienna (Austria). 1966, 118 p.

The general metabolism and detoxification mechanism operative in drin-insecticides proved to be dechlorination and hydroxylation. Metabolites of α-chlordane-^{14}C and dieldrin-^{14}C were isolated in crystalline form. Rabbits were given weekly doses of 100 mg of α-chlordane-^{14}C for 10 weeks by stomach tube; 2 weeks after the last dose they were sacrificed. 47.2% of the total administered activity was excreted in the urine, 22.7% in faeces, with only ~ 4% present in the fatty tissues. Hydrophilic metabolites were found in urine: metabolite A, with a toxicity <1/3 of that of chlordane and with a structure of 1-hydroxy-2-chloro-dihydrochlordane, and an even more hydrophilic metabolite B, where both Cl-atoms in positions 1 and 2 of α-chlordane-^{14}C may be replaced by hydroxylic groups. - In dieldrin tests, rabbits received 206 mg over 21 weeks, administered twice weekly: a total of 56-58 mg ^{14}C-dieldrin/kg body weight. At the end of the feeding period 42.2% of the radioactivity administered had been eliminated (29.7% in urine, 12.5% in faeces), increasing to 43.1% in urine after 52 weeks. A metabolite V was obtained as needle-like crystals. The epoxy ring system of dieldrin was concluded to be hydrolysed in vivo in the metabolite, leading to a 6,7-dihydroxydihydro-aldrin. The structural formula of metabolite V must correspond to one of the two enantiomorphic isomers of synthetical racemic trans-6,7-dihydroxydihydro-aldrin. Its acute oral toxicity to mammals was found to be ~ 1/2-1/16 of that of dieldrin. Two of the other metabolites (II and III) present in urine (~ 2-4%) were found to give the main metabolite by hydrolysis. Their probable structure is discussed. - After intravenous administration of telodrin-^{14}C lactone was isolated from the excreta of rats, explicable by the formation of the unstable acetate intermediate. Its acute toxicity for mammals was 30 times lower than of telodrin. - One of the sub-metabolites of dihydroheptachlor (in rat excreta) was chromatographically identical to synthetical 2-hydroxydihydro-chlordane.

655 MacRae, I.C., Raghu, K., Castro, T.F. PERSISTENCE AND BIODEGRADATION OF FOUR COMMON ISOMERS OF BENZENE HEXACHLORIDE IN SUBMERGED SOILS. J. agric. Fd Chem. 15, 5 (1967) 911-914.

The persistence of the γ isomer of benzene hexachloride (lindane), when added to submerged tropical soils at a rate approx. three times that recommended for the protection of rice from stem borer infestation and of the α, β, and δ isomers of benzene hexachloride applied at similar rates was between 70 and 90 d. Losses of all four isomers from sterilized, flooded soil samples were much slower than from non-sterilised samples, indicating that the microflora of submerged soils is able to degrade benzene hexachloride. Microbial degradation of γ-BHC was demonstrated by the release of $^{14}CO_2$ from submerged soils treated with ^{14}C-labelled γ-BHC. An application of γ-BHC at a rate approx. five times the usual field rate apparently inhibited CO_2 evolution from two tropical soils. (Auth.)

656 Matsumura, F., Hayashi, M. INTERACTION OF DIELDRIN WITH THE SUBCELLULAR COMPONENTS OF BOTH RESISTANT AND SUSCEPTIBLE STRAINS OF Aedes aegypti. Mosquito News 26, 2 (1966) 190-194.

Heads and (in some experiments) bodies of 4th-instar larvae of A. aegypti were homogenized in 0.25 M sucrose and incubated for 1 h at 24 °C with ^{14}C-labelled dieldrin (I). The material was separated by ultracentrifugation into crude nucleus, mitochondrial, microsomal, and supernatant fractions. With susceptible larvae, whole body crude nucleus absorbed more I than that of resistant larvae. Head crude nucleus absorbed only slightly more in vivo, resistant individuals picked up twice as much I as susceptible, but the distribution ratio of I between crude nucleus and other fractions is similar in the two cases. I evidently binds strongly with nerve compounds, but it does not appear that the in vivo I effect is related to the fundamental mechanism of resistance. (CA 65: 1966, 12805h)

657 Matsumura, F., Hayashi, M. DIELDRIN: INTERACTION WITH NERVE COMPONENTS OF COCKROACHES. Science, N.Y. 153 (1966) 757-759.

The amount of binding of ^{14}C-dieldrin and the effect of time on the rate of binding with the nerve components of susceptible and resistant Blattella germanica were investigated. There is evidence that the nerve components of the dieldrin-resistant cockroach have less binding capacity for dieldrin than those of the susceptible roach; the highest interstrain difference was in the crude-nucleus fraction. The dieldrin-nerve-complexes are not extracted by many organic solvents.

658 Matsumura, F., O'Brien, R.D. ABSORPTION AND BINDING OF DDT BY THE CENTRAL NERVOUS SYSTEM OF THE AMERICAN COCKROACH. J. agric. Fd Chem. 14, 1 (1966) 36-39.

The abdominal nerve cord of adult male Periplaneta americana, and ^{14}C-DDT (ethane-labelled) were used. It is hypothesised that DDT interferes with nervous function by forming a charge-transfer complex with a component of nerve. Studies on the kinetics and equilibria of DDT penetration into and out of nerve cords indicated the formation of complexes of DDT with two components of the cord and having dissociation constants of approx. 6×10^{-6} M and 1.5×10^{-7} M. At 10^{-5} M DDT, ~ 83% of the DDT in the cord is complexed. Two complexes have been partially purified on Sephadex and DEAE-cellulose columns. One contains protein and is extractable by butanol.

659 Matsumura, F., O'Brien, R.D. INTERACTIONS OF DDT WITH COMPONENTS OF AMERICAN COCKROACH NERVE. J. agric. Fd Chem. 14, 1 (1966) 39-43.

The nature and consequences of binding of DDT to components of the cockroach nerve cord were examined. ^{14}C-DDT (specific activity 4.93 mCi/mM) was added to the isolated nerve cord or injected into a living male cockroach with ethanol (final concentration of ethanol, 1%) followed by isolation of the nerve cord. When ion-transport through the nerve membrane was studied with radioactive cations, non-radioactive DDT was used instead. To study the effect of DDT in vivo, DDT was injected into a male roach and then, after 15 min, radioactive ions (either ^{42}K or ^{24}Na) were also injected. The radioactive salts used were ^{24}NaCl (100 mCi/g), ^{42}KCl (20 mCi/g), and $^{45}CaCl_2$ (500 mCi/g). - The butanol extract of a DDT-treated nerve homogenate showed a pronounced bathochromic shift in u.v. spectrum in comparison with DDT alone. The absorption spectrum of an unextracted DDT-treated homogenate showed a new shoulder at 240 to 270 mμ: the fluorescent spectrum on activation of 310 mμ showed a new peak at about 420 mμ. A complex, possibly of the charge-transfer type, was therefore suggested between DDT and a component of nerve. Nerve cords from DDT-treated cockroaches showed large increases in their ability to take up sodium or lose potassium, whereas ability to lose sodium or take up potassium was unchanged. The relation among complex formation, changes in ion permeability, and toxicity is not yet established.

660 Matsumura, F., Boush, G.M. DIELDRIN: DEGRADATION BY SOIL MICROORGANISMS. Science, N.Y. 156 (1967) 959-961.

An attempt was made to discover microorganisms that degrade dieldrin. Examination of >500 isolates from soil that had been heavily contaminated with various insecticides revealed the existence of a few microbes that are very active in degrading dieldrin to various metabolites (see table). Results of extraction and partitioning experiments on soils treated with ^{14}C-dieldrin indicated that ~ 1-6% of added dieldrin was converted to water-soluble metabolites by such soil samples.

661 Meeks, R.L., Peterle, T.J. THE CYCLING OF Cl-36 LABELLED DDT IN MARSH ECOSYSTEM. COO-1358-3, Ohio State Univ., Research Foundation, Columbus. Apr. 1967. 234 p. Thesis.

An enclosed 4-acre freshwater marsh was treated on 7 Jul. 1964 with 3.9 mCi of ^{36}Cl ring-labelled DDT at a rate of 0.2 lb of technical DDT/acre. Inert attapulgite granules carrying the DDT were applied by helicopter at 100 lb/acre. The project was designed to determine the accumulation and distribution of DDT rather than its effect. The labelled DDT residues were traced from 1 h until 15 months after application (~ 5000 environmental samples were assayed). Whole body residues were of major concern, although tissues were assayed from vertebrates that were too large to prepare as a unit. The results show that DDT is rapidly accumulated in the biotic environment. Residues were detected in sago pondweed, duckweed, bladderwort, crayfish, tadpoles, and carp when they were first assayed 4 h after DDT application; 3 d after the application Cladophora contained an average of 98 ppm, or 3125 times the environmental level. This was the highest accumulation recorded for any organism during the project. Fat contained the highest residues in most vertebrate tissues. A northern water snake accumulated 40 ppm 15 months after the application. The max. level in carp was 19 ppm in the soft palate. The skin and eyes of carp also contained relatively high residues. Plants and most invertebrates accumulated their highest residues during the 1st week while DDT could still be detected in the water. Vertebrates required longer periods of time. Tadpoles were an exception in that they immediately accumulated their highest DDT residues right after application. Examples of food-chain residues accumulation are noted. Plants re-accumulated low residues when they commenced growing the 2nd year. The DDT residues in plants, invertebrates, and small vertebrates remained fairly low throught the 2nd year; higher quantities often occurred in tissues from large vertebrates. Algae, the pondweeds (Potamogeton sp.), duckweed, crayfish, and small carp should make good indicator species of environmental DDT levels.

662 Meeks, R.L., II. THE CYCLING OF CHLORINE-36 RING-LABELLED DDT IN A MARSH ECOSYSTEM. Diss. Abstr. 27B, 9 (1967) 2947-8.

DDT [2,2-bis(p-chlorophenyl)-1,1,1-trichloroethane] residues are widespread in the biosphere. This project was designed to provide information about the occurrence and translocation of these residues in aquatic environments. An enclosed 4-acre marsh located at the southwestern edge of Lake Erie was treated with 3.9 mCi of ^{36}Cl-ring-labelled DDT at a rate of 0.2 pounds/acre. The DDT was applied by helicopter on 100 pounds of inert attapugite granules/acre. Radiolabelled DDT residues were traced until 15 months after the application. Approx. 5000 environmental samples were assayed. Whole body residues were of major concern, although tissues were assayed from vertebrates too large to assay entire. Residues were detected in sago pondweed (Potamogeton pectinatus), lesser duckweed (Lemna minor), bladderwort (Utricularia vulgaris), crayfish (Orconectes immunis), tadpoles (Rana pipiens), and carp (Cyprinus carpio) when they were first assayed four hours after the DDT application. 3 d after the application, the algae Cladophora contained an average of 96 ppm, or 3125 times the environmental level. This was the highest accumulation recorded for any organism during the project. Fat contained the highest residues in most vertebrate tissues. A northern water snake (Natrix sipedon) accumulated 40 ppm 15 months after the application. The maximum level in carp was 19 ppm in the soft palate. The skin and eyes of carp also contained relatively high residues. Plants and most invertebrates accumulated their highest residues during the 1st week while DDT could still be detected in the water. Vertebrates required longer periods of time. Tadpoles were an exception in that they immediately accumulated their highest DDT residues right after the application. Examples of food-chain residue accumulation are noted. Plants re-accumulated low residues when they commenced growing the 2nd yr. The DDT residues in plants, invertebrates, and small vertebrates remained fairly low throughout the 2nd year; higher quantities often occurred in tissues from large vertebrates. Algae, the pondweeds (Potamogeton sp.), lesser duckweed, crayfish, and small carp should make good indicator species of environmental DDT levels. (From DA)

663 Mercer, W.A., Ed. APPLICATION OF RADIOCHEMISTRY TECHNIQUES IN FOOD PROCESSING RESEARCH. RADIOISOTOPIC TRACER TECHNIQUES IN EVALUATION AND IMPROVEMENT OF INDUSTRY PRACTICES FOR REMOVAL OF PESTICIDE RESIDUES FROM FOODS. Annual Report No.4, SAN-536-10, National Canners Association Research Foundation, Washington, D.C. 30 Nov. 1964, 48 p.

A standard soil was treated with a commercial DDT formulation which had been enriched with random ring-labelled DDT-^{14}C. Autoradiography of samples of the treated soil showed a satisfactory uniformity

of distribution of the pesticide. Periodic analyses of soil core samples indicated a slow downward migration of the pesticide. Extraction of the soil with dichloromethane gave a complete recovery of added DDT-^{14}C in treated soil samples. Red cored Chantenay carrots were grown in five-gallon containers filled with DDT-^{14}C treated soil. Autoradiography of 36-d-old seedlings showed a faint image in the root system. Evidence was obtained for a root-to-foliage and for a foliage-to-root migration of radioactivity. Carrots grown in soil treated with non-radioactive DDT had radioactivity in the root system. Foliage, sprayed with cold DDT, on carrots grown in DDT-^{14}C treated soil contained radioactivity. The major part of the carrot crop was harvested after 124 d of growth. The carrots were washed in a rotating reel washer using cold water sprays (75 lb/sq in. pressure) to remove dirt. An interesting distribution pattern was found for radioactivity in various parts of the washed carrots. Sixty-eight percent of the radioactivity was found in the rootlets, tap root end, and skin. These portions, which represent less than 7% of the carrot wt, are removed by food preparation operations. The level of DDT or its transformation products in the prepared carrot was less than 0.05 ppm. An extraction of the foliage cut from the harvested carrots was made to isolate possible transformation products from the DDT. The extract was purified by column chromatography and the eluate fractions analyzed by electron capture gas chromatography and thin layer adsorption chromatography. Autoradiography of a developed thin-layer plate demonstrated the presence of radioactive spots (in addition to the major component DDT-^{14}C) corresponding in R_f to 2,2-dichloro-1,1-bis(p-chlorophenyl)-ethene (DDE-^{14}C) and to 2,2-dichloro-1,1-bis(p-chlorophenyl)-ethane (TDE-^{14}C). The low level of radioactivity in peeled carrots made further studies on the reduction of pesticide residue content by blanching and preservation by dehydration, freezing, and canning of little practical significance. In a continuing program to improve pesticide residue analytical procedures, a method of separation and identification of chlorinated pesticides was developed. New methods for the clean-up and thin-layer chromatography of thiophosphate pesticides are described. The masking by crop extractives was reduced by using glycerine in the assy jars or by employing a more rigorous cleanup procedure. (Auth.)

664 Miyazaki, S., Boush, G.M. MICROBIAL DEGRADATION OF CHLOROPROPYLATE®(ISOPROPYL 4,4'-DICHLOROBENZILATE). Bull. ent. Soc. Am. 13, 3 (1967) 192. Abstr. 93, at "New York Meeting of the Entomological Society of America. New York, N.Y., USA. 27-30 Nov. 1967".

A soil fungus, Trichoderma viride and other microorganisms were found to degrade ^{14}C-labelled Chloropropylate® in a solution of yeast extract and mannitol. Thin-layer chromatography in conjunction with autoradiography was used to assess degradation and separate metabolites. (Abstr.)

665 Morgan, D.J., Duxbury, G. THE DETERMINATION OF CHLORINATED HYDROCARBONS IN THE ATMOSPHERE BY ACTIVATION ANALYSIS. Ann. occup. Hyg. 8 (1965) 253-256.

The method is applicable to chlorinated hydrocarbons generally, although the actual tests were carried out on degreasing agents such as trichlorethylene. The air sample containing about 10 mg of chlorinated hydrocarbon is drawn through a small charcoal pack by means of a battery-operated air sampler. The charcoal is then placed in a neutron flux and the ^{38}Cl formed is determined by γ-spectrometry. The results of an operational investigation are described.

666 Mumma, R.O., Wheeler, W.B., Frear, D.E.H., Hamilton, R.H. DIELDRIN: EXTRACTION OF ACCUMULATIONS BY ROOT UPTAKE. Science, N.Y. 152 (1966) 530-531.

Certain forage crops can absorb and translocate the chlorinated hydrocarbon insecticide dieldrin from soil or sand. An extraction technique routinely used for analyses of residues does not quantitatively remove this internal chemical, but a method employing chloroform-methanol extraction leads to essentially quantitative recovery. ^{36}Cl-dieldrin was used. After some trial and error it was found that almost 100% of the radioactivity could be extracted from labelled plants by (1) maceration and repeated blending of the plant material with n-hexane-isopropyl alcohol (2:1); and (2) 12-h reextraction of this tissue with a 1:1 mixture of chloroform and methanol in a Soxhlet extractor.

667 Oppenoorth, F.J. TWO TYPES OF SESAMEX-SUPPRESSIBLE RESISTANCE IN THE HOUSEFLY. Entomologia exp. appl. 10 (1967) 75-86.

In a resistant strain of house fly, Fc, derived from a Danish strain, DDT resistance and most of the diazinon resistance are under the control of the 3rd chromosome. Resistance to both compounds is suppressed by sesamex. These two facts indicate that there is a single mechanism responsible for

resistance to these (and many other) compounds. It appears that in this strain DDT is rapidly metabolised and that water soluble products are excreted. This metabolism is blocked by sesamex. A Dutch strain with high resistance to dithion did not show the low aliesterase activity characteristic of most organophosphate-resistant strains. Therefore a resistance mechanism different from that in most other strains was expected. The fact that sesamex can suppress the dithion resistance indicates that a detoxication-mechanism that can be blocked by this synergist is responsible for the resistance. The gene for this resistance is on the 5th chromosome. Ring-labelled ^{14}C-DDT was used. The radioactivity in excrements was determined.

668 Paul, B.B., Rubinstein, D. METABOLISM OF CARBON TETRACHLORIDE AND CHLOROFORM BY THE RAT. J. Pharmacol. exp. Ther. 141 (1963) 141-148.

