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The Agency's Statute was approved on 20 October 1956 at an international conference held at United Nations headquarters, New York, and the Agency came into being when the Statute entered into force on 29 July 1957. The first session of the General Conference was held in Vienna, Austria, the permanent seat of the Agency, in October, 1957.

The main objective of the Agency is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

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BIBLIOGRAPHICAL SERIES
No. 9

RADIOISOTOPES
AND IONIZING RADIATIONS
IN ENTOMOLOGY

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA 1963
This bibliography on radioisotopes and ionizing radiations in entomology is the ninth in the "Bibliography Series" published by the International Atomic Energy Agency. Source materials published in English for the years 1950 to 1982 are discussed more fully than in earlier bibliographies, although every effort has been made to identify and list as fully as possible other publications in related disciplines. The bibliography covers various aspects of entomological problems related to radioisotopes and ionizing radiations. It should be of interest to those working in related disciplines or discovering particular aspects of the application of radioisotopes and ionizing radiations in entomological studies.

A special effort has been made to list articles and books that are likely to be of fullest use to those working in entomology, even if not strictly entomological in nature. Some publications may not be easily located elsewhere. To increase the accessibility of the bibliography, a subject index is included, in addition to a general index of authors, specific publications, and subjects.

The bibliography was prepared under the direction of the Division of Scientific and Technical Information and is part of the "IAEA Bibliography Series." Readers are invited to send comments and additional publications regarding the "Bibliography Series" to the Division of Scientific and Technical Information, IAEA, P.O. Box 100, A-1400 Vienna, Austria.

BIBLIOGRAPHICAL SERIES, No. 9: RADIOISOTOPES AND IONIZING RADIATIONS IN ENTOMOLOGY, IAEA, VIENNA, 1983

STI/PUB/21/9
FOREWORD
AVANT-PROPOS
ПРЕДИСЛОВИЕ
PREFAZIO

This bibliography on Radioisotopes and Ionizing Radiations in Entomology is the ninth in the "Bibliographical Series" published by the International Atomic Energy Agency. Source material was obtained from the open world literature for the years 1950 to 1960, inclusive. The aim, scope and details of coverage are discussed more fully in the Introduction. No claim to completeness is made although every effort has been made to include all pertinent references that could be traced. The bibliography reflects the enormous impetus given to research into various aspects of entomology by the availability of radioisotopes and ionizing radiations. It should be of interest to the specialist in need of a survey of relevant publications in related disciplines, and to workers requiring collected references covering particular aspects of the field. The Agency intends to continue bibliographical work in entomology.

A special effort has been made to present the references in such a way that they will be of the fullest use to readers in developing countries where certain publications may not be easily available. References have therefore been supplied with abstracts. To increase the usefulness of this bibliography a detailed subject index is included, in addition to the usual author index.

The bibliography was compiled by Mrs. M. Binggeli of the Agency's Division of Scientific and Technical Information.

Readers are invited to address their suggestions and other correspondence regarding the "Bibliographical Series" to: The Director, Division of Scientific and Technical Information, International Atomic Energy Agency, Vienna I., Kärntnerring 11, Austria.

La présente bibliographie, consacrée aux radioisotopes et aux rayonnements ionisants en entomologie, est la neuvième de la collection "Bibliographies" publiée par l'Agence internationale de l'énergie atomique. Les ouvrages cités ont été choisis dans la documentation publiée dans le monde entier entre 1950 et 1960. Le but, la portée et le détail de cette bibliographie sont indiqués d'une manière plus complète dans l'introduction. Sans prétendre à une étude exhaustive, on n'a ménagé aucun effort pour citer tous les ouvrages pertinents qu'on a pu retrouver. Cette bibliographie reflète l'essor considérable de la recherche dans divers domaines de l'entomologie depuis qu'on utilise les radioisotopes et les rayonnements ionisants. Elle devrait intéresser les spécialistes qui désirent posséder une liste de publications en la matière et les chercheurs qui ont besoin de rassembler des références sur certains aspects particuliers de la recherche entomologique. L'Agence a l'intention de continuer ce travail bibliographique en entomologie.
On s'est efforcé surtout de présenter les listes d'ouvrages de telle manière que les lecteurs des pays en voie de développement, qui peuvent avoir des difficultés à se procurer certaines publications, puissent en tirer le meilleur profit. On a donc fait suivre chaque titre d'un bref résumé. Pour qu'il soit encore plus facile de consulter cette bibliographie, on a comprét l'index par auteur habituel par un index détaillé par sujet.

Cette bibliographie a été établie par Mme M. Binggeli, de la Division de la documentation scientifique et technique de l'Agence internationale de l'énergie atomique, Vienna I, Kärntnerring 11, Autriche.

Esta bibliografía sobre en entomología es la novena en el carácter no confidencial publicada en la "Colección de estudio". Se describen detalladamente en el índice, por lo posible por recogida. Pese a ello, queda perfectamente claras las investigaciones sobre diversos aspectos de la entomología y los especialistas que necesitan de los datos bibliográficos. En este sentido, se refiere a los resultados de datos bibliográficos actuales, pero no tiene la intención de lograrla.

Se ha tratado especial por su interés del máximo interés de desarrollo, que quizás haya en las publicaciones. Por eso, contenido. Para facilitar el empleo, hay un índice detallado de cada autor.

La bibliografía ha sido redactada por el Científico Español y Tomo.

Se ruega a los lectores que hagan uso de la "Colección de estudio". Información Científica y Técnica, Vienna I, Kärntnerring 11, Viena I (Austria).
Esta bibliografía sobre el empleo de radioisótopos y radiaciones ionizantes
en entomología es la novena que edita el Organismo Internacional de Energía
Atómica en su "Colección de Bibliografías". En ella se recopilan las obras de
carácter no confidencial publicadas entre 1950 y 1960 inclusive. En la Introducción
se describen detenidamente los fines, el alcance y los detalles de las obras reco-
piladas. Claro está que la bibliografía no resulta completa, aunque se ha hecho
todo lo posible por recoger todas las referencias que se han podido encontrar.
Pese a ello, queda perfectamente reflejado el enorme impulso adquirido por las
investigaciones sobre diversos aspectos de la entomología gracias al empleo de
radioisótopos y de radiaciones ionizantes. La recopilación será de interés para
los especialistas que necesiten un análisis de las publicaciones importantes sobre
disciplinas afines a las suyas, y para los investigadores que precisen disponer
de datos bibliográficos acerca de un aspecto particular de esta esfera. El Orga-
nismo tiene la intención de continuar sus trabajos bibliográficos sobre entomo-
logía.

Se ha tratado especialmente de confeccionar y presentar la bibliografía de
forma que resulte del máximo provecho para los lectores de los países en vías
de desarrollo, que quizá tropiecen con dificultades para procurarse ciertas
publicaciones. Por eso, con cada obra citada se da un breve resumen de su con-
tenido. Para facilitar el empleo de esta recopilación, además del índice de autores
hay un índice detallado de materias.

La bibliografía ha sido preparada por la Sra. M. Binggeli, de la División de
Información Científica y Técnica del Organismo.

Se ruega a los lectores que envíen sus observaciones y toda la correspon-
dencia relativa a la "Colección de Bibliografías" al Director de la División de
Información Científica y Técnica, Organismo Internacional de Energía Atómica,
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GENERAL

A bibliographical survey was initially undertaken to provide a fully annotated bibliography of Isotopes of the International Work covering the 11-year period before 1950 and this can be seen in the work given in some of the reference up by the general availability of the publications. The present work, each dealing with a more specific and it is intended to aid those who own particular and rapidly where it is often difficult achievements. Yet such an achieve specialist's own problem.

SOURCES

The bibliography was communication search was conducted:

(a) Abstracting.
   Biological Abstracts
   Chemical Abstracts
   Bulletin Si
   Review of
   and B (B)
   Berichte der
   (BGB-A)
   Nuclear Science
   Excerpts
   Referativindexes

(b) Reference libraries.
   Bibliograph
   Agriculture
   which were for

Among the many surveys:

"Annual Review of Biochemistry 1-6 Palo Alto, CA"
"Advances in Pest Control" New York, (1957/59); Radiation Biology 1-7.
INTRODUCTION

GENERAL

A bibliographical survey on radioisotopes and radiation in entomology was initially undertaken to provide documentation for an internal study in the Division of Isotopes of the International Atomic Energy Agency. The decision to publish a fully annotated bibliography was taken subsequently, when it became clear that it would meet a real need. The present volume represents a reference work covering the 11-year period from 1950-1960. Relatively little was published before 1950 and this can easily be traced by following the references to earlier work given in some of the review articles cited. The exciting possibilities opened up by the general availability of radioisotopes for research in the field of entomology are reflected in the ever-increasing number of research reports and publications. The present bibliography will be followed up by further surveys, each dealing with a more specialized aspect, to bring the information up to date. It is intended to aid those who are interested in documentation, not only in their own particular and rapidly developing fields, but also in those border-line areas where it is often difficult to get an overall picture of research trends and achievements. Yet such an orientation may have important bearings on the specialist's own problem.

SOURCES

The bibliography was compiled from the open literature. A routine documentation search was conducted by scanning the following secondary sources:

(a) Abstracting journals, including
   Biological Abstracts (BA),
   Chemical Abstracts (CA),
   Bulletin Sinalétique (BS),
   Review of Applied Entomology, series A
   and B (RAE-A, -B),
   Berichte der gesamten Biologie, Teil A
   (BGB-A),
   Nuclear Science Abstracts (NSA),
   Excerpta Medica (EM),
   Referativnyj Žurnal (in as far as subject
   indexes were available); and

(b) Reference listings such as those in
   Bibliography of Agriculture (B.Ag.), and
   Agricultural Index (A.I.),
   which were followed up.

Among the many surveys, books and reports consulted are:

"Advances in Pest Control Research", (Metcalf, R.L., ed.) 1-3, New York, (1957/59);
Radiation Biology 1-3.
Annual Report of the Research Committee on the Applications of Artificial Radioisotopes in Japan, 1-3, Jap. Soc. for the Promotion of Science (1951/53);
Selected Abstracts of Atomic Energy Project Unclassified Report Literature in the Field of Radiation Chemistry and Bibliography of Published Literature, AERE C/R 1575 (1-6), (1958);
Bibliographies of papers published by United Kingdom Sources on Radiobiological and Allied Subjects;
Archiv für Geflügelzucht und Kleintierkunde: "Titler der im landwirtschaftlichen Zentralblatt 1960 referierten Arbeiten auf dem Gebiet der Kleintierzucht" (with reference to work on bees and silkworms); Congress and Conference Proceedings (see source references in bibliography) (including the Proc. UN Int. Conf. PUAE, 1955/56).
Books and bibliographies (as listed in the bibliography)

Nevertheless, an essential part of the work consisted in consulting and, where necessary, abstracting original papers, reviews and reports and in following up the references cited there.

ORGANIZATION

The references within any one section have been arranged alphabetically by first author.

Whenever abstracts have not been compiled directly their source has been indicated. The length of an abstract is not a criterion for the importance of the article concerned; thus, a good review article may be be dealt with very briefly. A comparative inaccessibility of the source may justify a more detailed abstract. Some papers which, as far as could be ascertained, have only appeared as abstracts without subsequent publication in full have nevertheless been when their contents would appear of sufficient cited partially or in toto interest.

Some research reports of special interest have been cited and abstracted individually; when publications under the same or similar titles have appeared, reference to corresponding preceding research reports has been limited to a brief comment at the end of the particular abstract.

The bibliography has been broadly divided into two main parts: I dealing with radioisotopes, as applied in research on insects and insecticides, and II dealing with ionizing radiations in research and their possible applications. Occasionally the assigning of categories proved difficult because of a certain overlap; therefore, cross-references are freely cited throughout.

A section (III) on techniques has been included in part I on radioisotopes. Sample papers have been chosen to represent work on autoradiography, dosimeter, isotope dilution techniques, the labelled-pool technique, paper chromatography and others.

For orientation purposes, an attempt was made to head sub-sections by some introductory or survey article(s). General bibliographies and reviews are grouped together in Section IV.

Some difficulties arose in separating research on ionizing radiation effects from applications since present-day research is frequently at a pre-application stage; it may then be taken to mean here "research with a definite application in view". This is true of much research on the screw worm fly and controlling stored-products insects.

Particular difficulties with an amount of fundamental work on Drosophila genetics (see Drosophila" (Bloomingdale), however, it would have been neither possible nor has this been neither possible nor has this been possible to avoid the publication, a personnel index) stressed that one should read the publications:

Catcheside, D.G., A. H. see Lea, A., Actions of..., 1957.

Muller, H. J., Cold see Hofflaender, A., Racine see (McGraw-Hill, N.

Bacq, Z. M., and Alex see Worthington Scientific.

A number of papers on the mosquito and silkworm) have been genetics research emerges interest, and the significance of, for particularization according to egg color, feeding, and feeding behavior.

Special attention needs to be placed on the applications of studies devoted to this aspect in the bibliography.

Addendum - A special section has been included.

Appendix - An appendix summarizing data with supporting references.

Author index - The usual method of listing institutions may easily be found in the abstracting journal were.

Subject index - A complete list of subjects, each entry linking the radioisotope studies.
Second Southeast Asia, UNESCO
Asia, INSDOC, N. P. L.

The Applications of Artificial
for the Promotion of Science

Assisted Report Literature
Bibliography of Published

Kingdom Sources on Radio-

Bibliography (in biblio-

PUAE, 1955/58).

Literature cited in consulting and, where
reports and in follow up

Arranged alphabetically by

Unfortunately their source has been
for the importance of the
be dealt with very briefly.
write a more detailed abstract.
not included, have only appeared as
not yet been when
or in toto interest.

When cited and abstracted
similar titles have appeared,
abstracts have been limited to a

The book is divided into two main parts: I dealing
insecticides, and II their possible applications.
self sufficiency, and II difficult because of a certain
throughout.

In part I on radiisotopes,
autorigraphy, dosimetry, technique, paper chromato-

In part II, Ionizing radiation effects
pre-application of the technique with a definite application


in view". This is true of the "sterile-male" technique applied to insects other
than the screwworm fly as much as of radiation measures envisaged for

trolling stored-products infestation.

Particular difficulties were experienced in selecting papers from the vast
amount of fundamental work which has appeared on radiation effects in the field
of Drosophilinae genetics (see I. H. Herskovitz "Bibliography on the Genetics of
Drosophila", Bloomington, Indiana Univ. Press (1958) 296p.), It would have
been neither possible nor justifiable to include more than a slight sampling;
however, it would have been equally untenable to ignore this field. Bushland (see
author index) stressed that "...anyone planning work on insect sterilization
should read the publications by

Catcheside, D. G., Advances in Genetics 2: 271 (1958),
Lea, D., Actions of radiations on living cells. (Macmillan, New York,
1957),
Muller, H. J., Cold Spring Harbor Symposia Quant. Biol. 9: 290 (1941),
Holländer, A., Radiation Biology, Vol. 1, Part 2 "High Energy Radiation"
(McGraw-Hill, New York, 1955)
Bacq, J. M. and Alexander, P., Radiobiol. Symp., Liège 1954 (Butter-
worths Scientific Publ., London, 1955) ..."

A number of papers on genetics (Drosophila, Habrobracon, Mormoniella,
mosquito and silkworm) have therefore been included. The importance of
genetics research emerges clearly in connection with the sterile-male technique,
and the significance of, for example, developing strains allowing sex differenti-
atation according to egg colour for the silkworm industry, and strains with modi-

Special attention needs to be paid to genetic and developmental effects in-
curred through radiisotope labelling, and a separate section (I: D) has been
devoted to this aspect in the present bibliography.

Addendum - A special section on nematodes of agricultural interest has been

Appendix - An appendix has been included, consisting of tabulated summar-
ing data with supporting references, taken from recent review articles.

Author index - The usual alphabetical author index has been included. Authors'
institutions may easily be traced by referring to the article in question, or to the
abstracting journal were indicated.

Subject index - A comprehensive subject index was compiled. Alongside
each entry the radioisotope or radiation used is indicated, when feasible.

ACKNOWLEDGEMENTS

Additional very useful references were also obtained through direct corres-

Professor Astaurov, Severtsov Institute of Animal
Morphology, Academy of Sciences of the USSR,
Bol'shaja Kalougeskaja

Dr. M. Legay, Maître de Conferences, Faculté des
 sciences de Lyon, Laboratoire de zoologie expé-

Dr. Shibematsu, The Sericultural Experiment Station,
Ministry of Agriculture and Forestry, Suginami-ku,
Tokyo, Japan;
Professor Tazima, National Institute of Genetics, Siznikaken - Mishima, Japan;
Dr. C.C. Hassett, United States Army Chemical Research and Development Labs.;
Dr. D.F. Heath, Medical Research Council, Toxicology Research Unit, MRC Laboratories, Woodmansterne Road, Carshalton, Surrey, United Kingdom;
Dr. T.L. Hopkings, Assistant Professor of Entomology, Kansas, USA
Professor Dr. K. Gósswald and Privatdozent Dr. W. Kloft, Institut für angewandte Zoologie der Universität Würzburg, Würzburg, Röntgenring 10, Federal Republic of Germany

The compiler of this bibliography is greatly indebted to Mr. Claude H. Schmidt of the Division of Research and Isotopes for active collaboration and advice.
Very useful references and reprints have also been received from a variety of other sources, too numerous to acknowledge individually. These have all been greatly appreciated and of considerable assistance.
PART I

RADIOISOTOPES
A review article (20 references).

Weighed samples of tree holes to various doses of γ-radiation at 30-d intervals up to the surviving arthropods. It was noticed as an effect on control levels at around 300 r.

The author comments on the period of 1930 to 1950. They study the physiology and ecology of the species. The plants are irradiated with Sr, Zr, and Pb.

Dick, W.E. RADIOACTIVE in Agriculture. Chapter 4, 1. Radioisotope tagging and (its use in phenomena), and application (work is cited by author and paper). 

Dugas, J.-P. L'EMPLOI DES RADIOISOTOPES DE DISPERSION, LE MARQUAGE DES VIRAUX, BACTÉRIES, ETC.
I INSECTS

I-A Ecology

I-A-1 Survey Articles


A review article (20 references). Methods for labelling insects, and the doses to be applied are discussed. Dispersal and behaviour of insects, population density, and plant-insect and insect-insect relations are amongst the problems which may be studied by these techniques.

Asperen 1958 - [804]


Weighed samples of tree hole substrate containing dense and complex arthropod populations were exposed to various doses of γ-radiation from a Co60 source. Irradiated samples were then maintained in the laboratory at 30-d intervals up to 90 d; a series of these samples was processed through Berlese funnels to obtain the surviving arthropods. It appears from the data on Collembola and Acarina that related species can differ in their sensitivity to radiation. Evidence of predator-prey differential radioactivity was also obtained for 2 mite species, Rhizoglyphus sp. (a herbivorous, saprophagus mite) and a predator (Neoparasitidae). It was noticed as an increase in number amongst individuals of the irradiated population above control levels at around 360 r.

Dahm 1963 - [805]

Dahm 1967 - [806]


The author comments on the (shend) less than 20 papers which had appeared in the field during the 20-year period of 1930 to 1950. They deal with problems in pharmacology, biosynthesis, genetics, biochemistry, physiology and ecology. The isotopes mentioned are C14, Na24, p32, S35, Mn54, Co59, As74 and As75, Br75, Sr89, Zr96, T122, and Ba146.


Radioisotope tagging and its use in insect studies (habits, physiology, insecticide action and resistance phenomena), and applications of radiation for killing or the production of sterile males are reviewed. (Work is cited by author and year but no bibliography is included).


Après avoir touché aux principes nécessaires pour l'application des radioisotopes, l'auteur donne plusieurs exemples où les radioisotopes ont été employés avec succès: le marquage d'insectes pour étudier leurs zones de dispersion, le marquage de pucerons et d'autres insectes vecteurs de maladie des plantes par transmission de virus, bactéries, etc.

A very useful review, dealing with insect physiology, insecticide metabolism and distribution, and insect tagging in dispersal and field studies. More than 100 relevant references are cited.

Review. The use of radioisotopes is discussed in studies of insect dispersal, abundance and size of insect populations, the transmission of disease, insect physiology, and the mode of action of insecticides. The biosynthesis by insects of complex radioactive chemicals from simpler tagged compounds, and the dispersal by aeroplanes of labelled insecticides are also covered. The absorption and transmission through plants of radioactive systemic insecticides, and the synthesis by plants grown in an atmosphere of C$^{14}$O$_2$ of various botanical insecticides, e.g., pyrethrum and nicotine, are discussed. The section on radiation effects on insects considers mutations, growth, physiology, metabolism, reproduction, longevity, behaviour, etc. Five tables are included. The comprehensive bibliography contains 176 references.

Lindquist, A.W. RADIOACTIVE MATERIALS IN ENTOMOLOGICAL RESEARCH. J. econ. Ent. 45 (1952) 264-70.
The possible applications of radioisotopes are reviewed, together with the nature of the problems involved, the results obtained in connection with recent research, and suggestions on how to initiate studies on the biology and control of insect pests. The need for close collaboration with other disciplines is stressed.

Review article. Entomology is among the scientific disciplines employing radioactive materials in studies on the biology, physiology, toxicology, biosynthesis, disease transmission, and effects of radiation on reproduction, habits, longevity, and control of insects. Flight habits, dispersal distances, migrations, longevity, and population numbers have been studied with specimens tagged with radioactive materials. Results are reviewed from studies on the effects of radiation on insects and studies with radioactive insecticides. Applications in the control of insect pests are discussed. (NSA 13: 8537, 1959)

Review article. Application of radioisotopes to studying the biology (dispersal, flight range, etc.) of a particular pest is described, with citations from the literature. The use of radiation effects (lethal) to various insects and the practical feasibility of such measures are discussed. Further possible applications of the sterile-males technique are considered. Tracers may be used to evaluate the effectiveness of control measures, and in insect-physiology studies, in which a labelled chemical is traced during its absorption, metabolism, and excretion. A similar technique is used for tracing the course of a systemic insecticide in animal and plant tissues. Insecticide residue hazards may also be evaluated. (57 references)

Various types of applications are reviewed such as in insect migration studies. The investigations described range from studies on the dispersal of populations of mosquitoes, locusts, blackflies, grasshoppers and pine weevils to that of the movement of individual cutworms and wireworms in the soil. Automatic recording equipment has been designed for the latter purpose. The dispersal of pollen, also by insects, is discussed. Eradication of insect pests by sterilization with γ-radiation is described.

In tracer studies of insect dispersal, if released and followed by means of a minimal effect on the readily available, experiment is described, together with applicable tagged insect is discussed, a tagging-element carriage unit is mentioned.