18 h after intraduodenal administration of $^{14}CCl_4$, 85% had been excreted in the expired air unaltered and 1% had been converted to $^{14}CO_2$. After administration of $^{14}CHCl_3$, 70% had appeared in the expired air unchanged and 4% as $^{14}CO_2$. Liver slices also formed CO_2 more rapidly from $CHCl_3$ than from CCl_4. The metabolism of CCl_4 and $CHCl_3$ is greatly diminished if the tissues are homogenized. The production of CO_2 from chloromethanes by liver slices is stimulated by citrate and acetate, inhibited by iodoacetate, fluoride arsenate, cyanide and by acid, alkali or heat treatment of the liver slices. Succinate stimulated the metabolism only of CCl_4, not of $CHCl_3$. Neither reduced glutathione nor cysteine increases CO_2 production from CCl_4. Some CCl_4 is converted to $CHCl_3$ in vivo and in vitro. No evidence of the formation of other chloromethanes from either $CHCl_3$ or CCl_4 was obtained. It is concluded that CCl_4 and $CHCl_3$ are converted to CO_2 by enzyme-catalyzed reactions and that $CHCl_3$ probably is an intermediate in the metabolism of CCl_4. (Auth. summary)

669 Peakall, D.B. PESTICIDE-INDUCED ENZYME BREAKDOWN OF STEROIDS IN BIRDS. Nature, Lond. 216 (1967) 505-506.

The effects of low doses of DDT (10 ppm) and/or dieldrin (2 ppm) were tested on white 1-yr-old King pigeons weighing ~600 g, females being used for the progesterone and males for the testosterone experiments. Labelled compounds, progesterone-4-^{14}C and testosterone-4-^{14}C, were used. The experiments demonstrate that relatively small amounts of DDT and dieldrin can induce increased rates of metabolism of steroids by induction of hepatic enzymes. The effects of the two pesticides are additive but not synergistic.

670 Perry, A.S., Hennessey, D.J., Miles, J.W. COMPARATIVE TOXICITY AND METABOLISM OF p,p'-DDT AND VARIOUS SUBSTITUTED DDT-DERIVATIVES BY SUSCEPTIBLE AND RESISTANT HOUSE FLIES. J. econ. Ent. 60, 2 (1967) 568-573.

Comparative toxicity tests with DDT and o-Cl-substituted DDT-derivatives showed that o-Cl-DDT was the most toxic compound to DDT-resistant house flies, Musca domestica L. Steric hindrance caused by the o-chlorine atom reduces the enzymatic dehydrochlorination of the molecule and, correspondingly, restores its toxicity against the resistant strains. One strain, highly resistant to o-Cl-DDT, did not dehydrochlorinate the latter compound to a great extent, but the resistance mechanism is not known. Deuterated-DDT is only slightly more toxic than DDT to DDT-resistant house flies. At low dosages the latter can dehydrochlorinate deutero-DDT with equal facility as ordinary DDT, but at higher dosages an isotope effect on dehydrochlorination is evident. ^{3}H-DDT is considerably more refractory to alkali dehydrochlorination than p,p'-DDT which correlates favourably with enzymic breakdown of ^{3}H-DDT by homogenates of resistant M. domestica.

671 Ralls, J.W. USE OF RADIOISOTOPE TECHNIQUES TO DETECT AND MEASURE PESTICIDE RESIDUES IN AND ON FOODS AND TO EVALUATE COMMERCIAL FOOD PREPARATION PRACTICES. p. 28-29 of "Isotope Systems Development Program. 6th Annual Contractors Meeting, Washington, D.C., USA, 9-10 Nov. 1964", Feb. 1965, 73 p. N65-15844, Atomic Energy Commission, Washington, D.C. Div. of Isotopes Development.

A detailed study was carried out of the pickup, distribution, and removal of ^{14}C-DDT in and from carrots. A standard soil was treated with a commercial DDT formulation which had been treated with random ring-labelled DDT-^{14}C. Autoradiography of samples of treated soil showed a satisfactory uniformity of distribution of the pesticide. Periodic analysis of soil core samples indicated a slow downward migration of the insecticide. Extraction of the soil with dichloro-methane gave a complete recovery of added DDT-^{14}C treated soil. Red-cored chantenay carrots were grown in

five gallon containers filled with ^{14}C-DDT treated soil. Evidence was obtained for a root-to-foliage and for a foliage-to-root migration of radioactivity. DDE-^{14}C [2,2-dichloro-1,1-bis(p-chlorophenyl) ethene] and TDE-^{14}C [2,2-dichloro-1,1-bis(p-chlorophenyl)-ethane] were found in foliage in addition to DDT.

672 Romm, R.F. APPLICATION OF RADIOISOTOPES IN THE CONTROL OF CHEMICAL PROCESSES. AEC-tr-6466/1. p.297-309 of "The Uses of Radioactive Isotopes and Nuclear Radiation in the USSR. Proceedings of the All-Union Conference. Riga, USSR, 12-16 Apr. 1960". Vol.1. General Problems Connected with the Use of Isotopes. Devices Incorporating Radioactive Sources. Radiation Chemistry. Chemical and Oil Industries. 1961, 347 p. Translated from: "Radioaktivnye Izotopy i Yadernye Izlucheniya v Narodnom Khozyaĭstve SSSR, Trudy Vsesoyuznogo Soveshchaniya. Riga, USSR. 1960".

The use of radioisotopes in the control of chemical processes is discussed. The control of extraction columns using γ density gages, the measurement of solid-particle concentration in fluid-bed systems, the desiccation of chlorine, the automatic monitoring and control of an alcohol chlorination column in the production of DDT, an automated circuit for the chlorination of kerosene in the production of sulfonol, and the automatic control of crystallization processes are considered in some detail. (NSA 20: 1966, 23553)

673 Sanchez, E. DDT-INDUCED METABOLIC CHANGES IN RAT LIVER. Can. J. Biochem. 45, 12 (1967) 1809-1817.

Administration of DDT to rats resulted in an increase in the rate of incorporation of DL-leucine-1-^{14}C into proteins by a liver cell-free system. This effect was paralleled by an increase in the activity of microsomal DDT-metabolising enzymes and in total liver protein, as well as by increased synthesis of RNA. The level of total glutathione in liver and blood was not modified, but the amount of the oxidized form was increased at the expense of the reduced form. Phenobarbital or hydrocortisone also increased the levels of microsomal DDT-metabolising enzymes but their combination with DDT produced a relative inhibition. The role of DDT as an enzyme inducer and the possibility that changes in RNA correspond to increased synthesis of messenger RNA are discussed. (CA 68: 1968, 38478d)

674 Schaefer, C.H., Sun, Y.P. A STUDY OF DIELDRIN IN THE HOUSE FLY CENTRAL NERVOUS SYSTEM IN RELATION TO DIELDRIN RESISTANCE. J. econ. Ent. 60, 6 (1967) 1580-1583.

In general, there are no large differences in the rate of uptake of ^{14}C-dieldrin by the central nervous systems of susceptible or dieldrin-resistant female house flies, Musca domestica L., following injection or infusion. No evidence could be found that binding of dieldrin to tissues within the central nervous system is a significant factor in resistance. Metabolism of dieldrin within the same tissues was not detectable in either strain. Dieldrin resistance in house flies may be largely due to insensitivity at the receptor site. (Auth.)

675 Schoettger, R.A. THE TOXICOLOGY OF THIODAN IN SEVERAL FISH AND AQUATIC INVERTEBRATES. Diss. Abstr. 27, 12 Pt.1 (1967) 4609-B - 4610-B.

The objective of this investigation was to determine whether Thiodan, a chlorinated hydrocarbon, is suited chemically and toxicologically for use in fish control. The toxicity of Thiodan was tested against rainbow trout, fertilized eggs of rainbow trout, western white sucker, Daphnia magna and damselfly naiads. The median tolerance limits for trout and sucker ranged between 0.28 and 8.00 ppb and the fish were at least seven times more susceptible than the invertebrates. Toxicity was influenced by temperature, length of exposure and alkaline pH. Thiodan was not toxic to fertilized trout eggs. The deposition and metabolism of Thiodan in western white sucker, northern creek chub and goldfish was traced with the aid of ^{14}C-labelled Thiodan, and chemical analyses of Thiodan in tissues. Residues of the insecticide occurred in the skin and muscles of fish exposed to acute, and to multiple, sub-acute concentrations. Residues were poorly correlated with exposure. The mortalities of fish which were poisoned sub-acutely were correlated with their size and the lipid content of muscle. The relative amounts of residues in the various tissues seemed to be associated with the method of treatment. A water-soluble metabolite of Thiodan occurs in the bile of treated fish. It appears to be a glucosiduronic acid conjugate of Thiodan alcohol. A possible metabolic pathway for Thiodan degradation is discussed. Thiodan appears to have little value as a selective piscicide

against rough fishes such as carp or sucker, but under certain conditions, it may be a good, general fish toxicant. (DA)

676 Schuntner, C.A., Schnitzerling, H.J. SEPARATION OF DDT AND RELATED COMPOUNDS ON A SILICIC ACID COLUMN USING GRADIENT ELUTION. J. Chromat. 21 (1966) 483-485.

Metabolites of ^{14}C-labelled DDT extracted from the cattle tick Boophilus microplus (Canes.) were required in a high degree of purity for spectroscopic examination. Solvent-washed, activated silicic acid was used for all preliminary separation and subsequent clean-up of metabolites. A column chromatographic method was used. A clear separation of DDE, DDT, DDD, and DDA was obtained. Although Kelthane and DBP were not completely separated here they should be resolvable by continuing the benzene gradient instead of using pure benzene elution. In the original metabolite work o,p'-DDT was present as a minor impurity and separated satisfactorily, eluting ahead of the p,p'-DDT. Recoveries in the present experiment ranged from 95%-100% by gravimetry.

677 Stenersen, J.H.V. DDT-METABOLISM IN RESISTANT AND SUSCEPTIBLE STABLE-FLIES AND IN BACTERIA. Nature, Lond. 207, 4997 (1965) 660-661.

Regular exposure of Stomoxys calcitrans(L.)to DDT having resulted in the development of 30-fold resistance to DDT, 110-fold resistance to methoxy-DDT (methoxychlor) and extremely high resistance to DDD (TDE), mainly due to one gene allele [RAE-B 54: 1966, 11], experiments were carried out to investigate whether the resistance was caused by differing rates of absorption, metabolism or excretion of DDT. Resistant and susceptible flies were treated topically with 0.0164 μg radioactive DDT (labelled with ^{14}C) in acetone and kept at 25°C [77°F] in glass cages and supplied with fresh blood every day. Examination of samples of flies at intervals after treatment showed that there were no differences in the rates of absorption, detoxication or excretion of DDT by resistant and susceptible flies. Both metabolised only small amounts to DDE. When resistant flies were treated with 10 μg DDD extracts of them yielded only this compound. Excreta of the resistant flies treated with DDT were collected in the 24 h after the application and were found to contain DDT, DDE, DDD and a water-soluble metabolite. Three strains of bacteria, including Serratia marcescans and an unidentified strain, facultative anaerobes, were isolated from the excreta and, with laboratory strains of three other bacteria (including the facultative anaerobe Escherichia coli), were grown in a medium containing radioactive DDT in various conditions of aeration. The facultative anaerobes converted DDT almost completely to DDD and DDE when growing in a nitrogen atmosphere or in conditions of oxygen deficiency, but neither facultative anaerobes nor obligate aerobes converted any DDT when grown in aerated culture. It is concluded that the mechanism of resistance in S. calcitrans must be unusual; and the fact that bacteria from the intestines of the flies could convert DDT to two of the three metabolites found in the fly excreta further indicates that the cause of resistance to DDT, methoxy-DDT and DDD in this species is not detoxication by the fly. (RAE-A, 54: 1966, 110)

678 Street, J.C., Chadwick, R.W. STIMULATION OF DIELDRIN METABOLISM BY DDT. Toxic. appl. Pharmac. 11, 1 (1967) 68-71.

The excretion of polar metabolites of dieldrin by DDT-treated female rats greatly exceeded that by rats given only dieldrin-^{14}C. Increased metabolite excretion was observed in both faeces and urine, the relative increase being greater in the urinary products. The chromatographic properties of the major urinary dieldrin metabolite in DDT-stimulated rats did not match those of trans-dihydroxydihydroaldrin, the principal urinary metabolite in the rabbit. (CA 67: 1967, 81470)

679 Strongin, G.M., Kulikova, M.N. THE USE OF THE RADIOACTIVE ^{36}Cl ISOTOPE FOR CONTROLLING THE PRODUCTION AND PROCESSING OF HEXACHLOROCYCLOHEXANE. Atomn. Energ. 18, 1 (1965) 84-85.

The isomeric composition of hexachlorocyclohexane (I) was measured by isotopic dilution, using the individual isomers labelled with ^{36}Cl; the measurements showed that the wastes contain 10-15% of the γ-isomer, rather than 3% (as assumed before the measurements). As a result, it was decided to use the wastes as an insecticide. Isomers labelled with ^{36}Cl were also used to measure the solubility of I in various solvents. Because of the high cost of ^{36}Cl and in order to reduce the accumulation of radioactive wastes, the ^{36}Cl was recovered from the labelled isomers by conversion into $Na^{36}Cl$. (CA)

680 Sun, Y.P., Schaefer, C.H., Johnson, E.R. EFFECTS OF APPLICATION METHODS ON THE TOXICITY AND DISTRIBUTION OF DIELDRIN AND RESISTANCE IN HOUSE FLIES. Bull. ent. Soc. Am. 12 (1966) 248. Abstr. 25, at "Portland Meeting, Portland, Oreg., USA. 28 Nov.-1 Dec. 1966".

Toxicities by injection, infusion, and topical application and distribution of ^{14}C-labelled dieldrin in house flies indicate a possible resistance factor in house flies. (Abstr.)

681 Sun, Y.P., Schaefer, C.H., Johnson, E.R. EFFECTS OF APPLICATION METHODS ON THE TOXICITY AND DISTRIBUTION OF DIELDRIN IN HOUSE FLIES. J. econ. Ent. 60, 4 (1967) 1033-1037.

When dieldrin is infused into Musca domestica L. its toxicity is much less than when it is injected into them. Similar results were obtained for DDT but not for SD 11319 (3-hydroxy-cis-crotonamide dimethyl phosphate). It was suspected that during infusion a good part of the dieldrin and DDT was adsorbed onto proteins or partitioned into lipids and thus was not available for penetration to the site of action. However, because of the hydrophilic property of SD 11319, its activity was about the same by either injection or infusion. Analyses of ^{14}C-dieldrin in house flies following injection and infusion indicate the effects of adsorption and partition on the distribution of dieldrin. No large differences could be found. The rate of penetration and amount of ^{14}C-dieldrin in the haemolymph and in the central nervous system, following injection or infusion, do not provide the same magnitude of difference as for the toxicity results. (Auth.)

682 Troitskiĭ, I.A., Kartashova, V.M., Kartashov, P.A. RESORPTION, EXCRETION, AND RETENTION OF LABELLED DDT IN ANIMALS. p.481-488 of "Trudy Tashkentskoĭ konferentsii po mirnomu ispol'zovaniyu atomnoi energii". Vol.3. Tashkent, Akad. Nauk Uzb. SSR, 1961.

10 min after a solution of labelled DDT (I) was applied on the skin of rabbits, the radioactivity appeared in blood. It increased progressively during the next 3 h, after which a decrease was found. Even after 1 yr a slight radioactivity of the blood was noted. I appeared in urine already 10-15 min after application. Excretion of I in faeces and urine was highest during the 5th to 15th day of the experiment, while only traces of I were found during 2.5-12 months. No excretion of I occurs in the skin. 30 min after the application, I was found in lung, spleen, and kidney; 1.5-2 h after that highest amounts of I were present in spleen, bone marrow, and kidney, while after 4.5 h in the liver. After 2.5 months highest retention of I was found in fat tissue, bone marrow, kidney, and liver. These amounts gradually decreased and after 1 yr I was present only in kidneys. Similar results were obtained when cats, cows, young rabbits, or claves were used. No degradation of I is thought to occur in the animal organism, since no presence of radioactive CO_2 could be detected. (CA 56: 1962, 12825a)

683 Ullberg, S., Koransky, W. AUTORADIOGRAPHISCHE UNTERSUCHUNGEN AN SCHNITTEN DURCH GANZE TIERE ÜBER DIE VERTEILUNG MARKIERTER SUBSTANZEN. (Autoradiographic investigations on sections through the whole animal as to the distribution of labelled substances.) Nauyn-Schmiedebergs Arch. exp. Path. Pharmak. 246, 1 (1963) 65-68. (In German)

With the aid of the method of autoradiography of sections through whole animals, elaborated by Ullberg, the two narcotics glutethimide and thalidomide and the contact insecticide hexachlorocyclohexane were studied. The substances were labelled with ^{14}C. The examination was made at different times after administration to pregnant animals and to some male animals. The results are demonstrated on the basis of numerous autoradiograms. The radioactivity of glucose labelled in the 6 position is distributed at a great speed over nearly all the tissues of the mother animal and foetus. As early as after 1 min a considerable accumulation manifests itself in brain and liver of the mother animal. Other maternal organs in which gradually an accumulation takes place are retina and lens, Harder's gland, salivary and mammary glands, the gastric wall as well as intestinal and vaginal mucosa, adipose and cartilaginous tissues and myocardium, but not the skeletal musculature. In the foetus at the same time a relatively uniform distribution of the radioactivity over all organs is seen. After administration of ^{14}C-glutethimide, an accumulation of radioactivity manifests itself in the adipose tissue, brain and myocardium, in the walls of the large blood vessels and in the mammary glands of the mother animal. In the embryo nearly all the organs have the same ray density as the foetal blood. Also thalidomide is relatively rapidly transferred to the foetus and is distributed with surprising uniformity over nearly all the organs of the mother animal

and embryo. No accumulation was seen in the lipid-containing structures. In the case of hexachlorocyclohexane the radioactivity is concentrated in the organs which are rich in lipids, notably in the adipose tissue and brain. The substance shows a great accumulation in some structures of the CNS. Comparison with histological sections shows that the accumulation takes place in the medullated fibres. (Nuclear Medicine)

684 Viel, G., Hascoet, M., Dubroca, G. THE ELIMINATION OF PESTICIDE RESIDUES ON APRICOTS BY WASHING BEFORE CANNING. Phytiat.-Phytopharm. 15, 1 (1966) 41-48.

Several detergents were tried for the elimination of S on apricots. The effect of the washings was assessed by the use of ^{35}S. About 60 treated apricots were soaked in 10 ℓ H_2O or solution, brushed mechanically for 2 min, and rinsed for 30 sec by spraying. Half of the lot was analysed immediately, the other half was canned to study eventual corrosion control. The washing treatments consisted of (A) H_2O (control), (B) H_2O and 0.002% dodecylbenzenesulfonate, (C) H_2O and 0.0125% oxyethylenated oleocetyl alcohol (I) (D) H_2O and 0.05% oxyethylenated sucrose tallow acid esters (II) and (E) H_2O with a mixture of 0.03% I and 0.02% II. Unwashed apricots contained 120-30 mg S/kg. Compared to the control treatment, the S content was reduced by 5.1% by B, to 17% by C, to 18% by D, and to 14% by E. Treatment D was preferred, as the detergent was biodegradable. Treatment C was also tried on apricots treated with DDT or with carbaryl. A H_2O washing reduced DDT content by 18% and carbaryl by 75%, but C reduced DDT by 28.5% and carbaryl by 83.5%. (CA)

685 Vinson, S.B. THE PENETRATION, DISTRIBUTION, AND METABOLISM OF ^{14}C LABELLED DDT IN THE LARVAE OF THE TOBACCO BUDWORM Heliothis virescens. Diss. Abstr. 26, 9 (1966) 5611.

Studies were carried out from Jun. 1963-Jan. 1965 to determine penetration, distribution and metabolism of ^{14}C-labelled DDT in 3rd-instar larvae of resistant and susceptible strains of H. virescens (F.). In the 3rd-instar larvae resistance is due to several factors. In the South Delta resistant strain, which had an LD50 of 117.9 µg/larva, the internal level of DDT was 0.41 µg/larva. Resistance in this strain appeared to be due to reduced penetration and to efficient elimination of the toxicant. Degradation was not important. The Mississippi resistant strain was the most resistant strain studied; LD50 was 286.2 µg/larva. DDT rapidly penetrated the cuticle in this strain. The dose was efficiently eliminated. Metabolism, however, was an important factor reducing the internal DDT concentration to a comparable level of 0.65 µg/larva. The rate of penetration was similar in the three susceptible strains. In the Auburn strain, the most susceptible studied, the ability to eliminate the dose was less than all strains studied. In this strain some DDT was degraded by a pattern similar to the Mississippi resistant strain. Even though metabolism occurred the internal level of DDT reached 1.07 µg/larva, the highest level found in the strains studied. In the Florida susceptible strain, which had an intermediate LD50 of 15 µg/larva, the rate of elimination was also intermediate between the two resistant and the Auburn strain. DDT degradation was of little importance in reducing the level of DDT internally. The internal level of DDT was 0.9 µg/larva. In the South Delta susceptible strain, which had an LD50 similar to the Florida strain, the rate of elimination and tissue levels of DDT internally were similar to the Florida strain. Although DDT degradation occurred in this strain it did not occur in the internal fraction and was, therefore, ineffective in further reducing the internal concentration of DDT. The only environmental difference between the South Delta resistant and susceptible strains was with diet consumed. The different diets resulted in a difference in response to DDT, and it appeared to be due to a change in cuticle permeability to DDT. It was suggested that the level of resistance in this insect was correlated to its ability to maintain DDT at a non-toxic level. Decreased penetration, efficient elimination and degradation of DDT appeared to be the main factors involved. Two degradation products of DDT were found. DDE was the predominant product found internally while both DDE and DDA were present in the holding vial fraction. The 5th-instar larvae are tolerant to DDT. This tolerance appeared to be due to the decreased ability of DDT to penetrate the cuticle in both resistant and susceptible strains. (DA 26: 1966, 5611)

686 Vinson, S.B., Brazzel, J.R. THE PENETRATION AND METABOLISM OF ^{14}C-LABELLED DDT IN RESISTANT AND SUSCEPTIBLE TOBACCO BUDWORM LARVAE, Heliothis virescens (F.). J. econ. Ent. 59 (1966) 600-604.

The fate of ^{14}C-labelled DDT* applied topically to larvae of the tobacco budworm, H. virescens (F.), was determined in several DDT-resistant and susceptible strains. The DDT did not penetrate effectively the cuticle of the older 5th-instar larvae. The same phenomenon occurred in the 3rd-instar larvae of the South Delta resistant strain. In the other resistant strain the DDT penetrated effectively the cuticle but was degraded rapidly and eliminated. The resistant South Delta strain when fed a diet of cotton leaves was susceptible to a topically applied dose of DDT which readily penetrated the cuticle. This diet-altered strain resembled one of the susceptible strains in the rate of penetration and elimination of the dose as well as having similar LD50 for DDT. The other susceptible strain showed DDT breakdown but was ineffective in reducing the DDT content internally owing to the rapid DDT absorption in conjunction with slow excretion of the dose. In all strains where DDT breakdown occurred both DDE and DDA were found, with the DDA increasing in the excreted fraction.

---

* ring-labelled ^{14}C-p, p'-DDT

687 Vinson, S.B. EFFECT OF SEVERAL NUTRIENTS ON DDT RESISTANCE IN TOBACCO BUDWORM. J. econ. Ent. 60, 2 (1967) 565-568.

Tobacco budworm, Heliothis virescens (F.), larvae were found to be more tolerant to DDT when reared on an artificial diet high in ascorbic acid content than when reared on the same diet low in ascorbic acid. An additional source of lipids in the diet was also found to increase the tolerance of the larvae to DDT. Other dietary components were found to influence tolerance of the larvae to DDT. ^{14}C-DDT was used in that part of the study concerned with penetration rates. Larvae were held for 120 h before the level of radioactivity penetrating the cuticle was determined.

688 Wheeler, W.B., Frear, D.E.H., Mumma, R.O., Hamilton, R.H., Cotner, R.C. QUANTITATIVE EXTRACTION OF ROOT-ABSORBED DIELDRIN FROM THE AERIAL PARTS OF FORAGE CROPS. J. agric. Fd Chem. 15, 2 (1967) 227-230.

A blending procedure widely used to extract insecticide residues from fresh plant materials is inefficient when applied to crops containing solely internal accumulations of dieldrin. The repeated blending of corn, alfalfa, orchard grass, and wheat in n-hexane-isopropyl alcohol (2 to 1, 8 to 10 ml/g) resulted in the extraction of only 50-90% of the total insecticide found. An additional extraction with chloroform-methanol (1: 1) in a Soxhlet apparatus completely removed dieldrin. Factors other than the actual processing technique may affect the efficiency of dieldrin extraction by blending when this chemical is present within plant tissues. The extraction of insecticides from plant materials, whether surface or internal residues, is often the weakest link in the entire analytical procedure. Only by the use of labelled compounds (1) (2) is it possible to determine the absolute efficiency of extraction procedures. (Auth.)

---

(1) ^{14}C-dieldrin
(2) ^{36}Cl-dieldrin

689 Williams, V.A. DETERMINATION OF THE FASTNESS PROPERTIES OF DIELDRIN IN WOOL BY RADIOACTIVE TRACER TECHNIQUES. Text. Res. J. 35, 2 (1965) 124-128.

Radioactive tracer studies show no exhaustion of dieldrin on wool from white spirit solutions, but a surface layer of crystals is formed which is easily removed by non-swelling solvents or detergents. From aqueous emulsions, rapid absorption of dieldrin occurs, which is hardly removed by aqueous extractions, and organic solvents remove only a small amount even after repeated extractions, which amount could be considered as lying on the surface of the fibres. (CA)

690 Witt, J.M. THE METABOLISM OF ^{14}C-LABELLED DDT BY THE LARGE MILKWEED BUG, THE HOUSE FLY, AND THE AMERICAN COCKROACH. Diss. Abstr. 26, 12 (1966) 7020.

Metabolism of DDT was studied in three species of insects which represented three different mechanisms of detoxification:

1.	No metabolism	Oncopeltus fasciatus (Dallas)
2.	Reduction	Musca domestica L.
3.	Oxidation	Periplaneta americana (Linn.)

The large milkweed bug, O. fasciatus (Dallas), did not metabolise significant quantities of DDT. This insect stores absorbed DDT as unchanged DDT in its internal tissues, and excretes unchanged DDT in the faeces. Although some water-soluble or oxidized products of DDT metabolism were indicated, the amount present was so small that detection was difficult. The unchanged DDT persists in the tissues for a long period of time and this is consistent with the long persistence of the symptoms of DDT intoxication in the milkweed bug. The house fly, M. domestica L., rapidly dehydrochlorinated DDT to DDE. DDE is stored in the insect tissues and excreted without further change. The house fly excretes a definite quantity of water-soluble products, but these compounds were minor metabolic products and could not be identified. The house fly either succumbs to, or survives, a dose of DDT within 24 h, and this is consistent with the rapid metabolism of DDT into DDE by the fly. The American cockroach, P. americana (Linn.), stores unchanged DDT and slowly metabolises the stored DDT into oxidation products. DDE is produced, but oxidized metabolites represent the primary excretion products. Seven products were detected in the faeces of the cockroach. Unchanged DDT and the commonly produced DDE represented two of these. One of the oxidized products was identified as DBP (p,p'-dichloro-benzophenone), and it was suggested that one of the other metabolites was DBH (p,p'-dichlorobenzhydrol). Unchanged DDT persists in the cockroach for a longer time than in the house fly, but not for as long a time as in the milkweed bug. This intermediate degree of persistence of DDT corresponds to the length of time the cockroach is subject to symptoms from an exposure to DDT. (DA)

691 Yaron, B., Swoboda, A.R., Thomas, G.W. ALDRIN ADSORPTION BY SOILS AND CLAYS. J. agric. Fd Chem. 15, 4 (1967) 671-675.

For most experiments, ^{14}C-aldrin (specific activity 56.7 μCi/mg) was used. The adsorption-desorption of aldrin as it initially comes in contact with soils, clays, and sand was studied in column and batch experiments. The aldrin was dissolved in a dilute aqueous electrolyte solution to simulate the conditions encountered in the field. The nature of clay minerals did not influence the amount of aldrin adsorbed. The amount of aldrin adsorbed by soils was found to be dependent on mechanical composition and organic matter content.

692 Yule, W.N., Chiba, M., Morley, H.V. FATE OF INSECTICIDE RESIDUES. DECOMPOSITION OF LINDANE IN SOIL. J. agric. Fd Chem. 15, 6 (1967) 1000-1004.

A mixture of soils was fortified with DDT, dieldrin, lindane, and heptachlor and was analysed monthly for qualitative changes. Only lindane decomposed during six months' exposure in percolated and standing moist soil. The breakdown product was analysed and identified chromatographically as γ-pentachlorocyclohexene, which was found by insect bioassay to be of the order of 1000 times less toxic than the parent lindane. The dehydrochlorination of lindane was 2-3 times greater in moist, acidic-to-neutral soil than in dry soil, and there was some experimental evidence that soil microorganisms were associated with the breakdown. However, specific in vitro microbial tests were inconclusive on this point. Bacillus cereus (also B. cereus variety mycoides), and a so-far unknown species of Bacillus were identified. When these specific bacterial cultures were fortified at 4 ppm with ^{14}C-labelled lindane, no evidence of a radioactive metabolite in the R_f position of γ-pentachlorocyclohexene was found by autoradiography of a thin-layer chromatography plate.

See also:

104 Effect of DDT on incorporation of ^{14}C-labelled glucose into protein and soluble intermediates of nymphal Triatoma infestans. (Villar, E. del. et al., 1967)

110 Enhanced protein synthesis in Triatoma infestans treated with DDT. (Agosin, M. et al., 1965)

111 The effect of DDT on the incorporation of glucose and glycine into various intermediates in DDT-resistant strains of Musca domestica L. (Agosin, M. et al., 1966)

112 The induction of NAD kinase by DDT in Triatoma infestans. (Agosin, M. et al., 1967)

138 Unique effects of DDT and other chlorinated hydrocarbons on the metabolism of formate and proline in the housefly. (Cline, R.E. et al., 1963)

163 Glutathione turnover in Triatoma infestans treated with 2,2-bis(p-chlorophenyl)-1,1,1-trichloroethane. (Hlivicky, J. et al., 1967)

585 Biochemistry of insecticide resistance in mosquitoes. (Perry, A.S., 1966)

586 The use of isotopes to study pesticide translocation in natural environments. (Peterle, T.J., 1966)

1717 Utilization of various radioisotopic devices and methods in the oil and chemical industries. (Dzhagatspanyan, R.V. et al.)

1729 Development of double isotope derivative assays for measurement of pesticide residues. (Bogner, R.L., 1965)

1731 Analysis of foods by neutron-activation techniques. (Buchanan, J.D. et al., 1963)

1737 Development of double isotope derivative dilution analyses for selected food additives. Final Report. (Bogner, R.L. et al., 1963)

1757 Radioactive nuclides in pesticide chemistry. II. (Dedek, W., 1967)

1.5.4. Organophosphorus Insecticides

693 Ågren, G., Ramachandran, B.V. THE EFFECT OF PYRIDINIUM ALDOXIMES AND ATROPINE ON THE INCORPORATION OF $DF^{32}P$ IN RAT LIVER FRACTIONS. Acta physiol. scand. 60 (1964) 95.

The incorporation of radioactive diisoprophyl phosphorofluoridate ($DF^{32}P$) in the subcellular fractions of rat liver cells has been studied when injected alone or followed or preceded by pyridine-2-aldoxime methane sulphonate (P2S), N,N'-trimethylene-bis-(pyridinium-4-aldoxime) (TMB-4) and atropine. In experiments with only $DF^{32}P$ the total labelled phosphorus (^{32}P) incorporated in the liver as well as the amounts taken up in the microsomal and mitochondrial fractions attain a max. value in 20 min, but there is a considerable readjustment of ^{32}P between the nuclear and supernatant fractions even at 60 min. The oximes administered prophylactically or therapeutically affect both the rate of uptake of $DF^{32}P$ and the quantity incorporated. The effects are explained on the basis of the rate of penetration of $DF^{32}P$ in the cell and possible direct action of the oximes. Atropine has a high retarding effect on the uptake of $DF^{32}P$ in the liver, the total quantity incorporated being reduced to 5-10% of the control in some experiments. (Auth.)

694 Akintonwa, D.A.A., Hutson, D.H. METABOLISM OF 2-CHLORO-1-(2,4,5-TRICHLOROPHENYL) VINYL DIMETHYL PHOSPHATE IN THE DOG AND RAT. J. agric. Fd Chem. 15, 4 (1967) 632-637.

A single oral dose of 2-chloro-1-(2,4,5-trichlorophenyl)- [^{14}C]vinyl dimethyl phosphate to rats is almost completely eliminated in 4 d. 78% of the ^{14}C is excreted in the urine, 16.5% in the faeces, and 0.5% in the expired gases; 0.8% of the ^{14}C is present in the gut and contents after 4 d. After oral administration of the compound to dogs, 92% of the ^{14}C is excreted in the urine and faeces during 4 d. The compound is completely metabolized in dogs and rats: unchanged insecticide is absent from the urine. The metabolic products in the urine of rats and dogs were as follows (% of total dose in rat and dog, respectively, given in parentheses): 2,4,5-trichlorophenylethanediol glucuronide (8, 12%), [1-(2,4,5-trichlorophenyl)ethyl- β-D-glucopyranosid]uronic acid (35, 0%), 2,4,5-trichloromandelic acid (24, 12%), 2-chloro-1-(2,4,5-trichlorophenyl)vinyl methyl hydrogen phosphate (4, 46%), 2,4,5-trichlorophenylethanediol (2.5, 4%), and 1-(2,4,5-trichlorophenyl)ethanol (2, 0%). (Auth.)

OMISSION. Reference should here be made to 904, erroneously listed in the wrong context.

904 Albanus, L., Heilbronn, E., Sundwall, A. ANTIDOTE EFFECT OF SODIUM FLUORIDE IN ORGANOPHOSPHORUS ANTICHOLINESTERASE POISONING. Biochem. Pharmac. 14, 9 (1965) 1375-1381.

695 Awad, T.M., Vinson, S.B., Brazzel, J.R. EFFECT OF ENVIRONMENTAL AND BIOLOGICAL FACTORS ON PERSISTENCE OF MALATHION APPLIED AS ULTRA-LOW-VOLUME OR EMULSIFIABLE CONCENTRATE TO COTTON PLANTS. J. agric. Fd Chem. 15, 6 (1967) 1009-1013.