Buha-Buha, B.L. ПРИМЕНЕНИЕ РАДИОИЗОТОПОВ 103-20.
Обзор экспериментальных изучения переноса воздуха генетических исследований насекомых и применения значительную радиобратья с 1950 до 1960 гг.
A review of experimental data on the aspect of entomology (ecology on insects, and applications of radioisotopes in the bibliography, including 32 references.

Some reference works are cited, including the Department of Agriculture's list of amino acid metabolism of the literature. Some works cited are also Canadian references.

The use of C$^{14}$ and P$^{32}$-labelled

Hassett, H. INSECTS TAGGING AND COUNTING. (In Russian.)

Kips, H., Latte, J., van der ENTOMOLOGY AND PHYTOPATHOLOGY. Review article.

Nichev, L. INSECT MARKING. (In Russian.)

Applications of radioisotope label choice of isotope to be made for warfare against insects is outlined.

In tracer studies of insect dispersal and behaviour, insects were tagged with a suitable radioactive tracer, released, and followed by means of a suitable radiation detector. The tracer needs to be easily applicable, have a minimal effect on the insect, be easily recognized, persistent, possess a suitable half-life, and be readily available. Experiments on mosquitoes, blackflies, grasshoppers, wireworms and cutworms are described, together with appropriate references. A method for the automatic plotting of the position of a tagged insect is discussed, including a block diagram, and a schematic diagram for interaction of a sensing-element carriage unit of the automatic following device. Work on the white-pine weevil is mentioned.


A review of experimental data covering the application of tracer methodology to basic and practical aspects of entomology (ecology, disease vectors, physiology, toxicology of insects, radiation effects on insects, and applications of ionizing radiations in insect control). The review contains a comprehensive bibliography, including 32 references to Soviet sources relevant to the present bibliography.


Applications of radioisotope labelling are reviewed, including their usefulness, hazards, costs, and the choice of isotope to be made for a particular study. One section is devoted to work on insects. The author warns against indiscriminate use of radioisotopes. Literature references cite work after 1945.
Behavour


21 Jenkins and Hassett 1960 - [808]

Aphids


Bean plants (Vicia faba) on which groups of A. fabae nymphs were feeding, were made radioactive by growing them in water culture with 32P added, so that the aphids took up the isotope and excreted it in their honeydew. The radioactivity of the honeydew taken from them by attendant Lasidus niger was then compared with that of the honeydew excited concurrently by unattended control aphids on separate plants. By increasing their uptake of plant sap the ant-attended aphids produced twice as much radioactivity in their excreta as did the ant-free aphids. The aphids directly control their rates of excretion and feeding, which are not determined solely by forces within the plant. The aphid apparently controls its feeding by the "sucking pump" in its head. It is suggested that the pump is normally closed but that periodically it opens to admit sap into its lumen and then closes ventrally to force the ingested sap into the stomach. During normal feeding the pump probably opens and closes at regular intervals; but when the aphid is ant-attended it could operate more frequently so as to force sap into the stomach more often. The uptake of sap by normally feeding aphids is apparently not continuous. (From author, summary)

22 Banks, C.J., Nixon, H.L. THE FEEDING AND EXCRETION RATES OF APHIS FABAE SCOP. ON Vicia FABA L. Env. exp. et appl. 2 (1959) 77-81.

The feeding and excretion rates of nymphs of A. fabae, feeding on young leaves of Vicia faba, were studied, using host plants grown in water culture and made radioactive with 32P. The amounts of sap ingested at first were small but the rate of ingestion increased rapidly between 12 and 16 h. The maximum rate of feeding was estimated at 0.2 mg sap/h, an uptake of 59% of the mean body weight of the insects per hour. The results are discussed in relation to other recent work on aphid feeding and excretion. (Auth.)


The volume of material ingested and excreted by Myzus persicae (Salt.) and Brevicoryne brassicae (L.) was measured by feeding aphids on sucrose solutions containing 32P as diisodium hydrogen phosphate or sodium dihydrogen phosphate through a plastic membrane or on isolated leaves of Brassica oleracea standing in a solution containing it. Myzus ingested approximately 0.07 mg plant material in one hour, and Brevicoryne less than one-twentieth of that amount. The results are discussed with reference to those obtained by other workers with M. persicae and Croicus stagnans (Evans) and to the mechanism by which aphids transmit plant viruses. Non-persistent viruses can be transmitted within a feeding period of 2 min, but in the present work no ingestion occurred so soon after insertion of the stylus. Short periods of starvation increase the amount ingested by Croicus, but not by Brevicoryne. The long feeding period required for the latter to ingest enough material for accurate measurement may vitiate the effects of starvation, but it seems likely that the effect of starvation on the ability of aphids to transmit non-persistent viruses may be due to factors other than the amount subsequently ingested. This summary is largely based on that of the authors.


Young test plants of Vicia faba L. were made radioactive by placing them in a neutral 32P-solution (specific activity 16 mc/mg). Wingless virgins of A. fabae Scop. were placed on the plants and tested for individual radioactive activity after various "sucking" periods and penetrations. It would appear that the phloem is the only source of nourishment. The duration of a feeding puncture has no evidence of whether suction has actually taken place or, if so, for how long it had continued. Radioactivity could usually only be detected once the Aphid had definitely settled down in one spot. The insects became radioactive on an average 25-60 min after the puncture.


26 Klotz, W. Rhinhardt, P. UNTERSUCHUNGEN ZUR STIKAFIKTENLAUS Linius (Neomyzus abietis Walk.) on the sucking activity and excretion of the insect. (Abstract.)

After dealing with the laboratory feeding rate of aphids with 32P by placing them on leaves placed in 32P-solution. Maximum activity was reached after 24 h when the aphids were allowed to suck non-radioactive sap. The excretion is similar to that observed for other aphids, the influence of sucking on the uptake decreased. The aphids were placed in a 32P-labeled solution of chlorotic spots within 10 minutes.

27 Klotz, W. WECHSELWIRKUNGEN ZWISCHEN BESORGUNGEN PFLANZENGEWEBES (Plant tissues) of the plant. Part 2. 1960 42-70 Part II (Habilitation dissertation). An investigation into the feeding rate of aphids with 32P was conducted. The feeding rate of aphids with 32P was investigated by placing them on leaves placed in 32P-solution. Maximum activity was reached after 24 h when the aphids were allowed to suck non-radioactive sap. The excretion is similar to that observed for other aphids, the influence of sucking on the uptake decreased. The aphids were placed in a 32P-labeled solution of chlorotic spots within 10 minutes.

28 Klotz, W., Kunke, H. EINFUHRUNG IN DIE PFLANZENGEWEBES (Plant tissue). A brief overview of the distribution of 32P in plant tissue. The course of saliva injection was elucidated by means of the transmission electron microscope (1960). The increase in the amount of 32P in the time elapsed from the first salivation of the aphids already showed an increase in the amount of 32P uptake. The aphids show increased radioactivity on an average 25-60 min after the puncture.

29 Lawson, F. R., Lucas, G. B., H. THE GREEN PEACH APHID. Myzus persicae. (Salt.) has recently been shown to excrete honeydew on which it feeds. In experiments...

A preliminary note reports on results obtained with radioactively labelled aphids on the mechanism of secretion and the distribution of saliva. Results are presented in more detail in Z. angew. Entomol. 46 (1960) 337-81 and ibid. 46 (1960) 42-70.

Kloft, W., Ehrenfeld, P. UNTERSUCHUNGEN ÜBER SAUGTÄTIGKEIT UND SCHADWIRKUNG DER SITKAFÄCHTENLAUS LIOCAPRAPHIS ABETINA (Walk.) (Neomyzaphis abetina Walk.) (Studies on the sucking activity and damaging effects of the Sitka spruce louse Liocephalopsis abetina (Walk.) (Neomyzaphis abetina Walk.) Physiopathologische Z. 35 (1969) 401-10. (In German)

After dealing with the laboratory rearing of L. abetina, sucking behaviour and sucking effects on larval tissue, the authors describe work on the secretion and composition of the saliva. L. abetina was labelled with 3H by placing them on larval branches stood in a NaH3PO4 solution (specific activity 1 mc/ml). Maximum activity was reached after 24 h and radioactivity could subsequently be transferred by lice allowed to suck non-radioactive needles. Measurements indicated that the mechanism of saliva excretion is similar to that observed for Myzus ascalonicus, i.e., a phloem-sucker. In order to investigate the influence of sucking on the metabolism and physiology of the needles, various damaged needles were placed in a 3H-labelled solution. Autoradiography showed that much less 3H was deposited in regions of chlorotic spots than in undamaged portions.


An investigation by means of plant physiological methods was made into the reaction of plant tissue to the penetration by and feeding of plant lice. Results showed that spontaneous primary reactions and long term secondary reactions must be distinguished. Data on the mechanism of saliva secretion was found by the use of a tracer, 3H. In phloem-feeding aphids (Myzus ascalonicus Donc.), saliva is secreted only with insertion (6-8 min) and retraction of the stylet, and not in the intervening time no matter how long the insect may feed. In contrast to this, parenchyma-feeders secrete more or less continuously and the fundamental differences between the two types of feeding are discussed fully. The mutual effects of plant and aphid, with a parenchyma-feeding species, are illustrated by histochemical and physiological methods. The distribution of saliva preferentially along veins of the leaf. On heavy infestation the saliva is distributed uniformly over the entire leaf surface.


The course of saliva injection was followed by means of 3H-labelled aphids (see Kloft, earlier work, 1960). The increase in radioactivity of aphids on radioactive Allium schoenoprasum L. was measured in terms of the time elapsed from the penetration of the mandibles into the plant. Within 16 min, 0-10% of the aphids already showed appreciable activity. Several hours are required, however, before all prickling aphids show increased radioactivity, thus indicating that they have reached the phloem, and that food uptake has actually started. The interval was measured between tracer uptake via food taken from the plant, and its elimination after resorption by the intestines or by secretion from the salivary gland. Results are discussed in their bearings on the transmission of plant diseases (virus) by sucking insects.


Myzus persicae (Sulz.) has recently become an important pest of tobacco in the United States, not only excerting honeydew on which soot moulds develop but also causing yellowing and stunting of the leaves on which it feeds. In experiments carried out in N. Carolina in 1951, [29] was used to determine whether...
the substances injected by this aphid into living plants are translocated. Aphids that fed on tobacco plants growing in soil treated with an aqueous solution of radioactive phosphoric acid became radioactive, and the tracer was found in their honeydew. It was also found in leaves on which the aphids had fed, into which the tracer was translocated to other parts of the plant, and part of the injury to tobacco caused by *M. persicae* may thus be due to translocation of injected salivary secretions. (RAE-A 45: 508, 1955)


The thistle plant was labelled by placing a solution containing 32P in a hollow cut into the pith of the main stem. The amount of uptake of 32P from the plant by aphids, *Aphidius sp.*, ants, and other insects was measured. The series of transfers, P, and the level of labelling of various insects was noted. The accumulation of radioactivity in predators in units lightly equivalent to the average radioactive level of the prey was observed and termed "unit predation concentration". The status of several insects was determined by using unit predation concentration to identify their activities. (RAE-A 39: 7057, 1960)


Adult aptera of *M. persicae* were fed on leaves containing 32P after fasting. The weight of sap imbibed by the aphids after varying feeding times was estimated, assuming that 32P is uniformly distributed in the leaf tissues. The results are used in a discussion of the mechanism of aphid transmission of plant viruses. (auth. summary.)

Jassid


In experiments on the transmission of the witch's-broom disease of lucerne by *Crosus argenteus* (Evans) in Australia, transmission was somewhat irregular, and since a similar irregularity had been reported in work with other Jassidae, tests were made to determine whether variations in feeding might be the cause and whether feeding was modified by routine procedures in handling. The method adopted was to confine the Jassids in cages on the leaves of young beet plants that had been left for 24 h with their roots in a culture solution containing tracer doses of sodium dihydrogen phosphate prepared with 32P and to transfer them to normal culture solution prior to infestation, or to feed them on a solution of sugars incorporating the radioactive material. *C. argenteus* ingested 32P incorporated into the plant, and exerted approximately 85% of the amount ingested within 30 minutes after feeding had begun. The total amount ingested increased directly with the feeding period during an experiment lasting 3 days. There was considerable variation in uptake between individual Jassids, but the differences were usually insufficient to account for the observed differences in ability to transmit the virus. No evidence of transmission of 32P to another plant was obtained. Anaesthesia by CO2 had little or no effect on subsequent feeding. Starvation for about 30 minutes before feeding slightly increased the amount ingested in a 30-minute period. The pH and the sugar concentration of the artificial diet did not significantly alter the amount ingested. (from RAE-A 41: 404, 1953)

Lygus


*Lygus obelinus* were made highly radioactive by feeding them sucrose solution to which radioactive phosphate had been added. Techniques and precautions to avoid contamination are described. On subsequent feeding on beans (*Phaseolus vulgaris* L.) the insects transmit their radiactivity at the feeding site as shown by counting and by radiograph. The results offer strong evidence that feeding oral secretions are injected into the host tissue.


The quantity of saliva injected by *Lygus obelinus* (3day) into bean tissue during feeding was determined by the use of 32P. Adults were fed on sucrose solutions containing large amounts of 32P until they had taken up amounts equivalent to about 500 mg dry tissue weight. The specimens were prepared as previously described. As soon as possible after feeding the bean tissue was excised, dried, and extracted to determine the 32P content. The mean length of the feeding period, which was constant for a given species, was 3 days 3 hours. After the proboscis is inserted into plant tissues, the feeding period is terminated by a long sucking phase.
Aphids that fed on tobacco plants that had become radioactive, in which the aphids had fed, into which the leaf by the aphid, and to which the leaf was cause by M. persicae may thus (0, 0.008, 1955).

INSECT-PLANT RELATIONSHIPS

A hollow cut into the pith of the Amuraphis sp., ants, and other insects of various insects was noted. The figs were exposed to the average radioactive level for 3 days. After 3 days, the status of several insects was again investigated. (RA 90: 7027, 1946)

Hosts PERSICAS (GULZ.) ON RADIOACTIVITY

The weight of sap imbibed by the leaf is uniformly distributed in the leaf and transmission of plant viruses.

FEEDING OF THE JASSID CROSUS

The by C. ovis argenteus (Evans) irregularity had been reported in leaves in feeding might be the cause and method adopted was to confine the leaves for 24 h with their roots in a culture solution with P²³ and to transfer them to a solution of sugars incorporating the plant, and excised approximately 10 h later. The total amount ingested increased, and there was considerable variation in sufficient to account for the observed on P²³ to another plant was obtained. Extraction for about 30 minutes before.

The pit and the sugar concentration (from RAE-A 41: 404, 1953).

HOST TISSUE THROUGH THE ORAL

A 16.9 (1952) 288-94.

Sucrose solution to which radioactive assimilation are described. On subsequent radioactive feeding at the site as evidenced that on feeding oral secretions

QUANTITY OF ORAL SECRETION

Joyce Thompson Inst. 16.9 (1952)

Mealybug


Work described by B.M. Lister in this report included the development of a method for determining, by means of radioactive phosphorus as orthophosphoric acid, whether Pseudococcus nijsseni used in experimental transmission has fed on the source plant; in tests, some of the mealybugs that had apparently settled on the plants did not pick up P²³ and so may not have fed. (see RAE-A 48: 79-82, 1955)


The report contains numerous studies on mealybugs. Observations on their movements showed that first-latn nymphs and adults comprise over 90 and less than 5%, respectively, of the mobile population of Pseudococcus nijsseni on cocoa trees. Mobile individuals occurred at all levels, but 85% of both moving and static populations were found in the canopy. Over a period of four months, significant positive correlations were found between numbers of mobile mealybugs and temperature and, to a lesser extent, hours of sunlight, but not with changes in the evaporation capacity of the air. Sunlight begins to penetrate the canopy at about noon, and movement continues from then, probably in response to increased temperature in the crown tents built by ants over the colonies, until about 6 p.m., with a maximum at about 3 p.m.


In the course of investigations in Finland on the way in which cereal bugs injure wheat grains and reduce the baking quality of the flour, specimens of Doraliporus baccarum (L.) and Lygus nigerpennis Popp. (Rebecs. Ret.) were allowed to feed on leaves of Corna indica rendered radioactive by exposure to light in a chamber containing C¹⁴O₂. Prepared from a compound of C¹⁴, and then enclosed in bags with wheat ears at various stages of ripeness. Most injured kernels were obtained from the bags containing L. nigerpennis. Positive radioautographs were obtained from 10 of these, 10 of which had been injured at the milky stage and 6 at the yellow stage of ripeness. In all of them, radioactivity was distributed over the whole kernel, indicating distribution of oral secretions, and in two it was relatively greater at the feeding point. Of the few kernels injured by D. baccarum, seven gave positive radioautographs. Radioactivity was strong at the feeding points, but evidence of spread of oral secretions was found only in two grains injured at a very early stage of ripeness. The great dilution in radioactivity during transfer from the leaves into the wheat kernels reduced measurements in the kernels difficult, and a G-M counter gave unsatisfactory results. The counts for all wheat samples, including the controls, differed significantly from the background, and this is attributed to the presence of the natural potassium isotope K⁴⁰. On the assumption that C¹⁴, was present in the carbon of the saliva in the same ratio as in the body, it is calculated that the maximum concentration of possible protocyclic enzymes (containing about 50% carbon) in the saliva of D. baccarum was 1:4900. (Rae-A 42: 376, 1954)
It was confirmed by the use of mealysbugs rendered radioactive with Pt that movement occurs from tree to tree through the canopy where the branches interlock.

Mites

Rodriguez 1954 - [301]

Liesering 1960 - [408]

Mosquitoes

Jenkins and Knight 1960 - [61]

Jenkins and Hassett 1951 - [110]


In studies at Cimichug, Manitoba, various tpp. of northern flowering plants took up and retained Pt when their stems are put in a Pt solution. Aeodes communis males and females visited flowers and ingested plant juices and nectars as shown by their accumulation of Pt from the activated flowering plants. This fact lends indirect support to the hypothesis that some arctic mosquitoes, observed to visit and probe flowers, may be able to produce viable eggs without a blood meal. (auth.-A.S.W.)


Under laboratory conditions Aeodes communis males and females visit Pt-labelled northern flowers and ingest plant juices and nectars as shown by their accumulation of Pt from the activated flowering plants. Northern mosquitoes have frequently been observed to visit and probe several species of arctic and subarctic flowers. Proof in the present studies that the mosquitoes ingest plant juices lends indirect support to the hypothesis that some arctic mosquitoes may be able to produce viable eggs without a blood meal from a mammalian or avian host. (from auth. summary)

Tiris

Klopf, W., Ehrhardt, P. Zur Frage der speichelinjektion beim saugakt von Thrips tabaci Lind. (Thysanoptera, Terenbrantia) (The problem of saliva injection during the sucking process of Thrips tabaci Lind. (Thysanoptera, Terenbrantia)). Naturwissenschaften 46 (1959) 580-7. (In German)

By means of radioactive labelling a gladiolar secretion was shown to be not merely a lubricant for the mouth parts but to be released into the plant during sucking. Adults of Thrips tabaci Lind. were left for about 24 h on cut chives (Allium schoenoprasum L.), placed in a radioactive phosphate solution. A measurable quantity was taken up by the thrips which were then transferred to moistened filter paper to get rid of external radioactive contamination. They were then caged in single-layered allium epidermis slabs by means of glass rings. The thrips then punctured some cells. After various intervals, the allium epidermis was carefully cleaned to remove any radioactive fasses. Subsequent autoradiography showed clearly that radioactive saliva had been injected into the tissue. Individual points of cell distribution and their distribution were recognizable. A contact-autoradiography is shown of an allium epidermis which had been sucked by the Thrips tabaci Lind.

Day and Inzykiewicz 1954 - [300]

Various


Pt was added to the river in order to follow its translocation. One section of the report deals with the uptake of Pt by 7 invertebrates, amongst them the black fly (Simulium), the stone fly (Pereonarcy), the caddis fly Brachycentrus, the burrowing mayfly Hexagenia and tabanids. Differences and fluctuations in the rate of uptake are described. Corrected counts per min per g are tabulated and discussed.

Ball, R.C., Hooper, F.F. (PM) IN A MICHIGAN TROUT Stream. Inst. for Fisheries Research, 44.

Phosphorus-32 was released in a theoretical maximum concentration of phosphorus through the food chain of insects. Results are compared.

Ball, R.C., Hooper, F.F. (PM) IN A MICHIGAN TROUT Stream. Inst. for Fisheries Research, 44.

Results are compared with results of benthic uptake to the amount of P present in the water. The work on insects was also studied. The work on insects is described.

Сорокин, Б.И., Нестеров, А.Ж. ЭССОТИ ПРОТОКОЛОВЫХ ВОЛС. ВИБЕСС НЕСТРОКОВОРОВ ВОЛС. НАСТРОКОВАЯ МОТОННАЯ. Тендея роса в мотоннах. Они очень быстро выдают небольшую мотонную боль небольшого размера. Настоящее большей степени.

Sorokin, Yu.L., Meshkov, A.I. ABSORPTION OF PROTOCOL IN TENDOLOGY 118,1 (1958) 205.

A suspension of Scenedesmus contaminating matter, and fed to the fish. They were excreted rapidly, and the material was found to be absorbed.


Six bees were trained to a distinct distribution of radioactive activity in 60% of the foragers and 16 to 40% of all radioactivity than the house bees. Unseamed cells were radioactive and this is suggested as the cause of similar odor produced by the honeybee. It is thought that the mission would enable slow-acting member of a honeybee colony.

Oentle, E., Emerson, R.B. V. HONEYBEES AFTER INGESTION Caged drone honey bees, with their antennae removed and with no access to food, were given a radioactivating dose of sugar solution. It can be inferred that the drone was not essential.
that movement occurs from tree

MOSQUITOES STUDIED WITH

plants took up and retained Ph when males visited flowers and ingested the activated flowering plant. This was observed to visit and probe

(Mosquitoes Studied With

Phlabeled northern flowers and from the activated flowering plants, several species of arctic and subarctic nectar feeders were indirect support to the

eggs without a blood meal from a

SAUGART VON THIRPS TABACI

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mix which had been sucked by Thrips

ION OF RADIOACTIVE PHOSPHORUS

formation Service, AEC. Progress news ecosystem',

section of the report deals with the

m, the stone fly Pterygurus, the

1. Differences and fluctuations in

habitat and discussed.


Phosphorus-32 was released in the West Branch of the Sturgeon River, Michigan, on July 8, 1959, at a theoretical maximum concentration of 1.25 x 10^5 mc/ml. Studies were made on the movement of radio-

phosphorus through the food chain during a two-month period. Data are also presented on the activity of insects. Results are compared with results from a similar study done in 1958.


Results are compared with results from similar studies during 1958 and 1959. An attempt was made to relate uptake to the amount of Ph present. The influence of chelating agents on the distribution of activity was also studied. The work on insects is somewhat incidental.