A comparison of the persistence of malathion applied to cotton leaves as a water-diluted emulsifiable concentrate or as an ultra-low-volume formulation showed that the ULV persisted longer than the emulsifiable concentrate with a half-life value of 4.6 and 2 d, respectively. Studies with glass

surfaces indicated that faster evaporation of the EC was, in part, responsible for the differential in persistence of the two formulations, particularly at 50°C. The EC formulation penetrated the leaf surface faster and a greater percentage of malathion was found in the internal fraction of the leaf compared with the ULV formulation. Results obtained by using ^{14}C malathion (labelled at the 2 and 3 position of the succinic acid moiety specific activity 2.87 mCi/mM) confirmed what was first found with the use of the colourimetric method, that the water-diluted ^{14}C-malathion EC disappeared at a faster rate than the technical ^{14}C-malathion. After 12 d from application, there was only 0.87% of the initial radioactivity on the surface of leaves which received ^{14}C-malathion EC, while after the same period of time radioactivity counts revealed that 21.8% of the initial radioactive malathion was still on the surface of those plants treated with ULV technical ^{14}C-malathion. Half-life values were 3.8 and 1.2 d for ULV and ^{14}C-malathion EC, respectively. Metabolism on the leaf surface did not appear to contribute to the difference in the persistence of both formulations, although a small amount of the monocarboxylic acid of malathion was found on the surface of plants treated with both formulations. In the internal fraction, the dicarboxylic acid metabolite of malathion was the major decomposition product.

696 Bazzi, B. DETERMINATION OF ROGOR AND CIDIAL BY THE ISOTOPE DILUTION METHOD. p. 27-32 of "Radioisotopes in the Detection of Pesticide Residues. Proceedings of a Panel. Vienna, Austria, 12-16 Apr. 1965". STI/PUB/123, International Atomic Energy Agency, Vienna(Austria). 1966, 118p.

Preliminary results of an isotopic dilution method applied to the determination of residues of (^{32}P)-Rogor and -Cidial in olive oil and apples, respectively, are discussed. The equation used was

$$P_2 = P_1 \left(\frac{s_1}{s_2} - 1 \right)$$

where P_2 =unknown quantity of substance in the sample
P_1 =known quantity of labelled substance added to the sample
s_1=known specific activity of labelled substance added to the sample
s_2=measured specific activity of total substance in the sample after dilution.

To determine residues of Rogor (dimethoate) a benzene solution was used, the sample containing 19.5 µg/ml of ^{32} P-Rogor (specific activity 175.2 cpm/µg of compound). The methods used are described, involving a microcolorimetric P determination, following the destruction of organic substance. For Cidial in apples, a chloroform solution containing 25.14 µg/ml of ^{32} P-Cidial (specific activity 169.1 cpm/µg of compound) was used, the active substance again being determined via a colorimetric method for assessing P contents.

697 Beynon, K.I., Wright, A.N. THE BREAKDOWN OF ^{14}C-CHLORFENVINPHOS IN SOILS AND IN CROPS GROWN IN THE SOIL. J. Sci. Fd Agric. 18, 4 (1967) 143-150.

A sample of chlorfenvinphos (Shell Registered Trade Mark: Birlane) (2-chloro-1-(2',4'-dichlorophenyl) vinyl diethyl phosphate) was used, with a specific activity of 2.86 nCi/µg, labelled in the two vinyl carbon atoms. Soils of four different types were treated with a relatively high dosage level (15 ppm) of ^{14}C-chlorfenvinphos and were stored at about 22° C for four months. After this time the following radio-labelled compounds were detected in the moist soils: unchanged chlorfenvinphos, 1.0-4.7 ppm; 1-(2',4'-dichlorophenyl)ethan-1-ol, 0.06-1.0 ppm; 2,4-dichloroacetophenone, 0.1-0.5 ppm; desethyl chlorfenvinphos, 0.1-0.2 ppm; (2',4'-dichlorophenyl)ethan-1,2-diol, <0.03 ppm; salts or conjugates of desethyl chlorfenvinphos, 0.05-0.6 ppm; 2,4-dichlorophenyloxirane, < 0.005 ppm; 2,4-dichlorophenacyl chloride, <0.005 ppm. Soils were also treated with 3-4 lb/acre ^{14}C-chlorfenvinphos and cabbages, onions, and carrots were grown to maturity in the soils. The edible part of cabbages at harvest contained no detectable chlorfenvinphos or breakdown products of it when the limit of detectability was about 0.005 ppm. At harvest at 8-10 weeks after soil application of chlorfenvinphos the edible roots of carrots contained 0.12 ppm of unchanged chlorfenvinphos, and onion bulbs contained 0.07 ppm. There was evidence of trace amounts of a compound, probably a salt or conjugate of desethyl chlorfenvinphos, in onions (< 0.01 ppm) and in carrots (≤ 0.024 ppm). Carrots also contained traces (about 0.005 ppm) of 2,4-dichloroacetophenone.

698 Boyer, A.C. VINYL PHOSPHATE INSECTICIDE SORPTION TO PROTEINS AND ITS EFFECT ON CHOLINESTERASE I_{50} VALUES. J. agric. Fd Chem. 15, 2 (1967) 282-286.

The S-isomers of 1,2-^{14}C-SD 8447 and SD 7859 were prepared with specific activities of 0.9 and 1.0 mCi/mM, respectively. ^{14}C-Methoxy-labelled SD 3562 (crotonamide, N,N-dimethyl-3-hydroxy-cis-, dimethyl phosphate), SD 9129 (crotonamide, N-methyl-3-hydroxy-cis-, dimethyl phosphate), and SD 8447 insecticides were prepared with specific activities of 1.2, 0.2, and 1.0 mCi/mM. The two vinyl phosphate insecticides, 2-chloro-1-(2,4,5-trichlorophenyl)vinyl dimethyl phosphate (SD 8447) and 2-chloro-1-(2,4-dichlorophenyl)vinyl diethyl phosphate (SD 7859), are sorbed to mammalian blood plasma and homogenates of house fly (Musca domestica) heads. The I_{50} values for the inhibition of the cholinesterase present in these preparations were determined for both compounds. The sorption data were used to correct the observed I values. The corrected I_{50} values represent the concentration of compound available for 50% inhibition of the enzyme, rather than the actual concentration of the inhibitor.

699 Bull, D.L., Lindquist, D.A. A COMPARATIVE STUDY OF INSECTICIDE METABOLISM IN PHOTOPERIOD-ENTRAINED AND UNENTRAINED BOLLWORM LARVAE Heliothis zea (Boddie). Comp. Biochem. Physiol. 16, 3 (1965) 321-325.

The metabolism of disulfoton (Di-Syston) labelled with ^{32}P in fifth-instar larvae of Heliothis zea (Boddie) from unentrained and light-synchronised populations was compared by the use of radiometric procedures. Larvae were treated by injection at consecutive 2-h intervals for 24 h and then analysed to determine the concentrations of hydrolytic and oxidative metabolites of disulfoton that were formed in 4 h. Differences in metabolite concentrations in unentrained larvae were not significant; however, in entrained larvae, variations were significantly different and followed a cyclic pattern. Maxima of hydrolysis product concentrations occurred at 24-h intervals in internal extracts and at 12-h intervals in excreta. Peak concentrations of oxidation products occurred at 12-h intervals in internal extracts but did not follow a definite pattern in excreta. (From auth.)

700 Bull, D.L., Lindquist, D.A. METABOLISM OF 3-HYDROXY-N-METHYL- CIS-CROTONAMIDE DIMETHYL PHOSPHATE (AZODRIN) BY INSECTS AND RATS. J. agric. Fd Chem. 14, 2 (1966) 105-109.

Different batches of radioactive Azodrin were used: Azodrin-O-methyl-^{14}C, Azodrin-N-methyl-^{14}C, and Azodrin-^{32}P. Insect species (insecticide-susceptible) used included adult boll weevils (Anthonomus grandis Boh.), females of adult Musca domestica L., adult Periplaneta americana L., and 5th-instar larvae of bollworm (Heliothis zea (Boddie)) and tobacco budworm (Heliothis virescens (F.)). Azodrin was administered orally to lepidopterous larvae. Male white rats (Wistar strain) were treated intraperitoneally. Various procedures were used to identify metabolites. Oxidative conversion of Azodrin to its N-methylol derivative occurred in the insects and rats. However, formation of the toxic unsubstituted amide derivative of Azodrin by complete oxidative N-demethylation apparently was a minor reaction. Similar metabolites of Azodrin were formed in the different test animals, but at widely different rates. Results are tabulated.

701 Bull, D.L. ABSORPTION AND METABOLISM OF TRICHLORFON BY INSECTS. Bull. ent. Soc. Am. 13, 3 (1967) 189. Abstr. 43, at "New York Meeting of the Entomological Society of America. New York, N.Y., USA. 27-30 Nov. 1967".

A comparison was made of the absorption and metabolism of ^{32}P-labelled trichlorfon by several different species of insects. Factors influencing differences in susceptibility among species will be discussed. (Abstr.)

702 Bull, D.L., Lindquist, D.A., Grabbe, R.R. COMPARATIVE FATE OF THE GEOMETRIC ISOMERS OF PHOSPHAMIDON IN PLANTS AND ANIMALS. J. econ. Ent. 60, 2 (1967) 332-341.

The fates of the cis and trans isomers of phosphamidon in plants and animals were determined by using radiometric and other procedures. Phosphamidon was labelled either with ^{14}C at the methylvinyl and carbonyl positions or with ^{32}P. Cotton plants were tested extensively. Insects used included 5-to 7-d-old adult boll weevils, Anthonomus grandis Boh., Musca domestica L., 5th-instar tobacco budworms, Heliothis virescens (F.), and boll worms, Heliothis zea (Boddie). The biological half-lives of toxic forms of the 2 isomers were very short in plants and animals and of comparable duration. Although both isomers were converted to similar oxidative and hydrolytic metabolites, the rates of formation were somewhat different: the faster rate of oxidative N-dealkylation of cis phosphamidon in all biological systems was particularly apparent. Not only were the trans isomers of phosphamidon

and its N-deethyl derivative substantially more toxic to adult boll weevils Anthonomus grandis Boheman, and horse flies, Musca domestica L., than were the cis isomers, but they also were significantly more potent inhibitors of acetylcholinesterase in the insects. Combinations of sesamex with cis and trans phosphamidon and N-deethyl derivatives caused a substantial increase in the toxicity of all compounds to boll weevils, particularly the cis isomers.

703 Calderbank, A. A MENAZON FELFEDEZESE, SAJTSAGAI ES ANYAGGCSEREJE. (Discovery, properties and metabolism of menazon.) p. 1-13 of paper 85, presented at the "Pflanzenschutzkonferenz, Budapest, Hungary, Feb. 1966". (In Hungarian, with English summary)

A new class of heterocyclic thiophosphate esters, which combine outstanding aphicidal properties with low toxicity to other insect species and to mammals is reported. The compounds are characterized by a diamino-S-triazinyl-methyl group and one of the most active members is S-(4,6-diamine-1,3,5-triazin-2-ylmethyl) O,O-dimethyl phosphorodithioate (I), now known as menazon. It is a colourless crystalline solid, slightly soluble in water and in common organic solvents and forms salts with acids. Menazon and its salts possess very high contact, residual and systemic toxicity to aphid species but relatively little against most other insect groups. It is nonphytotoxic at well above normal dosage rates. Only slight cholinesterase inhibition is shown in vitro, and mammalian toxicity is very low. Menazon is readily absorbed by roots, and translocated throughout the plant in the xylem. Uptake through leaves is poor and movement is again associated with the transpiration stream (largely upwards and outwards). There is an absence of selective translocation to growing points. Six metabolites have been detected in plants treated with either ^{14}C- or ^{32}P-labelled menazon and three (II, III and IV) identified. One of these, the thiolate (II), is present in only small amounts and does not accumulate in plants. It is also formed as a major metabolite of menazon in the rat and, although a better cholinesterase inhibitor than menazon, has still a low order of toxicity. The identification of a major metabolite, 2,4-diamino-6-hydroxymethyl-s-triazine (III) in plants and the demonstration that two of the remaining unidentified metabolites are acidic proves that detoxification by hydrolysis occurs. $^{14}CO_2$ is also evolved in small amounts from plants treated with ^{14}C-triazine ring-labelled aphicide, showing that ultimately degradation of the triazine ring occurs.

704 Clemons, G.P., Menzer, R.E. OXIDATIVE METABOLISM OF PHOSPHAMIDON IN ANIMALS. Bull. ent. Soc. Am. 13, 3 (1967) 191. Abstr. 81. "New York Meeting of the Entomological Society of America. New York, N.Y., 27-30 Nov. 1967".

Radiolabelled phosphamidon was metabolized in goats and rats to yield 9 organosoluble metabolites. Both dechlorination and N-dealkylation occurred. The identification of five of the metabolites and data on the remaining unknown metabolites is reported. (Abstr.)

705 Coleby, A.W.P. EFFECTS OF PHOTOPERIOD, TEMPERATURE, AND HUMIDITY ON THE UPTAKE, TRANSLOCATION AND METABOLISM OF A SYSTEMIC PHOSPHONATE INSECTICIDE. Diss. Abstr. 28, 1 (1967) 2-B.

The part played by the physical environmental conditions on the uptake, translocation and degradation of the ^{32}P-labelled systemic phosphonate, O-methyl O-p-methylthiophenyl methyl-phosphonothionate on cotton plants were investigated. Plant growth cabinets were programmed to give each of the following sets of conditions: (a) high humidity, 14-h photoperiod, 65°F; (b) high humidity, 14-h photoperiod, 80°F; (c) low humidity, 14-h photoperiod, 65°F; (d) low humidity, 14-h photoperiod, 80°F; (e) low humidity, 14-h photoperiod, 94°F; (f) low humidity, 10-h photoperiod, 80°F; (g) low humidity, continuous light, 80°F; (h) low humidity, continuous light, 94°F. The uptake, translocation degradation was measured using radiochemical and bioassay techniques. An increase in the length of the photoperiod from 10-14 h increased plant growth, rate and amount of total radioactivity taken up and translocated by the cotton plants and improved insecticidal action of the systemic, although the rate of degradation was also increased. A further increase in photoperiod to 24-h (continuous light) reversed the above trends, although, at 80°F continuous light gave slightly greater uptake and higher amounts of chloroform soluble fraction and aphid mortality than the 10 h photoperiod. There is therefore a point at which an increase in photoperiod does not increase uptake and translocation of a systemic because too long a photoperiod upsets the plant's physiological functions. High humidity slowed both the rate of uptake and translocation of the systemic and the growth of the cotton plants. High humidity also, in some way, reduced the chloroform soluble fraction a markedly at the 24-h sample. At the 3-d sample the chloroform soluble fration had increased to

approx. the same percentage of radioactivity as was found in the low humidity experiments, i.e., 17% and 30% higher than the one day sample at 65°F and 80°F respectively. High humidity slowed the rate of degradation of the chloroform soluble fraction, the difference being greater between high and low humidity at 65°F than at 80°F. For both humidities the rate of degradation was much slower at 65°F than at 80°F. Increase in temperature increased plant growth, increased the uptake and translocation of systemic and increased the rate of degradation. (DA)

706 Dedek, W., Schwarz, H. ZUM VERHALTEN VON ^{32}P-MARKIERTEN INSEKTIZIDEN ORGANOPHOSPHORVERBINDUNGEN NACH INTRAZISTERNALER APPLIKATION BEIM RIND - EIN BEITRAG ZUR RESORPTION BIOLOGISCH AKTIVER SUBSTANZEN AUS DEM EUTER DES RINDES. (The behaviour of ^{32}P-labelled insecticidal organophosphorus compounds, following intracisternal application to cattle. A contribution to the resorption of biologically active substances from the udder.) Arch. exp. VetMed. 21, 6 (1967) 1505-1510. (In German, with English and Russian summaries)

250 mg of each labelled compound (trichlorfon, butonate, DDVP, and dimethoate) were administered to lactating cattle. The rate of resorption of systemic organophosphorus compounds from the udder proved approximately proportional to their water solubility. The concentrations of active substance in the blood and milk of the untreated quarters of the udder become approx. equal within 1 h already because of their relatively high resorption rate. Rapid enzymatic decomposition also takes place in the lacteal gland.

707 Dedek, W., Lohs, K. DIE DURCHLÄSSIGKEIT VON SCHUTZBEKLEIDUNGSMATERIALIEN FÜR INSEKTIZIDE PHOSPHORSÄUREDERIVATE (I). [The permeability of protective clothing materials to insecticidal phosphoric acid derivatives (I).] Chem. Tech., Berl. 17 (1965) 624-625. (In German)

^{32}P-labelled Tinox (a thiol isomer) and DDVP (O,O-dimethyl-dichlorovinylphosphate) were used to test various materials used for making up protective clothing used in working with toxic pesticides. PVC proved particularly efficient as protective material.

708 Dedek, W. BEITRÄGE ZUR ANALYTIK SYSTEMISCHER INSEKTIZIDER PHOSPHORSÄUREESTER IN BIOLOGISCHEN MEDIEN MIT HILFE ^{32}P-MARKIERTER VERBINDUNGEN. (On the analysis of systemic insecticidal phosphoric acid esters in biological media by means of ^{32}P-labelled compounds.) Thesis. Karl-Marx-Univ. Mathematisch-Naturwissenschaftliche Fakultät, Leipzig (East Germany). 1966, 158p. (In German)

The use of ^{32}P is discussed in studying the mechanism of insecticidal action, the metabolism and residues of an insecticide in different systems, and different forms of application. Special attention has been paid to the systemic Systox homologue Tinox: thiono- and thiol-Tinox were traced in vitro and in vivo. - The bulk of the work reported concerns suitable methods for dealing with endoparasites in veterinary medicine. Trichlorfon was used against warble fly (Hypoderma) larvae. The enzymatic degradation of trichlorfon in serum was studied extensively by thin-layer chromatography, also the rate of breakdown in vivo. Bubulin, a combination product, was used on cattle and pigs against Hypoderma. Metabolites were analysed for identity and toxicity. Dorsal pour-on application proved the most economical and efficacious method, and radioisotopes helped to determine the minimum concentration which would ensure safety with regard to, e.g., toxic products in milk. A further improvement was obtained from tracing the percutaneous resorption of tribuphon, and monitoring the concentration of active substance in the milk and of its more suitable metabolites. Tribuphon in milk fat is rapidly broken down into non-toxic products by milk sterilization.

709 Dedek, W., Schwary, H. EXCRETION OF ^{32}P-LABELED TRICHLORFON AND ITS DEGRADATION PRODUCTS IN THE MILK OF COWS AFTER VARIOUS ROUTES OF ADMINISTRATION. Arch. exp. VetMed. 20, 4 (1966) 849-857. (In German)

^{32}P-labelled trichlorfon applied to lactating cows, by dipping or by i.v. or i.m. injection, is excreted nearly quantitatively in the aqueous phase of the milk. Variations in the toxicity of the milk may be estimated by measuring the degradation of trichlorfon during pasteurization at 85°C. The degradation products are DDVP, dimethyl phosphate, and demethyltrichlorfon. (CA 66: 1967, 75228b)

710 Dedek, W., Scharz, H. STUDIEN ZUM METABOLISMUS UND ZUR APPLIKATION VON TRICHLORPHON IN DER VETERINÄRMEDIZIN. (Studies on the metabolism and application of trichlorfon in veterinary medicine.) Atompraxis 12, 12 (1966) 603-606. (In German)

Review, citing numerous studies in which radioisotopes had been used.

711 Dedek, W., Kisro, J. DER ABBAU DER TINOX-ISOMERE IN DER TOMATENPFLANZE. (The metabolism of tinox isomers in the tomato plant.) Atompraxis 12, 2 (1966) 100-104. (In German)

By means of ^{32}P-labelled compounds of high specific activity, the metabolism of the systoxhomologous systemic pesticide tinox was studied in tomato plants. The metabolites formed from thiono and thiol isomers were separated by extraction and identified by thin-layer chromatography and autoradiography. (Auth.)

712 Dedek, W., Lohs, K. DIE DURCHLÄSSIGKEIT VON SCHUTZBEKLEIDUNGSMATERIALIEN FÜR INSEKTIZIDE PHOSPHORSÄUREDERIVATE (II). (The permeability of protective clothing materials to insecticidal phosphoric acid derivatives (II).) J. prakt. Chem. 4 (1966) 37-40. (In German)

By using ^{32}P-labelled compounds it was possible to evaluate the permeability of 15 different rubber materials to certain insecticides of practical importance which are produced technically on a large scale. The permeability values were established for methyl parathion, dimethoate, butonate, and DDVP.

713 Dedek, W., Schwarz, H. STUDIUM ZUR PERCUTANEN RESORPTION ^{32}P-MARKIERTER SYSTEMISCHER, MINDERTOXISCHER ORGANOPHOSPHOR-VERBINDUNGEN (OPV) BEIM RIND. (Studies on the percutaneous resorption of ^{32}P-labelled systemic organophosphorus compounds of lesser toxicity in cattle.) Z. Naturf. 22b, 7 (1967) 702-708. (In German)

By using ^{32}P-labelled compounds on cattle skin in in vitro test runs it could be shown that percutaneous resorption of water-soluble systemic organophosphorus compounds in solution may be considered as a first approximation of a two-phase distribution. Radiochemical investigations of the active substance in blood, following cutaneous application by the pour-on method to cattle in vivo confirm this relation even under in vivo conditions, particularly for trichlorfon and dimethoate.

714 Dedek, W., Schwarz, H. STUDIEN ZUR APPLIKATION UND ZUM METABOLISMUS DES ^{32}P-MARKIERTEN SYSTEMINSEKTIZIDS DIMETHOATE BEIM RIND. (Studies on the application and metabolism of the ^{32}P-labelled systemic insecticide, dimethoate, in cattle.) Z. Naturf. 22 b, 11 (1967) 1166-1171. (In German, with German abstract only)

The less toxic ^{32}P-labelled dithiophosphoric acid ester, dimethoate, was applied by intramuscular injection and by the pour-on method. The concentrations of the extracted substances and the total ^{32}P-activity in blood and milk were determined. Attempts to identify the metabolites by radio-thin-layer chromatography gave some results. Intramuscular injection produced some relatively high concentrations of active substance in the blood, which were only broken down slowly. After percutaneous resorption of dimethoate from suitable formulations the active substance attains a concentration in the blood sufficient for the satisfactory killing of endoparasites, as confirmed in insecticide tests.

715 Dedek, W. METABOLISMUS UND RÜCKSTÄNDE VON ^{32}P-MARKIERTEM BUTONATE IN PFLANZEN UND TIEREN. (Metabolism and residues of ^{32}P-labelled butonate in plants and animals) Paper presented at the "6th International Congress of Plant Protection, Vienna, Austria, 30 Aug.-6 Sep. 1967". Abstr. B V-12. (In German)

The ^{32}P-labelled systemic mildly toxic ester of phosphonic acid butonate (O, O-dimethyl-1-butyryloxy-2, 2, 2-trichlorethylphosphonate) was sprayed on apples, plums and wheat. By means of selective extraction methods residues and half times were determined. Trichlorphon was identified as metabolite by radio thin-layer chromatography. In the same way the metabolism in the serum of mammals was studied. Besides dimethylphosphate and trichlorphon also desmethyl butonate seemed to be formed in little amounts. The concentration of butonate and trichlorphon in blood and milk after percutaneous resorption (pour-on treatment) by the cow was determined. The intramuscular injection is not suitable for application. The metabolism of butonate in the milk is discussed. (Abstr.)

716 Dedek, W., Schwarz, H. LOW-TOXICITY PHOSPHORUS-32-LABELED PHOSPHONIC ACID ESTER BUTONATE APPLICATION TO CATTLE. Arch. exp. VetMed. 21, 4 (1967) 1023-1030. (In German)

Butonate labelled with ^{32}P was applied to lactating cattle by intravenous and intramuscular injection and by body drenching. The radioactive half-life in blood was 3-4 min in vivo. Butonate and its metabolites were detected in both the blood and milk. Systemic activity was observed only by the drench method, due to the low solubility of the compound in H_2O. Pasteurized milk from cows treated with butonate is safe for drinking, since it contains only nontoxic metabolites. The compound applied by drench is satisfactory for the control of endoparasites. (CA 68: 1968, 86363d)

717 DUNN, E., Ward, A.H. THE MOVEMENT OF ^{32}PHOSPHORUS-LABELLED DIMETHOATE IN THE CACAO TREE, Theobroma cacao L. Ann. appl. Biol. 56 (1965) 419-428.

The movement and persistence of the systemic insecticide dimethoate and its metabolite in the cacao tree have been studied by the use of ^{32}P in Rogor 40(O, O-dimethyl S-(N-methylcarbamoylmethyl) phosphorodithioate). In trunk injection experiments only 11% of the insecticide entered effectively into the tree, and of this 83% remained within 1 ft of the point of injection. The remainder was quickly translocated upwards but was unevenly distributed in the canopy. Uptake of dimethoate from soil into the stem and branches proceeded continuously but slowly, and was much less than from injections. In mature pods, > 86% of the dimethoate was found to be degraded into non-toxic metabolites: thus there is little hazard from dimethoate residues in cacao beans. (From auth. summary)

718 Engst, R., Seidler, H., Haertig, M. THE BEHAVIOR AND THE DISTRIBUTION OF METHYL PARATHION-^{32}P IN CARROTS (Daucus carota). I. LABELING AND PERSISTENCE OF METHYL PARATHION. Nahrung 10, 5 (1966) 413-418. (In German)

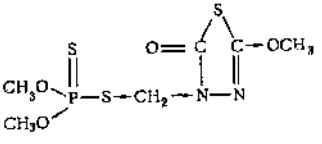
Duwicker and Marktgaertner strains of carrots were drenched with methyl parathion-^{32}P, 90 mg/l, at 6-133 d of age and with 40, 90, or 180 mg/l at 89-119 d of age, respectively. The Duwicker strain contained the most labelled residue (0.09 ppm) 28 d after a 90-mg/l drenching, whereas the Marktgaertner strain contained 7.0 ppm 14 d after 180 mg/l and 0.4 ppm 28 d after 40 mg/l. No methyl paraoxon was found, indicating that the degradation of absorbed methylparathion was very slow. (CA 66: 1967, 10004u)

719 Engst, R., Seidler, H., Haertig, M. THE BEHAVIOUR AND THE DISTRIBUTION OF METHYL PARATHION-^{32}P IN THE CARROT (Daucus carota). II. DISTRIBUTION AND HYDROLYSIS OF METHYLPARATHION-^{32}P. Nahrung 10, 5 (1966) 419-425. (In German)

Duwicker strain of carrots (D. carota) exposed from days 89 to 147 to 90 mg of methyl parathion-^{32}P/m incorporated 0.025 ppm of the label, whereas Marktgaertner strain incorporated 0.11 ppm into the integument; 0.007 and 0.008 ppm, respectively, was incorporated into the pith of these two carrot strains. The distribution of the label in the carrots was related to the amounts of essential oil present. During neutral hydrolysis in water or carrot juice, the carrot oil exerted a protective effect. Of the 5 P-containing degradation products separated by thin-layer chromatography, only monomethylphosphate and dimethylphosphate were positively identified. (CA 66: 1967, 10005x)

720 Esser, O., Müller, P.W. METABOLISM OF GS 13005, A NEW INSECTICIDE. Experientia 22, 1 (1966) 36-38. (In English)

GS 13005 is the active ingredient of a new insecticide of J.R. Geigy S.A., Basle, Switzerland, registered under the Trade mark of Supracide^R, with a structure O,O-dimethyl-S-[2-methoxy-1,3,4-thiadiazol-5-(4H)onyl-(4)methyl]-dithiophosphate



GS 13005, ^{14}C-labelled in the 5-position of the heterocycle, was synthesised by Dr. D.E. Ryskievich, Geigy Research Laboratories, Ardsley, N.Y. Its metabolism in plants was studied after application to young leaves of bean plants (Phaseolus vulgaris L.) and to freshly harvested apples, and in the rat. Considerable breakdown to CO_2 was found throughout. No accumulation of the intact insecticide or its metabolites was observed in either animals or plants.

721 Everett, L.J., Anderson, C.A., MacDougall, D. NATURE AND EXTENT OF GUTHION RESIDUES IN MILK AND TISSUES RESULTING FROM TREATED FORAGE. J. agric. Fd Chem. 14, 1 (1966) 47-55.

^{32}P-Guthion was used to determine total radioactivity in milk and urine. Blood samples were also counted directly after suitable dilution. Recoveries of ^{32}P-Guthion and its oxygen analogue from brain, fat, heart, kidney, liver, steak, and milk ranged from 87-100%. ^{14}C-Guthion was synthesised. After oral administration milk samples were examined. Results are generally illustrated by graphs. - Treatment of alfalfa with Guthion according to label recommendations will usually result in fresh forage residues of 1 ppm or less. Very occasionally residues in the 1.0-1.5-ppm range may be encountered. Use of such forage will not result in detectable residues in milk of either Guthion or its oxygen analogue or residues > 0.01 ppm of P-free metabolites containing the benzazimide structure. The exact nature of the metabolites has not been determined.

722 Ford, I.M., Menn, J.J., Meyding, G.D. METABOLISM OF N-(MERCAPTOMETHYL)-PHTHALIMIDE-CARBONYL-C^{14}-S-(O,O-DIMETHYL-PHOSPHORODITHIOATE)(IMIDAN-C^{14}): BALANCE STUDY IN THE RAT. J. agric. Fd Chem. 14, 1 (1966) 83-86.

The fate of Imidan-^{14}C labelled in the carbonyl carbon was determined following administration of a single oral dose to rats. 98% of the radioactive material was accounted for in studies with three male and two female rats. Of that recovered, 79% was excreted in the urine and 19% in the faeces at the time of sacrifice, either 72 or 120 h after treatment. Less than 1% of the administered compound appeared in the urine as Imidan or its phosphorothiolate analogue, N-(mercaptomethyl)-phthalimide-S-(O,O-dimethylphosphorothiolate)(Imidoxon). Tissue residues accounted for 2.6% of the administered radioactivity with no selective storage in any tissue. Little, if any (<0.04%), radioactivity was detected in the expired CO_2. (Auth.)

723 Fredriksson, T., Farrior, W.L., Jr., Witter, R.F. STUDIES ON THE PERCUTANEOUS ABSORPTION OF PARATHION AND PARAOXON. I. HYDROLYSIS AND METABOLISM WITHIN THE SKIN. Acta derm.-vener., Stockholm 41 (1961) 335.

Extensive studies were carried out. The ability of the skin of man, cat, rabbit, and rat to hydrolyse or otherwise metabolise paraoxon (E 600, or diethyl 4-nitrophenyl phosphate) or parathion (E 605, or diethyl 4-nitrophenyl thiononophosphate) was investigated using the Warburg technique and paper chromatography. Parathion was not hydrolysed or transformed into paraoxon by the skin of any of the species tested. ^{32}P-parathion was used. Paraoxon, on the other hand, was hydrolysed by skin from man, cat, and rabbit. This reaction, which was enzymic in nature, occurred at the fastest rate in the rabbit. In this tissue, about 20% of the paraoxon was hydrolysed in 1 h by 1 g of skin at 25°C, while only about 1% was converted by skin from man or cat. The relation of these findings to the percutaneous absorption of these compounds was discussed.

724 Fukami, J., Shishido, T. STUDIES ON THE SELECTIVE TOXICITIES OF ORGANIC PHOSPHOROUS INSECTICIDES. III. THE CHARACTERS OF THE ENZYME SYSTEM IN CLEAVAGE OF METHYL PARATHION TO DESMETHYL PARATHION IN THE SUPERNATANT OF SEVERAL SPECIES OF HOMOGENATES (Part I). Botyu-kagaku 28, 3 (1963) 77-81. (Japanese summary)

Investigations were carried out on the nature of the reaction system involved in the degradation of methyl-parathion (labelled with ^{32}P) to desmethyl-parathion in tissue homogenates of mammals and insects. The rate of the reaction, the optimum pH values and the effects of cofactors, various inhibitors and ions and lack of oxygen on the reaction system were examined. It is assumed that the reaction in the supernatant of the rat-liver homogenate is due to hydrolysis and not to oxidation. It is concluded that the reaction was a type of enzyme reaction, SH groups playing an essential part. Of several organs of the rat studied, the liver showed the highest degradation activity, and similar results were obtained with rabbit and guineapig. There was no degradation activity in the blood of larvae of C. suppressalis or Xylotrupes dichotomus (L.) or in the subcellular fraction of the blood of the latter. It appears that the reaction system involved in the degradation of methyl-parathion to desmethyl-parathion in the supernatant of rat-liver homogenate is not the same as A-esterase or paraoxonase. (RAE-A 55: 67, ref. 198)

725 Fukami, J., Shishido, T. NATURE OF A SOLUBLE, GLUTATHIONE-DEPENDENT ENZYME SYSTEM ACTIVE IN CLEAVAGE OF METHYL PARATHION TO DESMETHYL PARATHION. J. econ. Ent. 59, 6 (1966) 1338-1346.

Larvae of the horn beetle, Xylotrupes dichotomus (L.) (3rd instar, under hibernation) and of Bombyx mori (L.) (5th instar, in feeding period) were used. The specific activities of ^{32}P-labelled methyl parathion and Sumithion as used were 10-15 mCi/g. Homogenates of the various tissues were prepared, the incubation mixture consisting of 2.4 ml of homogenate tissue 4 x 10^{-3}M of cofactor and 0.3 ml of labelled insecticide (1.0 mg/ml), in a final volume of 3.0 ml, pH 7.4. The nature of the enzyme, in the supernatant fraction of tissue homogenates of rat liver and insect mid-gut, that cleaves O, O-dimethyl O-p-nitrophenyl phosphorothioate (methyl parathion) to O-methyl O-p-nitrophenyl phosphorothioate (desmethyl parathion) was examined. The enzyme, from both sources, is inactivated by dialysis or gel filtration and its activity is effectively restored by addition of reduced glutathione (GSH). Many rat tissues are active in methyl parathion-demethylation, but highest activity occurs in the liver. Although the addition of GSH increases the activity of insect midgut and fat body, these insect enzymes fall short of the degrading activity of rat liver. The degradation product of methyl parathion as formed by the supernatant fraction of rat liver fortified with GSH was identified as the desmethyl derivation. Two metabolites, the desmethyl derivative and phosphoric acid, were detected from the insect mid-gut preparations when fortified with GSH. Rat liver has approx. 5.5 times as much GSH as the midgut of larvae of horn beetle, X. dichotomus (L.). Cellulose chromatographic separation of the supernatant of rat liver and insect midgut homogenates reveals that the nature of these two enzyme proteins is different. The metabolic difference in the degradation of organophorphorus insecticides containing the P-O-methyl between mammals and insects is discussed in relation to the selective toxicity of these compounds.

726 Gage, J.C. METABOLISM OF MENAZON [O, O -DIMETHYL S-(4, 6-DIAMINO-s-TRIAZIN-2-YLMETHYL)PHOSPHORODITHIOATE] IN THE RAT. Fd Cosmet. Toxic. 5, 3 (1967) 349-357.

At least 80% of an oral dose of menazon-^{14}C to rats appears in the urine within 24 h. The urine contains no unchanged menazon. The major metabolites in urine are the O analogue of menazon, its demethyl derivative, and 2 methylsulfinylmethyl-4, 6-diamino-s-triazine which must derive from hydrolysis of menazon to give the thiomethyl-triazine, followed by methylation and oxidation at the S atom to give the sulfoxide. A small proportion of the dose is probably also excreted as 2-methoxymethyl-4, 6-diamino-s-triazine. These metabolites represent about 80% of the radioactivity excreted; small amounts of three other basic metabolites were also detected, but were not identified. A scheme is proposed for the metabolism of menazon in the rat. (CA 67: 1967, 107616r)

727 Gatterdam, P.E., Wozniak, L.A., Bullock, M.W., Parks, G.L., Boyd, J.E. ABSORPTION, METABOLISM, AND EXCRETION OF TRITIUM-LABELED FAMPHUR IN THE SHEEP AND CALF. J. agric. Fd Chem. 15, 5 (1967) 845-853.