A suspension of Scenedesmus was labelled with C14 via Na2C14O3. The algae were then washed free of contaminating matter, and fed to Tenderpele plumosus. Their activity ranged from 1.10^4 - 1.10^8 cpn/ml. They were excerted rapidly, very little being assimilated by the moth. On boiling the algae, the hydrolysed material was found to be absorbed to a much greater extent.

I-A-2-b TRANSMISSION OF FOOD

Bee


Six bees were trained to a dish, from which they collected 30 ml of sugar-syrup containing Ph. The distribution of radioactivity among the bees and larvae of their colony of 24,569 bees was then studied. 69% of the foragers and 16 to 21% of all the bees in the hive were radioactive within 4 h; 76% of the foragers and 43 to 60% of all the bees were radioactive within 27 h. The nucellus bees were significantly less radioactive than the house bees and the foragers significantly more so. Within 48 h all the large larvae in unsealed cells were radioactive. These results are attributed to widespread food transmission. Food transmission is suggested at the foundation of the division of labour within the honeybee community and of the similar odour produced by the members of each colony, which serves for mutual recognition. Food transmission would enable slow-acting insecticides contained in their food to be widely distributed among the members of a honeybee colony. (auth.)


Caged drone honey bees, with access to sucrose syrup, received radioactive material through a dividing screen from worker bees that had access to radioactive sucrose syrup. After correction for time and background the net radioactivity counts per minute were 456 for drones and 94 for workers of equal sample weight. It can be inferred that the drones had become at least partly dependent upon workers for food, or perhaps for an essential growth factor, or that they preferred regurgitated food to sucrose syrup. (auth. E.O.)
(A report was also published as AECU-2630, Bureau of Entomology and Plant Quarantine, Dept. of Agriculture. 1958, 7p.)

Ant

Eimer, T., Wilson, E.O. 

In a series of experiments, honey mixed with a radioactive isotope of iodine (Na[131]) was fed to colonies of several species of ants and the rate of intranidal transmission of this substance studied. Striking interspecific differences were noted; from very limited, almost negligible exchange in the myrmicine Pogonomyrmex badius (Linn.), to rapid transmission leading to near or complete colony saturation in the myrmicine Crematogaster lineolata (Say) and species of the formicine genus Formica. An unexpected additional discovery was that the nest queens and larvae were often the last individuals to receive honey and, as a rule, received less than the individual workers. (auth.)

Göswald, K., Kloth, W. 
UNTERSUCHUNGEN ÜBER DIE VERTEILUNG VON RADIOAKTIV MARKIERTEM FUTTER IM VOLK DER KLEINEN ROTEN WALDAMEISE (FORMICA RUBRATRATENSIS MINOR) (Studies on the distribution of radioactively labelled food amongst ants of a colony of Formica rubratrienssis minor) 
Waldhygiene 1 (1956) 200-2. (In German)

Honey water was labelled with PM, at a dosage which gave measurable activity even on very wide distribution of the labelled food. Measuring techniques are described. One individual pass food to 8-10 fellow ants. 1/3 of the food being given away within 15 seconds. Group experiments gave varying results, not only depending on the size of the group, but of the ants to be fed, the allocation of food being proportional to ant size. In Camponotus ligniperda, distribution of essentially liquid food was found to be much more rapid which was the case in Formica pratensis frezi.

Göswald, K., Kloth, W. 

PM was given in food or by injection into the hemolymph. The distribution of food was investigated, particularly in a group of Formica rufa. A worker ant can directly share food from the crop with 8 others, the contents of one crop being ultimately distributed between 80-100 animals. Winged and unwinged females, and males participate in distribution. Further problems studied were the speed of distribution, the effect of animal size on allocation, trophallaxis and general behaviour. Relations between social parasitic ants and their hosts and also myrmecophilous were also investigated.

Göswald, K., Kloth, W. 
RÄDIKOBIOLOGISCHE UNTERSUCHUNGEN AN STAATENBILDENDE INSEKTEN (Radiobiological investigations on colony-forming insects), Umschau A 48 (1958) 745-5. (In German)

Metabolic processes of inhibition were investigated by which animals in a particular insect colony are maintained as worker or soldier members instead of becoming sexually potent. PM-labelled worker ants of known activity were placed with 1-100 unfed fellow ants. The radioactivity of every insect was measured individually at various intervals. The level of measurable activity made it possible to gauge, both qualitatively and quantitatively, the extremely wide distribution of radioactively food available from one insect, Extract (puptary, secondary, etc.) and speed of distribution were a function of temperature. Both imaginal males and workers in developmental stages receive merely regurgitated food whereas queen larvae are fed with superior gland extract. Winged males also work actively in food distribution. An interchange between nursing ants and larvae (trophallaxis) was confirmed. Queens also release food to workers. Individual food requirements are much greater for bees than for ants; food is quickly resorbed and distributed throughout the entire organism. Drones also actively participate in passing on food to worker bees. The termite, Calotermes flavocollis, does not show a genuine caste system. The allocation of work in supplying food is described at different developmental and social levels. Distribution of food brought in by a few individuals was relatively rapid, though much slower than among bees or even ants.

The paper is a review of the interchange of substances which takes place in labelled ants between different castes, and different developmental stages, and also between the ant population and its hosts and social parasites. Results obtained by means of the radio-tracer technique allow further insight into the sociological structure within an ant colony.


After discussing techniques (radiation sources, application of radioisotopes, measurements and methods of calculation) the data thus obtained on the distribution of food amongst ants is described. A number of sub-families were used in the study. The distribution of labelled food in the individual ant (here, Formica polyctena Forest.) is described. Resorption only takes place in the mid gut, whilst regurgitated food is concentrated in the crop. Contact-autoradiography was used for following distribution with time; a very high activity was found in the labial gland. Food transmission within a group of workers (speed and extent) depends on several factors including temperature (opt. 25°C) and the size of the group: uniform distribution will ultimately be reached. The polymorphism within the worker caste has a direct influence on the quantity of food received: the larger ones appear better fed both quantitatively and qualitatively. Regurgitated food is accepted by queens although they normally receive gland-secreted food. The males participate actively in food transmission. Some problems of trophallaxis are discussed; uptake of larval material by nursing ants and vice versa is confirmed. Special characteristics of different types of ants are also studied (independent and social parasitic types).

GOSSWALD, K., KLOFT, W. UNTERSUCHUNGEN MIT RADIOAKTIVEN ISOTOPEN AN WALDAMEISEN (Radiocarbon studies on forest ants). Entomophaga 5, 1 (1960) 33-41. (In German)

The distribution of 14C-labelled food (honey water) among workers of the red forest ant was studied. The transmission process of the crop contents is a function of time and temperature. At optimal temperature (25-26°C) the contents of one single crop may be distributed amongst 80 workers, with a direct primary transmission to 6-8 workers, at most. Distribution is Gaussian. Winged and dawedged queens, and male ants also participate. Given a sufficiently large number of workers, the queens are fed with high-quality gland extracts. Similarly, larvae destined for a sexually active life are also given preferential treatment. Distribution amongst members of different species of Formica was also studied.


Transmission of honey in several species of ants was studied using 14C as tracer. Great variation in transmission rates between species was noted, ranging from negligible transmission over a 10-day period (in Pogonomyrmex badius) to complete colony saturation within 30 h (in Formica spp.). The honey was passed mostly among workers, very little being given to the queens or larvae. Indirect evidence is cited which suggests the occurrence of chain transmission beyond the primary donations given by the original foragers. (auth. summary)

By means of feeding filter paper soaked in $^{32}$P to homogeneous groups of termites, all larvae and nymphs from the third stadium onwards could be shown to feed independently. First stage larvae of termites absorb no food, and second stage larvae only very small quantities. Three-year old, sexually potent adults are able to feed independently, but only after having been separated from the larvae for 65-76 h. Trophallactic exchange takes place surprisingly slowly. When radioactive termites in the ratio of 1:10 are added to normal colonies then the level of radioactivity found in the insects is 4% after 12 h, 20% after 70 h and only reaches 100% after about 35 h. The older larvae and younger nymphs play the most important part in trophallaxis, in the sense of "chewing the cud".


Laboratory and field experiments are briefly reported in which radioactive labels in the form of radium sulphate were attached to larvae of Coccinella, thus permitting their detection at a distance of about 2 feet. Positions of larvae were recorded at intervals of several days. They are able to travel as much as 91 feet in 2 days. It is tentatively concluded from these preliminary experiments that ladybird larvae, while capable of making a thorough search of their surroundings, may be inefficient in finding their prey, which may be an important contributory cause of the high mortality suffered by the early-stage larvae.


For studies on the behaviour of newly-hatched Coccinella larvae on plants, the radioactive material has to be suitable for external application as small labels, yet have a sufficiently high specific activity for easy detection with a Ge-M device. Radium labels are too large to use on first instar coccinella larvae, and tantalum (Ta$^{180}$) was used instead, which has a half-life of 120 d, and emits a high-energy $gamma$-radiation. The method and apparatus used for attaching labels to larvae are described, and experimental details (dimensions, etc.) given. Labels of two levels of radioactivity were used on 1st instar larvae of Coccinella septempunctata L. (250 $mc$/mg and 45 $mc$/mg). In the first case, the larvae became less active and ceased feeding and after 2-3 d died without ecysis. The lower activity caused no noticeable effect on growth and movement, nor did the approximately 24% increase in weight due to the Ta$^{180}$-strip.


As the survival of a larva depends primarily on the ability of its 1st instar to find aphids, observations were made on larvae recently hatched from their egg shells. The species studied, Adalia bipunctata (L.), Coccinella septempunctata L., and Pappus gauzeae (Coccinella septempunctata L.), are common predators of Aphis fabae and others. Larvae were either labelled with metallic foil disks containing radium sulphate or with strips of radioactive tantalum (Ta$^{180}$). The behaviour of the larvae appeared to be rather random in their search for food, and it is considered likely that in areas of low prey density many larvae, especially newly hatched ones, die of starvation because they do not find food. Larvae which encountered aphid colonies tended to stay near them, because after feeding they made small turning movements from side to side, which increased the chance of meeting another aphid of a colony. This behaviour differed from that before feeding. Larvae, especially the 1st and 2nd instar, took a comparatively long time to consume aphids and, in the field, one of them was prevented from feeding on an aphid colony by the attacks of their attending ants.

Fuller et al., 1951 - [388]

61 Jenkins, D.W., Knight, K.J. QUEBEC. Proc. ent. Soc.

Fifteen species of cuticulus with breeding habitats, dates, adult species were Adalia coonii and acquired radioactivity in observed eating larvae of A. pulicatus and A. eurispertus. A. coonii showed a radioactivity of 8.1 $mc$ of A. pulicatus and A. eurispertus.

62 Kanozicki, P.B. THE USE OF THE AN'T LASIUS MINUTUS MiNUS.

Five widely-separated groups of honey mixed with Fe$^{57}$ was placed to represent a separate colony. Other members of each colony moved towards the presence indicated some in more mounds indicated some in more mounds. (auth.)


Orientation reactions of the v. were studied by following that the repellation of certain (1) inhibition of the feeding convention these are refer to do not preclude contact with Aldrin, Dieldrin, Endrin, hex type one repellency. Type to Aldrin-treated seeds where they were seed. Dieldrin, Endrin and intermediate between Lindane and * (An abstract of earlier work on insecticidal seed treatments on

64 Nagel, R.H., Davis, J.M. ENGELMANN IN 1935.

The device described here w. beetles were treated in batch-time. Mortality, as indicated was not considered excessive as easily located beneath the bare 2 weeks following the treatment in original value. About 9350 of beetles were examined by feeding and laying eggs in typical numbers.