^{3}H-famphur, O-demethyl famphur [O-methyl O, p-(N, N-dimethylsulfamoyl)phenyl phosphate, cyclohexylamine salt] and p-(N, N-dimethyl-sulfamoyl)phenol, containing, respectively, 241 and 330 μCi/g ^{3}H, were used and their synthesis is described. The metabolism of famphur, O, O-dimethyl O, p-(N, N-dimethylsulfamoyl)phenyl phosphorothioate, in the sheep and calf involves rupture of P-O-methyl, P-O-phenyl, and N-methyl bonds to yield water-soluble metabolites which are eliminated in the urine. Phenolic metabolites are excreted primarily as glucuronide derivatives. Marked differences in metabolism and excretion patterns occur depending on the method of administration, intramuscular injection providing more sustained famphur levels, and lower famoxon levels in blood than intravenous administration.

728 Getzin, L.W., Rosefield, I. PERSISTENCE OF DIAZINON AND ZINOPHOS IN SOILS. J. econ. Ent. 59 (1966) 512-516.

The persistence of ^{14}C-labelled diazinon and Zinophos ®/O, O-diethyl O-2-pyrazinyl phosphorothioate) was determined in four soils under laboratory conditions at 25°C. Treated soils were extracted at intervals with equal amounts of acetone and 0.05N CaCl$_2$ to remove the insecticide and its degradation products. The initial recovery of both insecticides was greater than 94%. The disappearance rate of ^{14}C-diazinon was similar in the four soils. One-half of the original applications was lost in 2-4 weeks and less than 8% remained after 20 weeks. The persistence of ^{14}C-Zinophos varied considerably in the four soils. The time required for 50% loss in an organic soil, sandy loam, silt loam, and

clay loam was approx. 10, 6, 4, and 1.5 weeks, respectively. After 24 weeks 2-27% of the original applications remained. Non-extractable radioactivity at the end of the experiment represented 20-30% of the original applications. ^{14}C from soil treated with ethoxy-labelled diazinon and pyrazinyl-labelled Zinophos was lost to the atmosphere as $^{14}CO_2$. In field trials diazinon and Zinophos were applied to a silt loam at rates of 5 and 6 lb/acre, respectively. Insecticide residues were measured at intervals by gas chromatography. A rapid loss of toxicant during the first eight weeks after treatment was followed by a much slower decline with both insecticides. After 24 weeks approx. 10% of the original applications remained. Degradation curves for the laboratory and field experiments were similar. (Auth.)

729 Getzin, L.W. METABOLISM OF DIAZINON AND ZINOPHOS IN SOILS. J. econ. Ent. 60, 2 (1967) 505-508.

The identity and persistence of degradation compounds associated with the decomposition of ^{14}C ring-labelled diazinon* and Zinophos ®(O,O-diethyl O-2-pyrazinyl phosphorothioate)** were determined in a silt loam by thin-layer and gas-liquid chromatography. A primary degradative pathway of the insecticides is hydrolysis at the heterocyclic phosphate bond, followed by disruption of the cyclic moiety with subsequent formation of $^{14}CO_2$. After 20 weeks at 25°C, 10 to 15% of the insecticides remained. Of the ^{14}C from diazinon and Zinophos, 35 and 60% respectively, were evolved as $^{14}CO_2$. A radioactive hydrolysis product, 2-isopropyl-4-methyl-6-hydroxy-pyrimidine was extracted from soil treated with diazinon, but 2-pyrazinol, the expected hydrolysis product of Zinophos, was not identified positively in non-sterile soil. Greater amounts of the hydrolysis compounds were recovered from fumigated soil in which the microbial activity was reduced, than from non-fumigated soil. Conversely, little $^{14}CO_2$ was released from the fumigated soil. The oxygen analogues of diazinon and Zinophos were not detected in soil treated with the parent compounds.

* at the 2-position of the pyrimidine ring.
** labelled in the 3-position of the pyrazinal ring.

730 Gunner, H.B., Zuckerman, B.M., Walker, R.W., Miller, C.W., Deubert, K.H., Longley, R.E. THE DISTRIBUTION AND PERSISTENCE OF DIAZINON APPLIED TO PLANT AND SOIL AND ITS INFLUENCE ON RHIZOSPHERE AND SOIL MICROFLORA. Pl. Soil 25, 2 (1966) 249-264.

^{14}C-Diazinon was used, labelled on the C^1 of the ethyl ester, with a specific activity of 3.21 µCi/mg, diluted 1: 800 in either water or hexane prior to application. The rapid translocation of Diazinon through bean plants and its emergence in bean root exudates maintained under sterile conditions could be demonstrated. The presence of bean rhizosphere microflora did not appear to be a factor in the metabolism of Diazinon by the bean plant. Diazinon applied at the rate of 3 lbs per acre to soil under non-sterile conditions persisted for as long as 180 d after application. No Diazinon was detectable after ten weeks in soil receiving 0.3 lbs per acre. Diazinon or its degradation products exerted a selective effect common to both soil and rhizosphere microflora which expressed itself in the selective enrichment of a cocoidal rod. Numbers of fungi seemed unaffected by the presence of Diazinon. After 180 d a large number of the genus Streptomyces appeared as a seeming climax population. The predominant microbial isolate utilized Diazinon as a S, P, C and N source in that order of preference. The biodegradability of Diazinon was conditioned by its solubilization in a suitable carrier, and by the presence of an additional carbon source.

731 Harris, L.W., Fleisher, J.H., Clark, J., Cliff, W.J. DEALKYLATION AND LOSS OF CAPACITY FOR REACTIVATION OF CHOLINESTERASE INHIBITED BY SARIN. Science, N.Y. 154 (1966) 404-406.

Inhibition of rat brain acetylcholinesterase by ^{32}P-sarin in vivo results initially in ^{32}P-isopropylmethylphosphonylated enzyme. The percentage of inhibited enzyme that could not be reactivated by pyridinium aldoxime methochloride (aged enzyme) approximated the amount of radioactivity identified as ^{32}P-methylphosphonate. The ^{32}P-isopropyl methylphosphonate not released from the inhibited enzyme by the oxime accounted for 51 ± 10% (standard deviation) of the radioactivity fixed to brain tissue. It showed no correlation with aging and was probably bound to sites other than acetylcholinesterase. (Auth.)

732 Hassan, A., Zayed, S.M.A.D., Mostafa, I.Y. METABOLISM OF ORGANOPHOSPHORUS INSECTICIDES. VIII. DEMETHYLATION OF DIPTEREX. Z. Naturf. 21b (1966) 498-500. (In English)

The fate of the methyl groups of Dipterex in cotton plant (Gossypium barbadense) and in fungus (Fusarium sp.) was investigated using ^{14}C-Dipterex, the two methyl groups being labelled with ^{14}C. Plants, two weeks old, were immersed in a solution containing ^{14}C-Dipterex (20 mg/20 ml) for 3 d. The ^{14}C-atoms of the methyl groups were found to be incorporated into a chloroform-soluble substance containing no P. Dipterex degradation by the fungus was studied by incubating it for 10 d. The absence of the oxidative pathway : methanol → formaldehyde → formate → CO_2 is clearly indicated. On the basis of these and previous results (published elsewhere) it was concluded that the detoxification of the insecticide in vivo proceeded as follows: (a) in the rat: exclusive hydrolysis of the phosphonate bond of both Dipterex and its demethylated metabolite; (b) in Prodenia larvae: 70% hydrolysis of O-methyl ester linkages and 30% splitting of C-P bond; (c) in cotton plant: hydrolysis of the phosphonate bond, followed by demethylation of the methylated phosphates; (d) in microorganisms: exclusive hydrolysis of O-methyl ester bond(s).

733 Hollingsworth, R. M. DESALKYLATION AND TOXICITY OF ORGANOPHOSPHATES. Bull. ent. Soc. Am. 13, 3 (1967) 189. Abstr. 40, at "New York Meeting of the Entomological Society of America. New York, N.Y., USA. 27-30 Nov. 1967".

The detailed in vitro metabolism of ^{14}C-labelled methyl paraoxon was examined in mammalian liver fractions and compared to metabolism of the same compound in vivo. The relative importance of competing pathways of metabolism was determined with several other organophosphates and related to mammalian toxicity. (Abstr.)

734 Hollingsworth, R. M., Metcalf, R. L., Fukuto, T. R. THE SELECTIVITY OF SUMITHION COMPARED WITH METHYL PARATHION METABOLISM IN THE WHITE MOUSE. J. agric. Fd Chem. 15, 2 (1967) 242-249.

The metabolism of ^{32}P-labelled methyl parathion and its 3-methyl analogue, Sumithion, has been studied in the white mouse at a series of dosage levels in further investigation of the low mammalian toxicity of Sumithion. The metabolism of the corresponding methylphosphonothionate analogues of methyl parathion and Sumithion also has been investigated. Seven of the eight metabolites of methyl parathion and Sumithion excreted in mouse urine have been identified. All are products of hydrolysis and oxidation. No pronounced differences were observed between these two compounds either in pattern of metabolism or the rate of excretion of metabolites. Evidence is presented that the high selectivity level of Sumithion depends on the ability of the system cleaving the P-O-alkyl bond to play an enhanced role in detoxication as the dosage is increased. This situation is particularly evident with the analogous phosphonothionates, where little desmethylation occurs and the selectivity level of the Sumithion analogue is greatly reduced. (Auth.)

735 Hollingsworth, R. M., Metcalf, R. L., Fukuto, T. R. THE SELECTIVITY OF SUMITHION COMPARED WITH METHYL PARATHION METABOLISM IN SUSCEPTIBLE AND RESISTANT HOUSEFLIES. J. agric. Fd Chem. 15, 2 (1967) 250-255.

The metabolism and fate of methyl parathion and Sumithion has been studied in OP S-and-R house flies in an investigation of the nature of the resistance mechanism. The two compounds behaved almost identically with respect to penetration, activation and degradation in the two strains. Resistance was attributed to the presence of enhanced phosphatase activity in the resistant strain which resulted in greater degradation of the activation products, methyl paraoxon and Sumioxon, and thus a 3-to 4-fold lower level of these active toxicants was present in the resistant strain. A secondary factor in resistance may be the slower penetration into the resistant flies. The high level of resistance could be at least partially attributed to saturation of the penetration and activation mechanisms at high dosage levels, which leads to a decreased rate of accumulation of the activation product. At the same time, the over-all rate of degradation of these insecticides by the resistant flies at the high dosage was still as great as with the susceptible flies at the low dosage. (Auth.)

736 Hollingsworth, R. M. BIOCHEMICAL FACTORS DETERMINING SELECTIVE TOXICITY OF THE INSECTICIDE SUMITHION AND ITS ANALOGS. Diss. Abstr. 27 (1966) 340-B - 341-B.

A study was made of the chemistry, metabolism and general toxicology of Sumithion (O, O-dimethyl O-(3-methyl-4-nitrophenyl) phosphorothioate) and some of its analogues in order to explain its very low mammalian toxicity. Methyl parathion (O, O-dimethyl O-p-nitrophenyl phosphorothioate) or its appropriate analogue was used as a reference compound in each case. Similar studies were carried

out with organophosphorus resistant and susceptible house flies in an attempt to explain the nature of the resistance process. Metabolism of Sumithion and methyl parathion in mice was investigated with ^{32}P-labelled compounds by ion-exchange, paper and thin-layer chromatography. All the major metabolites in the urine after oral dosage were identified. No significant differences existed between the compounds in their rates of excretion, or in the types and amounts of the different metabolites produced from them. A clear increase in the importance of desmethylation as a detoxifying system was noted as the dosage increased. Evidence from several sources suggests that desmethylation is a crucial factor in the low mammalian toxicity of Sumithion. Analogous metabolic studies with the very toxic phosphono analogues of Sumithion and methyl parathion suggest that little desmethylation occurs with these compounds. (From DA)

737 Hutson, D.H., Akintonwa, D.A.A., Hathway, D.E. THE METABOLISM OF 2-CHLORO-1-(2',4'-DICHLOROPHENYL)-VINYL DIETHYL PHOSPHATE (CHLORFENVINPHOS) IN THE DOG AND RAT. Biochem. J. 102 (1967) 138-142.

A single oral dose of chlorfenvinphos-^{14}C to rats was quantitatively eliminated in 4 d. Rats did not show a sex difference in the elimination pattern and showed only a small degree of biological variation in the total excretion data. Of the label, 87.2% was excreted in the urine (67.5% in the 1st day after dosage), 11.2% in the faeces, and 1.4% in the expired gases; <0.9% of ^{14}C was present in the gut and contents after 4 d. After oral administration of chlorfenvinphos-^{14}C to dogs, 94.0% (91.8-97.6%) of the ^{14}C was excreted in the urine and faeces during 4 d. Dogs did not show a sex difference in the pattern of elimination, and excretion of radioactivity in the urine was very rapid: 86.0% of ^{14}C during 0-24 h. Chlorfenvinphos was completely metabolised in rats and dogs; unchanged chlorfenvinphos was absent from the urine and from the carcass, when elimination was complete. In rats, 2-chloro-1-(2',4'-dichlorophenyl)vinyl ethyl hydrogen phosphate accounted for 32.3% of a dose of chlorfenvinphos, [1-(2',4'-dichlorophenyl)-ethyl β-D-glucopyranosid]uronic acid for 41.0%, 2,4-dichloro-mandelic acid for 7.0%, 2,4-dichlorophenylethanediol glucuronide for 2.6%, and 2,4-dichlorohippuric acid for 4.3%; in dogs, 2-chloro-1-(2',4'-dichlorophenyl)vinyl ethyl hydrogen phosphate accounts for 69.6%, [1-(2',4'-dichlorophenyl)ethyl β-D-glucopyranosid] uronic acid for 3.6%, 2,4-dichloromandelic acid for 13.4%, and 2,4-dichlorophenylethanediol glucuronide for 2.7%. Dogs and rats showed a species difference in the rate of excretion of ^{14}C in the urine, and in the proportions of the metabolites, with the exception of 2,4-dichlorophenylethanediol glucuronide, that are excreted in the urine. Alternative explanations for the latter species difference are suggested. 2-Chloro-1-(2',4'-dichlorophenyl)vinyl ethyl hydrogen phosphate and 2,4-dichlorophenacyl chloride probably lie on the main metabolic pathway of chlorfenvinphos since, in common with that insecticide, they give rise to [1-(2',4'-dichlorophenyl)ethyl β-D-glucopyranosid] uronic acid and 2,4-dichloromandelic acid as major metabolites in the urine. The proposed scheme for the metabolism of chlorfenvinphos represents a detoxication mechanism. (CA 66: 1967, 1818s)

738 Immel, R., Stiasni, M. A CONTRIBUTION TO THE ACTION OF THE INSECTICIDE BROMOPHOS (O,O-DIMETHYL-O-2,5-DICHLORO-4-BROMOPHENYL THIONOPHOSPHATE) IN AND ON PLANTS. p. 506-513 of "3rd British Insecticide and Fungicide Conference 1965. Proceedings. Brighton, Sussex, England. 8-11 Nov. 1965".

Reports investigations on the translaminar effect of bromophos, which was studied by means of bromophos labelled with ^{32}P, following earlier tests showing that when this compound is applied to leaves, it penetrates the surface and is effective against leaf-mining insects, though it is not translocated in the sap of plants. (RAE-A 55: 1967, ref. 577)

739 International Atomic Energy Agency, Vienna (Austria). THE APPLICATION OF RADIOISOTOPES TO STUDY THE MODE OF ACTION OF PESTICIDES USED AGAINST PLANT VIRUSES AND THEIR INSECT VECTORS. Research contract 236. p. 69-71 of "IAEA Research Contracts. Eight Annual Report". Technical Reports Series No. 85. Vienna, International Atomic Energy Agency. 1967, 142p. STI/DOC/ 10/85.

Research Institution: Faculty of Agriculture, Nagoya University, Nagoya, Japan.
Principal scientific investigator: T. Hira. Period of contract: 1 Oct. 1963 - 30 Nov. 1966.

The degradation of isotopically labelled organophosphate insecticides, trichlorfon [dimethyl (2,2,2-trichloro-1-hydroxyethyl) phosphonate] and the chemically related NS-2662 [dimethyl (2,2-dichloro-1-hydroxyethyl) phosphonate] revealed a more rapid degradation in sucking than in chewing insects.

Chewing insects are not generally vectors of plant viruses. Dimethoate and vamidethion showed a selective action against sucking insects. On soil application, both insecticides penetrated to rice plants and moved to felicar parts. Blasticidin S, an effective antiviral antibiotic, was labelled with ^{14}C and found to inhibit the virus-transmitting activity of insect vectors (leafhoppers fed on rice plants). It was found to penetrate into insects and inhibit virus synthesis, especially in the salivary gland.

740 Ivey, M.C., Claborn, H.V., Hoffman, R.A., Graham, O.H., Palmer, J.S., Radeleff, R.D. RESIDUES OF SHELL COMPOUND 4072 IN THE BODY TISSUES OF SPRAYED CATTLE. J. econ. Ent. 59, 2 (1966) 379-382.

Studies were made to determine whether the use of Shell Compound 4072 (2-chloro-1-(2,4-dichlorophenyl)vinyl diethyl phosphate) sprayed on cattle at a concentration adequate for insect control would cause residues to accumulate in the body tissues. The low residues of the chemical found in the tissues after spray application were preponderant in the fat and were eliminated in 28 d or less. The tissues were analysed also for 2,2',4'-trichloroacetophenone, a likely metabolite, but no residues of this chemical were detected in any of the body tissues. In two of the three sets of experiments ^{32}P-labelled 4072 was used.