65 Rings, R.W. FRUIT INSECT B. St. 729 (1953) 59-60.

A solution of at least 50 $mc$/ml tracheus nematode then reach the body. No mass movement of woodlands was indicated. The

66 than in the adjoining woodland

Fifteen species of culicids were collected from tundra, alpine, and northern conifer forest habitats. The breeding habitats, dates, adult activity and biting habits are presented for each species. The most important pest species were Aedes communis, A. pullatus, and A. exsanguis. Radioactive (P32) test pools were used and acquired radioactivity measured in the mosquitoes. Ochotona nympha and some caridus adults were observed eating larvae of A. pullatus in the field. Dytiscid and gyldus larvae were observed preening larvae of A. pullatus and A. exsanguis in the field, and eating them in the laboratory. Large dytiscid larvae showed a radioactivity of 8.5 mR/h in a radioactive pool which indicated that they had fed on radioactive A. pullatus and A. exsanguis larvae.


Five widely-separated groups of mound of this hypogaeic ant were studied in a swamp in South East Michigan. Honey mixed with P32 was placed in a mound of each group to determine whether or not each mound represented a separate colony. The honey was quickly fed upon by workers of these mounds and passed to other members of each colony. Within 6-8 h food had spread throughout each colony. Sampling of adjacent mounds showed the presence of radioactive ants in some of them. Occurrence of radioactive ants in nearby mounds indicated that some mounds are interconnected by tunnels. Thus, a colony may occupy one or more mounds. (auth.)


Orientation reactions of the wireworm, Melanotus communis Gyll., to various insecticide seed treatments were studied by following the movements of individual larvae tagged with Co60 in the soil. It was found that the repellency of certain insecticide seed treatments to wireworms apparently has two components: (1) inhibition of feeding reaction, and (2) orientation of the insects away from treated seeds. For convenience these are referred to as type one and type two repellencies, respectively. Type two repellency does not preclude contact with treated seeds, and varies in degree depending on the insecticide used. Aldrin, Dieldrin, endrin, heptachlor and Lindane seed treatments all appeared to possess considerable type one repellency. Type two repellency was most pronounced with Lindane-treated seeds, and with Aldrin-treated seeds where this insecticide was not used in excess of 1 oz of actual toxident per bushel of seed. Dieldrin, Endrin and heptachlor seed treatments showed a degree of type two repellency intermediate between Lindane and Aldrin on the one hand and untreated control seed on the other. (auth.)

(An abstract of earlier work appeared in Bull. ent. Soc. Amer. 5, 3 (1956) 97, abstr. 18 under “Effects of insecticide seed treatments on wireworm activities”)


The device described here was used in the treatment of about 18,000 beetles with 14C in Colorado. The beetles were treated in batches of about 1000 each, and the entire lot treated and released in about 2 hours’ time. Mortality, as indicated by those remaining in the trays the following day, was about 15%. This loss was not considered excessive as many were in poor health when treated. The treated beetles were fairly easily located beneath the bark of trees, by use of portable scintillation counters, for a period of about 3 weeks following the treatment. At this time the radioactivity of the isotope was only about one fourth of its original value. About 850 beetles (ca. 55) were later relocated by their radioactive tag. A few tagged beetles were examined by peeling the bark from over them. They appeared to be making typical galleries and laying eggs in typical numbers, indicating that little adverse effect had resulted from their treatment.


A solution of at least 50 µg/ml of P32 was required for labelling peach terminal. Plum curculios (Ceratothrix nemophila) then reached an activity of 5 mR/h within 3-4 d. P32 being present nearly throughout the body. No mass movement of the curculios into the centre of the orchard from the outside rows bordering woodlands was indicated. The greatest proportion of labelling curculios can be found in the orchard rather than in the adjoining woodlands.

Laboratory-reared Malathion-resistant flies (Grove) were tested for any behavioural resistance in terms of an avoidance reaction to Malathion and Dipexnet baits. The baits, which contained 1% toxicant, and the plain sugar standards were mixed with 85% phosphoric acid. Mortality was determined after 24 h. The Malathion bait killed 40% of the Groves females, 85% of the Groves males, and 100% of the normal flies. All the flies of both colonies were killed by the Dipexnet bait. No mortality was observed with the sugar controls. Both physiological and behavioural resistances to Malathion were involved in the survival of the Groves females. The results of the test with Dipexnet bait run on female flies only, showed no such evidence. The laboratory experiments are not strictly comparable with field conditions.

I-A-3 POPULATION DYNAMICS (DISPERsal, FLIGHT RANGE, Etc.)


Studies of this type have assumed increasing importance since the cockroach has been proved to be a potential vector of several human diseases (McGee). In sharp contrast, its capacity in transmission needs evaluation under varied field conditions. Movements of Periplaneta americana from sewer manholes were studied by a trap, mark, release, and recapture technique using paint or Pt-N (about 100 cc of a 95% aqueous casein solution containing 10 µc of Pt-N/cc per group of roaches treated). In 2 experiments where only the resident manhole populations were marked, very limited migration was observed, only 4 of 800 marked cockroaches being recovered. However, when 1200 marked cockroaches were super-imposed on a resident manhole population of 300, 71 tagged individuals were recovered within 15 d: 1 in a home, 5 in yards, and 65 still in the sewer system at distances up to 350 ft. from the release point. This suggests that even population over that of the carrying capacity of the environment may not cause migration from the centre of pressure.


Cockroaches are known to be able to harbour Salmonella for several days, the collection of Periplaneta americana (L.) contaminated with 3 species of Salmonella from sewer manholes in Texas was reported by S. Bitter and O. B. Williams (1949), and J. W. Syverton and others (1952) recorded the isolation of 4 strains of poliomyelitis virus from P. americana, Blattella germanica (L.) and Supella superba. The movements of P. americana in and from city sewage systems, which might affect its importance as a transmitter of disease, was studied at Phoenix, Arizona, in Oct. 1952. Surveys at 22 manholes for 7 weeks showed a weekly average of 92-144 cockroaches, all of this species, whereas the predominant cockroaches in dwellings were S. superba and S. germanica. Some 1500 individuals of P. americana were trapped in sewer manholes, marked with radioactive phosphorus by spraying with a solution containing 96 casein and 10 mc Pt-N/ml, and released in 4 manholes. During the next 8 weeks, traps at 3 of the release sites yielded 992 cockroaches, of which 906 were radioactive. There were 54 traps in other manholes of which most were less than half a mile and the others up to one mile from the release sites yielded 1602 cockroaches, of which none was radioactive, and 10 traps on premises in blocks adjacent to the release sites yielded only one cockroach which was radioactive and was caught 60 ft. from the nearest release site. The lack of evidence of movement was surprising in view of an observed tendency of the species to disperse at the likelihood of induced population pressure at the points at which the cockroaches were released. (RAF-B 43: 150, 1956)

By means of flight mills, flight performances with captive beetles were recorded and compared for (1) possible adverse effects of tagging solutions used earlier in dispersal studies; and (2) the influence of nematodes on flight in the case of infested specimens. (See Davis and Nagel, 1966)


There is circumstantial evidence that fleas of ground-squirrels can transmit plague bacilli from wild rodents to rats in rural areas of the western United States, and the development of a method for tagging fleas with radioactive carbon (C) made possible the direct investigation of the transfer of fleas from host to host. One male and two female voles (Microtus californicus), marked by clipping their toes, were placed in each of a number of experimental plots simulating field conditions, in which they could establish nests; 10-40 radioactive fleas (M. galaxias telmochum (Berth.) were put on certain of these. The animals caught in traps set each day were lightly anesthetized and any fleas were removed, examined for radioactivity and returned to the host. Fleas were found to have transferred from one vole to another in all of five trials and were found in nests in the three trials in which nests were established. In a second type of experiment in which 30 tagged fleas on three voles transferred to three rats (Rattus norvegicus), kept in an adjacent enclosure, while the vole was alive. After the litter had been killed, seven fleas moved to rats that were allowed to enter the area with the dead vole, but no transfers were noted on three new voles put in the enclosure after the rats had been returned to the adjacent. Of 40 tagged fleas put on the new voles, 12 moved to rats in the same area. None of the 60 fleas was found in the nests of the voles, but 37 were recovered from those of the rats. Radioactivity was twice detected in the Mesenteric fasciae once in rat fasciae. (RAE-B 48: 28, 1969)


The following is based on the authors' summary and conclusions. Two releases of radioactive houseflies (Musca domestica L.) were made in a dairy community near Port Whyte, Manitoba, during the summer of 1954 to investigate the effect of wind direction and wind-borne odours on dispersion and to determine whether houseflies dispersed from one farm unit to another within the experimental area. The flies were tagged by marking with P in aqueous solution on their wings. The recaptures from the two releases indicated that houseflies orientate to wind-borne odours from farms and migrate from one farmstead to another in appreciable numbers even in weather that is not optimal for flight. This suggests the need for community rather than individual attempts at control.


Although some results are presented on the dispersion of flies and mosquitoes marked with radioactive isotopes, the article is mainly a summary of the use of these isotopes in marking insects, and their potential in research on disease vectors and disease organisms. (BA 33: 7816; 1959)


Three specimens of flies were tagged by feeding them solutions of P -labeled phosphoric acid and then released. A total of approximately 86,000 Musca domestica (L.), 15,000 Phaenicia sericata (Meig.), and 1,000 Phormia regina (Meig.) flies were released, of which the following ratios of tagged to untagged flies were caught in the traps: 1:1 for Musca domestica, 1:70 for Phaenicia spp., and 1:500 for Ph. regina. P. regina comprised approximately 50% of the total number of flies caught. Most of the tagged flies were caught the first day in the traps 0.5 mile from the release point. Tagged flies had moved outward 4 miles in each cardinal direction the first 24 hours after release. Traps set in barnyards caught several times as many houseflies and Phaenicia as those set in open fields. The use of radioactive P as a means of tagging flies has proved satisfactory and reduced the
amount of work in examining large batches of flies over that necessary when pigmented dusts are used to colour insects. (from auth. summary)


In a field study of adult populations (Rothamsted) it was found that the males emerge slightly before the females and that the emergence period may cover at least 3 weeks in late June and early July. Although the number of males may exceed the number of females at first, the females dominate later in the season due to the shorter life span of the males. The numbers of flies on the wheat fluctuate appreciably throughout the day. During the 1st week of the emergence period the number of flies taken increased steadily throughout the day. After the date of population peak, however, the max. numbers occurred in the crop in the very early morning and the late evening, which suggested a daily flight dispersion followed by a general or localized return of the flies to the crop. Further study of the data showed that the daily temperature rhythm was only partly responsible for this daily flight dispersion, and that these appeared to be an active return flight to the crop in the evening. Generally the males were more active than the females and did not settle so deeply in the crop. Recaptures of Pb labelled flies indicated that the extent of the sometimes rapid dispersions was not very great. The females dispersed more than the males, and were somewhat influenced by the occurrence of wheat in flower. Frequently flies were found to have congregated on the lee edge of the crop, but other preferred regions have been observed which could not be attributed to wind influence. (from auth. summary)


The use of laboratory-bred blowflies for experiments on release and capture of marked flies is briefly discussed. In an experiment to test the possibility of a rhythmic protein-hunger cycle complicating the results when a uniform history of protein hunger are used, no difference was observed in the response to carrion-baited traps of groups of flies from whom protein had been withheld for 3, 9 and 6 days. In release experiments the ratio of marked to unmarked flies in traps sampled differed irregularly between laboratory-bred and wild flies, apparently depending on whether the climatic conditions at release were markedly or only slightly different from those of the insectary. (auth.)