741 Iya, V.K., Mani, R.S., Desai, C.N. et al. PREPARATION OF SOME SPECIAL RADIOISOTOPE LABELLED COMPOUNDS AT TROMBAY. p. 218-222 of "Nuclear and Radiation Chemistry. Proceedings of a Symposium. Bombay, India, 1966". Bombay, Department of Atomic Energy.

Methods were developed at Trombay for the preparation of ^{32}P-labelled insecticides (malathion and parathion).

742 Jacquinot, L. STUDY WITH ^{35}S OF INSECTICIDE PHORATE RESIDUE ON MILLET. Inst. Rech. agron trop. cult. Vivrieres, Bull. 21 (1966) 173-180.

743 Jezdic, V., Skakun, M., Konstantinovic, S. SYNTHESIS OF MALATHION LABELED WITH ^{35}S OR ^{32}P AND DIPTEREX-^{32}P. Bull. Boris Kidrich Inst. nucl. Sci. 17 (1966) 29-37.

Malathion and dipterex are two of the group of organophosphorus compounds that are widely applied in agriculture as insecticides. In order to study the effect of malathion and dipterex as insecticides, methods were worked out for their synthesis with incorporated radioactive isotopes ^{32}P and ^{35}S. The syntheses described are simple and give greater yields than those previously reported. (Auth.)

744 Kansouh, A.S.H. DIAZINON ABSORPTION, METABOLISM, AND PERSISTENCE IN WHEAT GRAIN AND BEAN PLANTS, Phaseolus vulgaris. Diss. Abstr. 28, 5 (1967) 1975-B - 1976-B.

This study investigated the absorption of diazinon in wheat grain and plant tissues, its persistence, translocation, possible conversion to more toxic compounds, and identification of metabolites or degradation products. ^{14}C-diazinon in conjunction with thin-layer and paper chromatography was used to study metabolites or degradation products in wheat grain. ^{14}C-2-isopropyl-4-methyl-pyrimidin-6-ol appeared in small amounts after 30 d in wheat grain and on glass beads. Atmospheric moisture and aging factors could cause diazinon hydrolysis on either substrate, as well as enzymic activity in wheat grain. Bean plants were treated with aqueous solutions of ^{14}C-diazinon using root absorption, stem injection, and petiole absorption by excised leaves and held under controlled conditions of temperature and photoperiod. ^{14}C-2-isopropyl-4-methylpyrimidin-6-ol was the only metabolite detected in plant extracts of all treatments by chromatogram scanning or autoradiography. Chromatograms of excised leaf extracts indicated the hydrolysis of ^{14}C-diazinon at 8 h after treatment with a max. amount at 5 d. Both ^{14}C-diazinon and its hydrolysis product, were completely lost at 22 d after treatment. In another experiment it was found that trace quantities of ^{14}C-diazinon in the excised leaves were converted to $^{14}CO_2$ with maximum production at 24 h after treatment. Both ^{14}C-diazinon and ^{14}C-2-isopropyl-4-methylpyrimidin-6-ol were detected in plant tissues and nutrient solution at 84 h after treatment showing translocation of these compounds from the leaf into the nutrient solution. $^{14}CO_2$ was also produced from ^{14}C-diazinon absorbed through bean plant roots, increasing from 0.068-0.110% of the original amount absorbed when treated with 8.0 and 20.0 ppm, respectively. The $^{14}CO_2$ was respired in smaller quantities during light periods than during dark periods corresponding to the cycles of photosynthesis. ^{14}C-2-isopropyl-4-methyl-pyrimidin-6-ol and diazinon were detected in the plant homogenates and the nutrient solution at

6 d after treatment, demonstrating translocation and exudation of these compounds from the roots. Hydrolysis of the phosphorus pyrimidinyl ester linkage was the only significant mechanism for diazinon metabolism by bean plants. Only trace amounts of the original diazinon absorbed were converted to $^{14}CO_2$ in 6 d, thus indicating the stability of 2-isopropyl-4-methylpyrimidin-6-ol. ^{14}C-diazoxon was not detected in plant tissues or nutrient solution, indicating that P=S oxidation did not occur to any appreciable extent in the bean plant. (From DA)

745 Katague, D.B., Anderson, C.A. METABOLISM OF ^{32}P-LABELED DASANIT IN COTTON PLANTS. Bull. envir. Cont. Toxicol. 2, 4 (1967) 228-235.

When applied directly to the stems or taken up by the roots of young cotton plants, ^{32}P-labelled Dasanit (O,O-di-Et O-p-(methylsulfinyl) phenyl phosphorothioate) was metabolised in 4-9 d to the ^{32}P-labelled Dasanit O analogue (3.5-7.2% of the isolated organosoluble ^{32}P), labelled Dasanit sulfone (8.2-12.0%), and a trace amount of the Dasanit O analogue sulfone. However, most (79.9-88.3%) of the isolated organosoluble ^{32}P was in the form of the parent compound. No S-Et analogues were found. (CA 67: 1967, 52973)

746 Knowles, C.O., Arthur, B.W. RESIDUES ASSOCIATED WITH BACKRUBBER APPLICATION OF RONNEL TO DAIRY COWS. J. econ. Ent. 59 (1966) 752-753.

^{32}P-ronnel was synthesised from ^{32}P-thiophosphoryl chloride, and a solution applied to two Jersey cows in an advanced stage of lactation but still producing 13.7 lb/head/d; a total area of 24 in. x 50 in. was treated. Cows were treated after morning and evening milkings for seven consecutive days. No detectable residues (lower limit or sensitivity 0.02 ppm) were present in the milk analysed for total ^{32}P materials or in various fractions of the milk (acetonitrile, n-hexane, water, and unextractable). Most of the radioactive materials eliminated in the urine were hydrolytic products, based on chloroform to water partition data. No data as to peak concentration of ^{32}P-materials were obtained as no samples were collected during the first 4 d of the experiment. No detectable ^{32}P-materials were present in any of the faecal samples. The hair samples contained ~147 ppm of radioactive materials after the 1st treatment, residues declining to ~2.9 ppm by 14 d after the initial treatment. Half an hour after the 1st treatment >98% of the radioactive material partitioned into the chloroform; 10 d later this portion had dropped to 48%. Ronnel had evidently undergone conversion on the hair to a more polar material(s).

747 Knowles, C.O., Arthur, B.W. METABOLISM OF AND RESIDUES ASSOCIATED WITH DERMAL AND INTRAMUSCULAR APPLICATION OF RADIOLABELED FENTHION TO DAIRY COWS. J. econ. Ent. 59, 6 (1966) 1346-1352.

^{32}P-labelled fenthion having a specific activity of 5.0 mCi/g was formulated as a 0.5% emulsion and applied dermally to 2 dairy cows at a rate of 1 qt per cow. Two other lactating cows were treated intramuscularly with 3.5 g of fenthion (8.6 mCi/g) per cow. Fenthion and certain oxidative metabolites were isolated from milk, urine, and faeces following either method of treatment. The ratio of these metabolites in the urine was vastly different from that in the faeces. Fenthion was rapidly degraded to phosphoric acid derivatives and was eliminated primarily in the urine and to a lesser extent in the faeces. Residues were negligible in edible tissues 14 d after dermal treatment, but persisted throughout the 21 d test period in cows treated intramuscularly. Mortality of the house fly, Musca domestica L., and the stable fly, Stomoxys calcitrans (L.), caged on cows treated dermally with fenthion was 100% at 1 d after treatment. (Auth.)

748 Koch., H., Abendroth, C. UNTERSUCHUNG ZUR ANWENDUNG VON P-32-MARKIERTEM DIMEFOX IM HOPFENBAU. (Study connected with the application of ^{32}P-labelled dimefox to hop growing.) p.149-150 of "Arbeitstagung Angewandte Radioaktivität. Leipzig, German Democratic Republic, 11-14 Oct. 1966". Deutsche Akademie der Wissenschaften zu Berlin. Institut für Angewandte Radioaktivität. 1967, 154 p. Abstr. (In German)

The synthesis of labelled dimefox [bis(dimethylamino)-phosphorylfluoride] is described. The hydrolytic breakdown in vitro involving acid and alkaline reactions was investigated. The hydrolysis of dimefox catalysed by acidity is initiated by a break in the P-N bond, leading to phosphoric acid via unstable intermediate products. Hydrolysis under alkaline conditions, on the other hand, splits the P-F bond to lead to the relatively stable bis(dimethylamino)-phosphoric acid or its salt which is broken down in additional reactions to give phosphoric acid. The speed of uptake following

root and foliage application was studied in the laboratory. Only slight uptake was found in the leaf surface due to the low lipid solubility of the compounds. A high rate of uptake could, however, be observed after root treatment with a culture solution containing active substance, where selective absorption from the solution took place. In field experiments on hop plants at different stages of development, the uptake in younger plants was limited to a shorter period. Using injected plants it was found that the active substance is mainly carried along in the direction of transpiration and that only small quantities were retained by assimilation. In order to determine the duration of insecticide effectiveness, residues in plant leaves were determined at different intervals. The concentration of active substance found in the leaves ensured protection against aphid attack for the whole experimental period which was also confirmed by a biological test.

749 Konrad, J.G., Armstrong, D.E., Chesters, G. SOIL DEGRADATION OF DIAZINON, A PHOSPHOROTHIOATE INSECTICIDE. Agron. J. 59, 6 (1967) 591-594.

Aqueous diazinon solutions equilibrated with the Ella loamy sand, an AC Prairie soil, Kewaunee clay, a gray brown podzolic, and Poygan silty clay, a humic gley, showed an initial rapid decrease in solution concentration of diazinon resulting from soil adsorption. Following adsorption, a slow but continual decrease in diazinon concentration was observed and attributed to degradation. For all soils, the total ^{14}C activity decreased initially due to adsorption of diazinon but increased on prolongued incubation as the degradation products of diazinon were liberated into solution. The reactions of diazinon in soil were a rapid adsorption followed by degradation at the adsorption sites and release of the degradation products into solution. For each of the soils data indicate that degradation rates are related closely to the extent of initial soil adsorption. Adsorption was more extensive and release of degradation products to solution more rapid in the Poygan than in the other two soils in which release of degradation products was similar, as was the initial adsorption. The extents of diazinon adsorption and degradation rates depend on the pH of the soils, organic matter content, and clay content of the soils. Adsorption increases with increasing organic matter and clay content. In soil-free systems under acid conditions diazinon hydrolysis is a major mechanism of degradation and the rate of hydrolysis is controlled by the pH of the system. Diazinon hydrolysis in aqueous systems can be acid- or alkali-catalysed. From the results it was concluded that the mechanism of diazinon degradation in soils is a partial chemical hydrolysis with the formation of the ring-labelled 2-isopropyl-4-methyl-6-hydroxypyrimidine and diethylthiophosphoric acid, the predominant chain-labelled degradation products of diazinon in soil, and both compounds were stable in terms of the length of these experiments (10 d). (CA 68: 1968, 11914f)

750 Labadan, R.M. COMPARATIVE EFFECT OF SELECTION IN THE LARVAL AND ADULT STAGES ON DEVELOPMENT OF ORGANOPHOSPHOROUS INSECTICIDE RESISTANCE IN THE HOUSE FLY. Diss. Abstr. 28, 1 (1967) 222-B.

Control of house flies by residual deposits of insecticides on the walls and ceilings of barns is known to cause resistance in adult flies. It is probable that during spraying accidental manure contamination results in the treatment of larvae. Larval selection probably occurs, as well as adult selection. A comparative study was undertaken in the laboratory to determine relative effects of larval and adult selection on development of resistance. In addition, cross-resistance of diazinon resistant larvae was determined. Finally, permeability of the larval cuticle was studied by means of radioactive diazinon, to determine role of permeability in larval resistance. — Results obtained by larval dipping showed larval resistance in all eight strains collected from New York State. LC 50's could not be determined as 1% diazinon emulsion gave mortalities less than 50% for all strains used. The LC 50 for the Wilson susceptible strain was 0.0055% diazinon. Selection during the larval stage gave rapid development of diazinon resistance. It was found that an immediate increase of resistance occurred in the F_1 generation to such a high degree that no further increase occurred. Since three unrelated strains used in this study give similar results, the bimodal status of New York State house fly resistance to diazinon appears to be a general situation. Selection during the adult stage indicated that the resistance level increased much less rapidly. Adult selection was not rigorous. Evidence was not found of a bimodal status for adults. Cross resistance studies by larval dipping of a diazinon resistant strain showed fenthion, dichlorvos and Compound 4072 highly toxic. Six other insecticides gave low to moderate mortalities while ten were non-toxic at 1% concentration. Loss of adult resistance when insecticide pressure is relaxed was found for two strains in 1962 and four strains in 1963. Larval dipping tests showed slight reversion to susceptibility after ten months without selection. This is the first report of larval loss of resistance to diazinon. Cuticular permeability studies showed no significant differ-

ence between diazinon resistant and susceptible strains in the rate of penetration. On this basis, it is suggested that larval resistance to diazinon is not due to penetration but to other mechanisms unknown at present. (From DA)

751 Lindquist, D.A., Bull, D.L. FATE OF 3-HYDROXY-N-METHYL-CIS-CROTONAMIDE DIMETHYL PHOSPHATE IN COTTON PLANTS. J. agric. Fd Chem. 15, 2 (1967) 267-269.

Azodrin (3-hydroxy-N-methyl-cis-crotonamide dimethyl phosphate, Shell SD-9129) is a substituted vinylphosphate insecticide that appears promising as a foliar spray and a systemic for the control of several insect pests. Azodrin is similar to that of the closely related vinyl phosphate, Bidrin (3-hydroxy-N, N-dimethyl-cis-crotonamide dimethyl phosphate). ^{32}P-Azodrin (4.1 and 10 mCi/g) and ^{32}P-Bidrin (12 mCi/g) were used. The nature and rate of metabolism of Azodrin (3-hydroxy-N-methyl-cis-crotonamide dimethyl phosphate) were studied in cotton plants. Oxidative conversion of Azodrin to its N-methylol derivative was of minor importance. The primary sites of hydrolytic degradation were at the vinyl-phosphate bond and one methyl-phosphate bond. The half life of Azodrin in cotton leaves was about 7 d. Azodrin was rapidly lost from the surface of cotton leaves following foliar application.

752 Lloyd, J.E., Mathysse, J.G. POLYMER-INSECTICIDE SYSTEMS FOR USE AS LIVESTOCK FEED ADDITIVES. J. econ. Ent. 59, 2 (1966) 363-367.

Polymer-insecticide feed-additive larvicides were developed for minimum insecticide loss in livestock and max. release in manure. O-methyl-^{3}H dimethoate, bis-ethyl-1-^{14}C diazinon, 2-^{3}H-phenyl famphur, 1-^{14}C-vinyl dichlorvos, and O-^{14}C dimetilan were used in studying insecticide release. Rates of ^{14}C and ^{3}H tagged insecticide elution were determined in vitro aqueous and in the digestive tract of cattle. Greater insecticide water-solubility and polymer flexibility and smaller particle size increased insecticide elution rate. Inclusion of polymer fillers also controlled elution rate. Rates of release were uniform. Polyvinyl chloride was the most promising polymer.

753 Lucier, G.W., Menzer, R.E. METABOLISM OF DIMETHOATE IN BEANS IN RELATION TO MODE OF APPLICATION. Bull. ent. Soc. Am. 13, 3 (1967) 189. Abstr. 44, at "New York Meeting of the Entomological Society of America. New York, N.Y., USA. 27-30 Nov. 1967".

Metabolism of ^{32}P- and ^{14}C-dimethoate in beans was studied using four modes of application. The oxygen analogue was formed in all cases. Variations were observed in the amount of hydrolysis products formed, although no product accumulated in large amounts. High levels of radioactivity were found in the plant pulp and pigments. (Abstr.)

754 Mallory Boush, G., Matsumura, F. INSECTICIDAL DEGRADATION BY Pseudomonas melophthora, THE BACTERIAL SYMBIOTE OF THE APPLE MAGGOT. J. econ. Ent. 60, 4 (1967) 918-920.

P. melophthora (Allen and Riker), an obligate extracellular bacterial symbiote of the apple magot, Rhagoletis pomonella (Walsh), has demonstrable degradation activities against all six insecticides tested (dichlorovos, diazinon, parathion, DFP (diisopropyl phosphorofluoridate), dieldrin, and carbaryl), belonging to three major groups (chlorinated hydrocarbons, organophosphates, and carbamates). The methods employed to analyse the degradation pattern of P. melophthora against naphthalene ring ^{3}H-labelled carbaryl and diethyl ^{3}H-labelled parathion were essentially those of Ref. 835. Diethyl ^{14}C-labelled diazinon, diethyl ^{14}C-labelled dichlorvos, and diisopropyl ^{14}C-labelled DFP (diisopropyl phosphorofluoridate) were handled as with parathion. ^{14}C-dieldrin was used. This is the first demonstration of insecticidal degradation by an insect microbial symbiote. However, the significance of this unique property as a possible protecting mechanism of the host insect is unknown.

755 Martinenghi, C., Riccardi, A., Baraldi, C. OSSERVAZIONI SPERIMENTALI SULLA MARACUTRA IN VITRO DELLE CELLULE EMATICHE CON DIISOPROPILFLUOROFOSFATO (DFP^{32}). (Experimental data on in vitro labelling of blood cells with diisopropylfluorophosphate (DF^{32}P).) Acta isotopica 5, 1 (1965) 91-100. (In Italian, with English, French, and German summaries)

The effects of temperature and concentration of DF^{32}P on in vitro labelling of erythrocytes and granulocytes were studied. The radioactive concentration of the blood cells could be shown to increase with increasing plasma concentration, tending asymptotically to a max., whereas the

incubation temperature did not affect labelling of the cells. Analysis of the results suggests that the tracer may be contained in the cells in at least two different states – one more stable, and the other labile. This might account for the elution phenomenon observed in vivo for erythrocytes. (Based on auth.)

756 Martinenghi, C., Riccardi, A., Baraldi, C. CONTRIBUTO ALLO STUDIO DELLA MARCATURA IN VIVO CON ^{32} DFP DEGLI ERITROCITI NEL CONIGLIO. (In vivo labelling of red blood cells with DF ^{32}P in the rabbit.) Minerva nucl. 9 (1965) 332-335. (In Italian, with English and French summaries)

The labelling of erythrocytes with DF ^{32}P was investigated in rabbits by administering 20 μCi/kg of body weight intravenously and by measuring the radioactivity of the plasma and the red blood cells for 17 d. It was found that the curve expressing the concentration of the radioactivity in the red blood cells shows a peak at 2 h after the injection of the tracer and then declines following a couple of exponentials. The hypothesis is suggested that the 1st term, with a steep negative dip, is due to a phenomenon of elution of a part of the tracer which is less firmly bound to the endocellular complexes, whereas the second, with a less steep negative dip, expresses the survival of the erythrocytes. (Auth.)

757 Matsumura, F., Boush, G.M. MALATHION DEGRADATION BY Trichoderma viride AND A Pseudomonas SPECIES. Science, N.Y. 153 (1966) 1278-1280.

To study the total ability of the soil samples used to break down malathion, a 10 g portion of each soil sample was first incubated for 24 h at 30°C with 20 mg of ^{14}C-malathion (labelled at 1,2-succinyl carbon moiety) that had been previously applied to the inner surface of the sample flasks as thin films, with the aid of acetone as a carrier. Malathion was found to be metabolised quickly by a soil fungus, T. viride, and a bacterium, Pseudomonas sp., which were originally found in soils from northern Ohio that had been sprayed heavily with insecticides. Results of a survey of the breakdown capabilities of 16 variants of T. viride revealed that certain colonies from this species had a very marked ability to break down malathion through the action of a carboxylesterase(s). The enzymes can be made soluble by preparing the acetone powder suspension.

758 McDuffie, W.C. USE OF RADIOISOTOPES IN THE DETECTION OF RESIDUES IN MEAT AND MILK. p.3-17 of "Radioisotopes in the Detection of Pesticide Residues. Proceedings of a Panel. Vienna, Austria, 12-16 Apr. 1965". STI/PUB/123, International Atomic Energy Agency, Vienna (Austria), 1966, 118p.

^{32}P was used in residue analyses of labelled ronnel, coumaphos (Co-Ral), ruelene, dioxathion (Delnav), Ciodrin ®, and Shell Compound 4072. Various studies are reviewed and relevant references cited.

759 Mengle, D.C., Lewallen, L.L. BIOCHEMICAL-RADIOLOGICAL DETERMINATIONS OF PARATHION RESISTANCE IN Aedes nigromaculis. J. econ. Ent. 59 (1966) 743-744.

The fate of ^{32}P-parathion was studied in resistant and susceptible strains of A. nigromaculis. To approximate the concentration used in the field for mosquito control, 4th-instar larvae were treated at the 24-h LC 90 of the susceptible strain (0.025 ppm). Mosquitoes were removed and tested at intervals of ¼, ½, 1, 2, 4, 6, and 24 h, and assayed for parathion and hydrolysis products. The water solubles increased more rapidly in the resistant larvae, indicating that there was more rapid breakdown of the insecticide in that population. After initially absorbing nearly the same amount of insecticide as the susceptible larvae the resistant larvae contain a lower level of organic solubles. The chromatographic determination of water-soluble metabolites indicates that both the susceptible and resistant strains convert parathion to a water extractable material (0.72 and 0.68) whose R_f is similar to that of paraoxon (0.70). The R_f value 0.58 indicates the presence of a water-soluble compound present in resistant larvae treated with large quantities of paraoxon, a compound not present in the susceptible larvae following similar treatment. Also, treatment with a massive dose of parathion, while producing paraoxon in vivo in both strains, did not result in formation of detectable amounts of a material with R_f of 0.58.

760 Michailova, O.S. METABOLISM OF TRICHLOROMETAPHOS 3 IN ANIMALS. Khim. sel'sk. Khoz. 4, 8 (1966) 619-622. (In Russian)

To study the rate of cutaneous penetration of the insecticide trichlorometaphos 3 (I), 0.2 ml of a 10% aqueous solution of ^{32}P- and ^{35}S-labelled I were applied on the skin of mice, which were sacrificed at various intervals; the skins were subjected to radiometric analysis. The amount of I in the skin dropped within 1 d to 1/2, and within 14 d to 1/10 of the original. In rabbits, the cutaneous application of 200 mg I/kg body weight (as an aqueous emulsion) led to its appearance in the blood within 15 min, with peaks on the 2nd and 3rd day, and a total duration of 10 d. In the organs and tissues of the experimental rabbits the max. I content was obtained on the 3rd day. Cutaneous application of 1.5 l of a 1.5% aqueous solution of I to a cow resulted in its appearance in the blood within 1 h, with a max. on the 2nd day, when the blood cholinesterase activity was least. I was detected in all organs and tissues of this cow (sacrificed on the 3rd day), high concentrations being recorded in lungs, brain, bones, liver, kidneys, and the foetus. Peroral administration of 100 mg I/kg body weight to rabbits, caused its appearance in organs and tissues within 30 min, with a max. concentration in the lungs and liver, with a continuous increase up to 3 h, followed by a slow decrease to zero within 40 d. Peroral administration of 20 mg I/kg body weight to a calf, which was sacrificed on the 2nd day, resulted in a high radioactivity of the lungs, spinal cord, bones, liver, and kidneys, and a minimal amount in the spleen and muscles. A study of the excretion of cutaneously applied I via urine, faeces, and milk revealed that in rabbits I is intensively eliminated in the urine for 4 d, and with the faeces for 5-6 d, reaching zero within 20-25 d, while in a calf the urinary excretion lasted 11 d, and the faecal excretion 14 d, with peaks on the 1st day. I and its metabolites were secreted in milk over a period of 10 d. (CA 65: 1966, 19244)

761 Miller, C. W., Zuckerman, B. M., Charig, A. J. WATER TRANSLOCATION OF DIAZINON-^{14}C AND PARATHION-^{35}S OFF A MODEL CRANBERRY BOG AND SUBSEQUENT OCCURRENCE IN FISH AND MUSSELS. Trans. Am. Fish. Soc. 95, 4 (1966) 345-349.

One day after application of diazinon-^{14}C and parathion-^{35}S to a model cranberry bog, these chemicals were transported off the bog in water used in a simulated frost protection flood. Fish (Fundulus heteroclitus) and fresh-water mussels (Elliptio complanatus) were exposed to these contaminated waters and analysed periodically. The majority of the chemicals disappeared from the water after 144 h. During this time, no labelled metabolites of diazinon were detected; however, three labelled parathion degradation products were encountered. The fish and the mussels accumulated both pesticides. (CA 66: 1967, 27980u)

762 Miyamoto, J., Sato, Y. DETERMINATION OF INSECTICIDE RESIDUE IN ANIMAL AND PLANT TISSUES. II. METABOLIC FATE OF SUMITHION IN RICE PLANTS AT THE PREHEADING STAGE AND ITS RESIDUE IN HARVESTED GRAINS. Botyu-kagaku 30, 2 (1965) 45-49.

Metabolic fate was followed in rice plants after the plants were sprayed with ^{32}P-labelled Sumithion (O,O-di-Me S-[1,2-bis(ethoxycarbonyl)ethyl] dithiophosphate) at the preheading stage. After penetration into the tissues, Sumithion was decomposed rather rapidly into demethylsumithion, dimethylphosphorothioic acid, and phosphorothioic acid as determined by thin-layer chromatography. Presence of the O analogue of Sumioxon (O,O-di-Me O-(3-methyl-4-nitrophenyl) phosphate) was also demonstrated. Residual amounts of Sumithion and its metabolites in the rice grains of several varieties of rice were determined after its application under various conditions. Sumithion and Sumioxon were hardly detectable, while 1 ppm or less of degradation products such as dimethylphosphorothioic acid, phosphorothioic acid, and free p-nitrocresol were identified. (CA)

763 Morikawa, O., Saito, T. DEGRADATIONS OF VAMIDOTHION AND DIMETHOATE IN PLANTS, INSECTS, AND MAMMALS. Botyu-kagaku 31, 3 (1966) 130-135. (In English)

The metabolism of dimethoate-^{32}P (I) and vamidothion-^{32}P (II) in insects, plants, and mammals was studied in vivo and in vitro. Several metabolic products of II* were detected within insects, plants, and mouse urine by paper chromatography. Demethylvamidothion was detected only in plants. The optimum pH for the degradation of I and II was ~8 for the rat liver homogenate and 7 - 7.4 for the insect homogenate. I and II were hydrolysed greatly by the fat body homogenate and slightly by the total gut and muscle homogenates of the American cockroach. The hydrolysis of the S-C bond of I and II was specific to the rat liver homogenate. (CA 68: 1968, 28719 u)

* Vamidothion = O,O-dimethyl S-2-(1-methylcarbamoylethylthio)ethyl phosphorothioate.

764 Muelder, W.W., Wass, M.N. A SEMIMICRO PREPARATION OF O,O-DIETHYL O-(3,5,6-TRICHLORO-2-PYRIDYL-2,6-C^{14}) PHOSPHOROTHIOATE. J. agric. Fd Chem. 15, 3 (1967) 508-511.

Dursban insecticide (Dow Chemical Co.) contains O, O-diethyl O-(3,5,6-trichloro-2-pyridyl-2,6-^{14}C) phosphorothioate. Using a 6-step synthesis, 40 mCi of ^{14}C-KCN were converted to 7.5 mCi of tracer having a specific activity of 1.5 mCi/mM, via glutaronitrile-1,5-^{14}C→glutarimide-2,6-^{14}C →2,3,6-trichloropyridine-2,6-^{14}C→3,6-dichloro-2-pyridinol-2,6-^{14}C→3,5,6-trichloro-2-pyridinol-2,6-^{14}C. It assayed better than 99.5% by thin-layer chromatography. The yield is one half of the expected amount based on results from pilot experiments. With the 1.7 mCi of recovered precursor, 3,5,6-trichloro-2-pyridinol-2,6-^{14}C, a radiochemical yield of 23% was obtained.

765 Nakatsugawa, T., Tolman, N.M., Dahm, P.A. DEGRADATION OF P^{32}-AND S^{35}-LABELED PARATHION IN VIVO. Bull. ent. Soc. Am. 12 (1966) 264. Abstr. 57, at "Portland Meeting. Portland, Oreg., USA. 28 Nov.-1 Dec. 1966".

Degradation of ^{32}P- and ^{35}S-labelled parathion was studied with male rats. SKF 525-A delayed urinary excretion of diethyl phosphorothioic acid indicating the significance of liver microsomal enzymes in degradation of parathion. Detached sulphur appeared in urine as inorganic sulphate later than diethyl phosphorthioic acid. (Abstr.)

766 Nakatsugawa, T., Dahm, P.A. MICROSOMAL METABOLISM OF PARATHION. Biochem. Pharmac. 16, 1 (1967) 25-38.

Studies of the microsomal activation of parathion-^{35}S showed that a ^{35}S metabolite was bound onto microsomes, probably as the result of desulfuration in the activation reaction. Further work indicated that rabbit liver microsomes also degraded parathion by splitting at the aryl phosphate bond. Both activation and degradation by microsomes required NADPH and O, and were inhibited by SKF 525-A and insecticide synergists. The system was specific to parathion and did not degrade paraoxon. The degradation was also demonstrated with microsomes from rat liver and cockroach fat body and a model system (EDTA, Fe^{2+}, and ascorbate). (CA 66:1967, 75229c)

767 Nakatsugawa, T., Tolman, N.M., Dahm, P.A. METABOLISM OF ^{35}S-PARATHION IN INSECTS. Bull. ent. Soc. Am. 13, 3 (1967) 191. Abstr. 82, at "New York Meeting of the Entomological Society of America. New York, N.Y., USA. 27-30 Nov. 1967".

Diethyl phosphorothioic acid (DEPTA) and SO_4 were generally the major ^{35}S-metabolites of parathion in vivo in Periplaneta americana and Musca domestica. Topically applied sesamex suppressed the production of both metabolites, indicating the participation of oxidative enzymes. In vitro production of DEPTA was also examined. (Abstr.)

768 Neal, R.A. STUDIES ON THE METABOLISM OF DIETHYL 4-NITROPHENYL PHOSPHOROTHIONATE (PARATHION) IN VITRO. Biochem. J. 103, 1 (1967) 183-191.

The metabolism of the phosphorothionate parathion in vitro was examined by using [^{32}P]parathion and microsomes isolated from the livers of various animals species.* The major metabolic products of parathion in this system in vitro were identified as diethyl 4-nitrophenyl phosphate (paraoxon), diethyl hydrogen phosphate, diethyl hydrogen phosphorothionate and p-nitrophenol. The reaction leading to the formation of diethyl hydrogen phosphorothionate and p-nitrophenol requires the same cofactors (NADPH and oxygen) required for metabolism of parathion to its active anti-acetylcholinesterase paraoxon. The enzyme activity towards parathion per unit weight of liver is increased some 65-130% by pretreatment of male rats with phenobarbital and 3,4-benzopyrene. The metabolism of parathion is inhibited by incubation in a nitrogen atmosphere and in an atmosphere containing CO. Pure O_2 is also inhibitory. These results are discussed in terms of a deficiency of oxygen for maximal activity as well as the lability of some component of the system to oxidation. (Auth.)

*rats, mice and guinea pigs.

769 Pietri-Tonelli, P. de, Bazzi, B., Santi, R. ROGOR (DIMETHOATE) RESIDUES IN FOOD CROPS. Residue Rev. 11 (1965) 60-95.

This paper presents first a review of methods developed by several workers for the qualitative detection and quantitative estimation of Rogor and of its metabolites in treated plants. Several physico-chemical procedures are thus reported based on colorimetry, column, paper and thin-layer chromatography, paper electrophoresis, gas chromatography, and radiometry. Then a brief account is given of bioassay techniques used for the same purpose and applied directly on homogenized plant tissues or on the extracts. Autoradiographic procedures are also mentioned which were adapted for the investigation of the pattern of distribution of ^{32}P-Rogor and of its radioactive metabolites in macrosections of plant organs. The residue degradation and persistence curves of Rogor and its metabolic fate in plants are then considered and data are reported regarding several treated fruit crops (cherries, apricots, peaches, olives, tangerines, grapefruit, apples, and grapes) and vegetable crops (sugar beets, cotton, potatoes, snap beans, and carrots). The findings support the evidence that the concentration of Rogor and of its P=O metabolite in plant organs decreases at a variable rate depending, among other factors, upon the botanical species and variety, rate of growth, morphological structure, and location of the organs in the plant and on the date of treatment. Finally a summary is presented of harvest residues determined by various methods on 35 fruit and vegetable crops treated with Rogor in different ways and under different conditions. (Auth. summary.)

770 Ralls, J.W., Gilmore, D.R., Cortes, A. FATE OF RADIOACTIVE O,O-DIETHYL O-(2-ISOPROPYL-4-METHYLPYRIMIDIN-6-YL) PHOSPHOROTHIOATE ON FIELD-GROWN EXPERIMENTAL CROPS. J. agric. Fd Chem. 14, 4 (1966) 387-392.

Plants* grown in a fenced, controlled, and monitored agricultural plot were sprayed with Diazinon labelled with ^{35}S. The residue level of diazinon fell rapidly below tolerance levels (0.75 ppm) on all crops studied. There was no evidence of predicted S-containing metabolites at levels above 0.1 ppm on crops treated at recommended dosage. The only metabolite identified from the field samples was oxo-diazinon at an estimated level of 0.01-0.05 ppm. Radioactive 2-isopropyl-4-methylpyrimidin-6-ol was isolated from tomatoes 5 d after spraying with pyrimidine ring labelled diazinon-^{14}C. The present evidence suggests that diazinon is oxidized rapidly to oxo-diazinon which is, in turn, hydrolysed to 2-isopropyl-4-methylpyrimidin-6-ol. The latter compound is metabolised, in part, to carbon dioxide by a pathway which does not appear to involve acetoacetic acid (or its amide). (Auth.)

*tomato, snap beans, spinach.

771 Ramachandran, B.V. DISTRIBUTION OF DF^{32}P IN MOUSE ORGANS. I. THE EFFECT OF ROUTE OF ADMINISTRATION ON INCORPORATION AND TOXICITY. Biochem. Pharmac. 15, 2 (1966) 169-175.

The LD 50 of diisopropyl phosphorofluoridate (DFP) for mice by the intraperitoneal route was 6.8 mg/kg, while that by the subcutaneous or intravenous route was much lower (3.8 and 3.4 mg/kg, respectively). When DF^{32}P is injected into mice or rats by the intraperitoneal route, there is a higher uptake of radioactivity in the liver, with a corresponding reduced incorporation in other organs than when the administration is by the subcutaneous or the intravenous routes. Death occurs when the concentration of DF^{32}P reaches a certain critical value in some organs including the brain, whatever the route employed. A large part of the detoxication of DFP which is known to take place in the liver is thus due to its absorption by the liver esterases whose inhibition obviously does not contribute materially to the overall toxicity. (CA 64: 1966, 14888g)

772 Reesor, J.B., Perry, B.J., Sherlock, E. THE SYNTHESIS OF HIGHLY RADIOACTIVE ISOPROPYL METHYLPHOSPHONOFLUORIDATE (SARIN) CONTAINING P^{32} AS TRACER ELEMENT. Can. J. Chem. 38 (1960) 1416-1427.

Procedures are described for the safe processing of multicurie quantities of irradiated red phosphorus into isopropyl methylphosphonofluoridate (sarin) having a specific activity of 250-300 mCi/g. The use of costly remote-handling equipment is avoided by suitable choice of synthetic route and apparatus design. (Auth.)