*Kartmann et al. 1958 - [406]

Friesen et al. 1963 - [334]


Four different methods of marking insects are described in detail. Although they have been applied by the present authors only to the British Calliphorinae, they should be of value in ecological studies of mobile arthropods in general. These methods are; (a) marking with paint, (b) marking with radioactive labels using Pb, and (c) a combination of the last two. A fifth method in which the emerging fly labels itself with fluorescent dust, is briefly described. The circumstances affecting the choice of method are outlined. Technical details are given concerning the supply and dilution of Pb, given in a succrose solution. Alternatively, it was added to the drinking water instead. Experiments were made using the following flies: C. eritrophoeus, C. vomitoria (L.); Lucilia spp.


Employing as marking agents a combination of radioactive chemicals (Pb, Ca, and Sr) incorporated in their food and a variety of dyes dusted on them before release, dispersal halts of the common species of flies in urban areas were studied. Ca, used as calcium chloride, proved unsatisfactory since causing considerable mortality among flies marked with it. It was also rapidly excreted, and no dispersal data was obtained for flies marked with it. The iodine caused considerable mortality among male flies. Flies marked with phosphorus and iodine were not continuous and independent of these were recovered in vacant areas breeding near the city were found to be an abattoir and a garbage dump. From the relation between the genera Lucilia (Phaenicia), C. fannia posti (Wied.) and Sarcophaga city-wide and should be in some future production. (from auth. summary)


Dispersal tests were conducted by trapping adult flies feeding them with Pb-labelled food. To minimize the effect of Pb after it had become too dark for the flies to leave. In another test in late June, flies were marked with Pb to mark the test flies from 4 weeks to 24 hours after release, with Sarcophaga macellaria. The higher percentage of the general belief that it is the ground cover 8 to 10 from the release point. Within which area food and breeding materials are present great numbers of flies are in a large area is a normal pattern of dispersal.


In studies of the dispersal range of 250, 30 flies marked with Pb from baited traps distributed over 294 marked flies, of which 88% proportion of radioactive flies is except that more were taken at the same sites. The number of marked flies decreased fairly rapidly the fact that 10% of the marked flies were taken in October were taken two miles from the point of release. The insects are more or less away from the point of release. The attracting factors can be photographed by a pack of a community fly control.


Release of about 8000 marked flies in Virginia, during 1951 and 1952 in 3 d and just over 10 miles within 5 miles of the site of release. A total of 31 of the city ridges 400-500 ft high or by water, with maximum reduction of P. regina, the prolific breeding 3-4 miles away. Flies was to feed them on radial.
with phosphorus and iodine were separated by the differences in types of emissions. Dispersal was rapid, continuous and independent of direction. Large numbers of Callitroga macellaria (F.) and some of all species were recovered in vacant areas considerably removed from major fly-breeding foci. Sources of heavy breeding near the city were found to contribute substantially to the city's fly population. Flies from calendars, an abattoir and a garbage dump situated outside the city moved into all parts of the city and right across it. From the relation between the release and trapping points for Musca domestica L., blowflies of the genus Lucilia (Phaenicia), C. macellaria, L. cuprina cuprina (Wied.), Spiloprosopis Shannon, L. sericata (Mg.), Parnia pusilla (Wied.) and Sanaphaga sueta Wulp. It was concluded that municipal fly control should be city-wide and should in some instances include the most important of the immediately outlying foci of production. (from author, summary)


Dispersal tests were conducted with natural populations of wild house flies and Callitroga macellaria, obtained by trapping adult flies on the rural premises used as the release points. They were marked by feeding them with $^{32}P$-labelled milk. The marked flies were released where they had originally been caught. To minimize the effects of temporal caging, the releases of the marked flies were made at dusk after it had become too dark for them to migrate. In test in early May, only one release point was used. In another test in late June, five release points were used simultaneously. Dyes were used in combination with $^{32}P$ to mark the test flies. Houseflies were recovered up to 6 miles from the release points in less than 24 hours after release, with a range and pattern of flight apparently quite similar to those of Callitroga macellaria. The higher percentages of C. macellaria taken in the recovery traps tend to substantiate the general belief that it is the more migratory of the two species. In both tests the flies apparently dispersed at random over an area of 5 to 10 miles in diameter, with a few individuals being trapped up to 10 miles from the release point. Within the general dispersal area, the flies tended to congregate more at premises where food and breeding material were favourable. The availability of these materials, however, did not prevent great numbers of flies from leaving any given location, indicating that movement over this relatively large area is a normal pattern of fly activity. (from author summary)


In studies of the dispersal range of flies, principally Musca domestica L., made at Phoenix, Arizona, in 1951, 31,000 flies marked with $^{32}P$ were released in June and 50,000 in September. Catches made subsequently from baited traps distributed over the metropolitan area in concentric rings or segments included 217 and 246 marked flies, of which 88 and 81% respectively were found within a mile of the place of release. The proportion of radioactive flies in the catches varied inversely with the distance from the place of release, except that more were taken at one mile than 0.5 mile in June and about equal numbers in September. Some flies travelled a mile within 4 hours, three miles within 48 hours, and four miles within 72 hours. The numbers of marked flies collected three, four and five miles from the release points were small, but the fact that 10-13% of the marked flies recovered in June-July and 13% of those recovered in September-October were taken two miles from the release point indicates that movement to this distance may be of practical importance. The importance to a community of an area of high fly production situated a mile or more away from it depends on the sources of attraction in the intervening area. In the view of the influence of attractants on the infestation of Musca domestica into an area, removal of these substances is as important a part of a community fly control programme as the elimination of breeding media. (from RAE-B 41: 42, 1953)


Release of about 8000 marked adults of Phormia regina (Mg.) from each of two sites in Charleston, West Virginia, during 1951 and 1952, and subsequent trapping revealed dispersal for distances up to nearly 10 miles in 3 days and for over 10 miles on the 4th day, though most of the marked flies recaptured were taken within 8 miles of the site of release. It was shown that flies moved from a zone with a low standard of sanitation to all parts of the city, and that their migration was not prevented by the presence of wooded ridges 400-500 ft high or by watercourses. The findings supported the recommendation that to effect the maximum reduction of P. regina within a community, control operations should be extended to sites of prolific breeding 3-4 miles beyond the boundaries of the urban area. The method adopted to mark the flies was to feed them on radioactive milk (containing 1 mc/1 $^{32}P$ as phosphoric acid) and then to

The relative importance of five major sources of houseflies (Musca domestica L.) near Phoenix, Arizona, on the control programme in operation in the town was studied in 1952. Flies marked with PA and a dye characteristic of the site were released simultaneously from the 5 sites, and catching stations were operated at the release sites themselves, 0.5 and 1 mile from each site in all directions and 2, 3 and 4 miles from each site in the direction of the centre of town. The recaptures are discussed in some detail. The following is based on the authors' summary of the findings. Flies from three sites, two on the periphery of the town and one 0.5 mile away, readily infiltrated into the town itself, but comparatively few flies from sites 1, 2 and 2 miles away did so. From 50 to 81% of the marked flies recovered were taken within 1 mile of the release points and from 86 to 94% within 2, 3, 4 miles. Maximum recovery of marked flies occurred at release sites on the first day after release and at other sites on the fourth day. Available evidence indicates that although house-flies can travel 5-20 miles, the dispersion capacity of the mass population is expended within 0.5-2 miles because of the randomized, reciprocal type of movement that characterizes housefly movement. One mile is the distance to which it is recommended that control flight operations should be extended outside most communities. (RAE-8 43: 166, 1954)


In continuation of investigations carried out in the summer of 1952, about 147,000 radioactive houseflies (Musca domestica L.) were liberated at a primary release site at Phoenix, Arizona, on 50th Oct. For the next two days, 15 fly traps were operated at three secondary sites half a mile from the primary release point. The flies collected at each secondary site were then dusted with a characteristic dye and liberated. Catches at 48 collection stations within a mile of the primary release point indicated that, although fly dispersion from that site followed a general random design, radioactive flies were recaptured at a higher rate in one sector of the recovery zone than in the other two. In all, 145 T40 dyed radioactive houseflies were caught. Movement from each of the secondary release sites was random; some individuals reversed their initial path of migration and returned in the general direction of the primary release site. The findings indicate that M. domestica is essentially a species of migrating habits. The flies apparently spend most of their lives moving from site to site not only in search of suitable places in which to feed and breed but also from an inherent instinct to wander. (from auth.)


The report covers a number of fly dispersal studies conducted by investigators in Arizona, Oregon, West Virginia and Georgia. Flies were tagged by feeding on PA labelled milk-honey or sugar solutions (1 mc/ml of milk) for a 24-h period. Dispersal from each site proved random in pattern. Specimens congregate in areas or sites having suitable feeding or breeding sites. In some studies, flies liberated from several sites were dusted with different dyes. It was concluded that flies can move rapidly from site to site; overall movement of the population is from 1-2 miles for Musca domestica. Maximum dispersal distance for this species is 20 miles. Blow flies generally migrate farther and more rapidly than houseflies. Maximum dispersal distance for Phormia regina is 20 miles. Other species investigated were Callitroga macellaria, Ophyra leucostoma, O. aeneascens, Phaenicia cuprina, P. sericata, P. caesuviridis, Fannia pustulosa, sarcophaga ventralis and S. bullata, Musca stabilis. In some instances abatement measures 0.5 to 1 mile around the periphery of a municipality will suffice for housefly control. With blow flies, control treatments 0.5 miles beyond the city may be necessary.


The range of dispersal of flies from a garbage dump situated about half a mile from densely inhabited districts of Leningrad was studied between 23rd June and 25th July 1954. Identification of 2,000 adults taken on the dump in June showed that Phormia (Phantophrora) tarsenovae, D.-D., constitutes 82.5, 12.8, 2.0 and 0.5% of the population. Dishes of a bait consisting of a liquid mixture of sugar, yeast, flour and water, with the addition of 10% meat, 1.8 mc/lb were exposed for 4 hours and were rendered radioactive. Two radioactive examples of P. tarsenovae, distances ranging up to 2, 86, 2, 464 km, but inhabited districts were the flies were carried for up to about 5 km.

Shura-Bura, B.I., Shatkov, A.D. EMPLOI DES MOUCHES. J. Hyg. Epid.

Cess pools in a town were labeled. It was found to be radioactive. PA (phosphate of Na radioactif, added to the water) was used to study dispersal in another experiment. The population area, up to 10.7 km (protection belongs around towns), was used to study migration of drosophila type. Flies 1/3 to 1/2 km away from the population had already been impacted by disperser and resected the radioactivity.


The results of tests obtained for a field trial at a suspension of 10 treated stings 3 mc/mc and then dried and dried under populations from 4 nearby banks. Flies in the stream were radioactive, and the artificial insect was a little dirty, indicating very little dispersal.

Waldrop, R.H., Peel, R., Schalt, R. Dispersion of Flock 7-B. Mod. Sanit. Build. PA labelled flies were released. Additional marking with dyes, at the levels of sanitation existing in both communities antibiotic contamination.

Yates, W.W., Lindquist, A.W. RADIOACTIVE PHOSPHORIC ACID.. This further study into field data for the acid. Details are given, the PA and Phaenicia sp., their activity with a thin-walled Ge. The range of traps are given, and the results are used for long flight: a maximum for Musca domestica.
with the addition of 10% meat meal and enough P\textsubscript{50} as sodium phosphate to give a radioactivity of 1.0 mcg/ib were exposed for 4 d on the dump, and it was found that about 8% of the first two species were rendered radioactive. Traps were subsequently operated at various distances from the dump, and radioactive examples of P. terranova, Musca domestica, Musca stabulinus and L. casar were taken at distances ranging up to 2.6, 2.4, 1.3 and 2.86 miles, respectively. Dispersion occurred in all directions, but inhabited districts were the most attractive. It was mainly due to active flight, though many flies were carried for up to about five miles on vehicles. (RAE-840 230, 1967)


Cass pools in a town were labelled with \textsubscript{32}P in Na\textsubscript{2}H\textsubscript{3}PO\textsubscript{4} solution, 0.8% of flies captured subsequently was found to be radioactive. Privy pits located not far from the town were marked similarly. Flies (Musca domestica) were found to move as far as 5 km from the pits towards the town. Maximal flight ranges were studied in another experiment, M. domestica covered as much as 3.84 km and, in a trial run in a sparsely populated area, up to 10.7 km. Other species of synanthropic flies behaved similarly, Sanitary measures (protection belts around towns), as at present, evidently need revision. On feeding flies a labelled culture of dyesynthetic type Flextex 1/3 to 2/3 of the radioisotope was found in the intestinal content whilst the remainder had already been incorporated in the fly tissues. It is inferred that the insect digest the agent of dyesynthetic and releases the radioactive phosphorus.


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The results were obtained for a natural population. The test consisted of labelling flies with P\textsubscript{32} by suspending 10 treated strings 5 ft long which had previously been soaked in a 5% sugar solution containing 3 mcg P\textsubscript{32} and then dried under a heat lamp. The wings were placed in a steer shed and left for 24 h. Fly populations from 4 nearby barns were sampled by using insecticide-treated strings. Seven percent of the flies in the steer shed were radioactive on the following day while only 1% and 0.5% was radioactive in the house and the artificial insemination barn. No radioactive flies were found in the swine barn 1400 ft away, indicating very little dispersion under prevailing conditions.


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P\textsubscript{32} -labelled flies were released in 5 adjoining communities. The release sites could be distinguished by additional marking with dyes. Attached-bait-pat type traps were used. The resultant captures reflect the levels of sanitation existing in the particular area. Maximum benefits in fly control are only achieved if both communities undertake control programs.


This further study into flight habits was made on laboratory-reared flies which were fed radioactive phosphoric acid. Details are given. The investigation was made on Phormia regina (Meig.), Musca domestica (L.) and Phaenicia sp. their activity ranging from 200 to 8000 cpm/insect. A standard laboratory monitor equipped with a thin-walled Geiger-Müller tube was used for testing. Details of the type and spacing of traps are given, and the results of the various collections. Both sexes of Phormia were shown to have the capacity for long flight; a maximum of 8 miles was observed. The remarkable flight range of 30 miles was noted for Musca domestica.

About 15% of a naturally occurring population of Rhagoletis mytis completa Cress. in a 5-acre walnut grove in California were labelled within 28 h by spraying small areas of foliage on 15 trees with a water solution including 5% of a liquid maize protein hydrolysate, a powerful attractant, containing 0.05 mc Pb^41/mL. The recovery of radioactive flies in traps at various distances from the bailed trees showed that populations redistributed themselves fairly rapidly through the grove and that the comparatively mature population there contributed about 7% of the individuals in the surrounding area, to a distance of 0.226 mile, and about the same proportion in an orchard 0.5 mile away. As labelled flies were caught almost a mile away in the third week after baiting, it is concluded that the species may easily spread a few miles in a season under reasonably favourable conditions. In the treated orchard, 56% of the females contained eggs, and radioactive eggs were readily collected from the walnuts. (RAE-A 86: 813, 1960)


General review article covering representative fruit flies. Mention is made of a radioscope study on the migration of Ceratitis capitata. A naturally emerging male tagged with Pb^210 was recovered more than 26 miles away, with the distance traversed including at least 9 miles or more of open sea.


Investigations in Oregon in 1950 showed that Pb^41 labelled phosphoric acid could be combined with sucrose as a food for adults of Rhagoletis cingulata (Lw.) without shortening their life. The flies ingested the food readily, and those with an initial radioactivity of 6000 cpm could be detected for 6 weeks with a portable survey meter. There were considerable variations in the amount of radioactivity retained by individual flies, but 90 selected at random after feeding on radioactive sucrose for 2-4 days showed an average of 8833 cpm. Females that received heavy dosages of radioactive phosphoric acid failed to oviposit in cherries, and their excreta and the juice and pulp of the cherries caged with them became radioactive.

On 16th July 1951, 210 radioactive adult flies were released in a cherry orchard, and captured in traps containing ammonium carbonate, with an insect net or under trees sprayed with nicotine sulphate were made until 5th August. In all, 30 radioactive individuals were recovered, including 14 from the point of release, seven 250 ft away and one each 556 and 942 ft away: one was taken in another cherry orchard on the far side of a beet field, 560 ft from the release point.


Three tests were carried out at Edcouch and Pharr, Texas, in 1951 to determine the extent to which Drosophila migrated from pit privets into houses, using flies marked with Pb^210. In the first test, treated baits were placed in the pits of 10 privets and marked flies were subsequently recovered in 8 of the 10 adjacent houses. In the second test, flies were trapped, marked, and released in a privy pit; during the following 4 nights marked specimens were recovered in houses and privy pits as far as 500 ft from the release point. In the third test approximately 1000 marked D. melanogaster were released in one privy pit, and 3000 marked D. repleta were released in another privy pit 150 ft away. Subsequent trapping indicated that both species dispersed rapidly from the release privy pits to other privies and houses in a nearby area. Drosophila melanogaster were recaptured as far as 500 ft from the release point and D. repleta almost 1000 ft from the release point. The three tests demonstrated there was extensive migration of Drosophila from privy pits to houses in the area studied. The indications were that a major portion of the Drosophila which were found in the houses had, at one time or another, frequented privies. (auth. summary)


Various methods of marking Diptera with radioactive phosphorus for field-studies were tested for use on Dacus ferrugineus donaldi Hendel. In the first test, potassium dihydrogen phosphate containing Pb^210 was added to the carrot medium used for routine rearing of the larvae at the rate of 0.1 or 0.34 mc Pb^210/mL, and 500 eggs were placed on 200 ml of the mixture. Differences due to the two concentrations of Pb were not adequate to distinguish between individuals from different samples. However, the fruitflies were sufficiently radioactive to permit their identification in releases made at time intervals of the half-life of Pb^210 (14.3 d) by taking adv. but kept without food or water, 3.9 mc Pb^210/mL, and then reared between the two groups were feeding. A variety of individuals differed with the method of marking of turnover of the Pb^210. Female eggs collected from them 18 adults from treated larvae showed from treated larvae resembled fertility, viability of larvae per did not complicate normal rearing.

Riggs 1953 - [65]


Pb^210 was used for labelling several Mediterranean fruit fly Ceratitis species. Reared flies up to 26 miles away, males occurred with methylene blue, females spread as far as 30 miles. (Work to be published in near future)


Review article. Brief mention engelmanni have been located.


The overwintering females of Dacoides and their hibernation quarters and the species are confliction, and at its full appearance, 1600 adults were and liberated under pine trees on the occurrence of direct sunlight at the plantation, and total males should be separated from inferno around the infested ones to remain to act as a mechanical factor.


Spring emergence of white-pine, bark is now predicted by plantation has been burned by Nagey and Davis 1956 - [64]

Nagel and Davis 1956 - [64]
complete Cress, in a 5-acre walnut
field of foliage on 15 trees with a water
weilful attractant, containing
plants. The plants from the bailed trees showed that
and that the comparatively mature
landing area, to a distance of 0.125 mile.
seeded were caught almost a mile
may easily spread a few miles in a
5, 50% of the females contained
wings. 48: 513, 1960)

made a radioisotope study on the

with Ph was recovered more than
at more of open sea.

55. J. econ. Ent. 42, 5 (1955) 616-7,

acid could be combined with sucrose
their life. The flies ingested the food
be detected for 6 weeks with a
point of radioactive repletion by indi-
cause for 3-4 days showed an average
phosphoric acid failed to oviposit
aged with them became radioactive,
orchard, and captures in traps con-
with nicotine sulphate were made
including 14 from the point of release,
in another cherry orchard on the far

DROSOPHILA FROM PIT PRIVES.

determine the extent to which
with Ph. In the first test, treated baits
discovered in 8 of the 10 adjacent
in a privy pit: during the following
last day 500 ft from the release point
decided in one privy pit, and 9000
Subsequent trapping indicated that
and houses in a nearby area. Drosophila
and D. repleta about 1000 ft from
migration of Drosophila from privy pit
of the Drosophila which were found
summary)

PHOSPHORUS FOR FIELD-MOVEMENT

field movement studies were tested
um dibutyl phosphate containing
base at the rate of 0.1 or 0.34 µc Ph³²/ml.
ion to the two concentrations of Ph³² were
5. However, the fruitflies were
at time intervals of the half-life of

Ph³² (14.3 d) by taking advantage of
radioactivity decay and excretion losses. In the second test, 600 adults
were kept without food or water for 24 h, allowed to feed for 24 or 48 h on
a sugar solution containing
3.9 µc Ph³²/ml, and then restored to the normal diet. Assays showed that
the differences in radioactivity
between the two groups were inadequate for positive identification of all adults according to the period of
feeding. Assay of individuals at different intervals after marking showed that the rate of loss of radioactivity
differed with the method of marking, probably owing to differences in the biochemical distribution and rate
of turnover of the Ph³². Females reared from marked larvae lost Ph³² more rapidly than the males, and 80 mg
collected from them 15 d after emergence gave a reading of 1000 cpm. Neither treated adults nor
adults from treated larvae showed adverse effects from exposure to the different levels of radiation. Those
from treated larvae resembled the normal laboratory strain in percentage emergence from pupae, fecundity,
fertility, viability of larval progeny and length of life under laboratory conditions, and the use of Ph³²
did not complicate normal rearing unduly.

* Rings 1953 - [68]

Stelzer, L.P., Mitchell, W.C., Holloway, J.R., Nakagawa, S. LURE EFFICIENCY AND MOVEMENT
STUDIES WITH TAGGED FRUIT FLYS. Bull. ent. Soc. Amer. 5, 3 (1959) 117, abstr. 66.

Ph³² was used for labelling several hundred thousand flies of all 3 species (Dacus orientalis Hendel, the
Mediterranean fruit fly Ceratitis capitata Wied., and the melon fly D. cucurbitae Coq.). Recoveries
revealed flights up to 12 miles over 12 miles of ocean. Up to 59% recovery of released oriental fruit fly
males occurred with methyli Eugenol. One release of this species spread over an area of 100 sq. miles.
Females spread as far as males with heavier recaptures made downwind.

(Work to be published in near future, according to personal communication from the author, dated Aug. 7,
1962)

Wamer, R.M. RADIOACTIVE TAGGING FOR TRACING MOVEMENTS OF DROSOPHILA. Calif. Fig.

Forest insects

Beal, J.A. STATUS AND TRENDS IN FOREST INSECT RESEARCH IN THE UNITED STATES. p. 329-30 in

Review article. Brief mention is made of radioisotope applications to forest insects. Tagged Dendroctonus
engelmanni have been located underneath log bark up to 3 miles from the release point.

WEEVILS IN SMALL PLANTATIONS. J. econ. Ent. 50, 3 (1957) 594-6.

The overwintering females of Pissodes strobi (Peck) which infest white pine, Pinus strobus, disperse from
their hibernation quarters and oviposit from mid-April to mid-June. Reports on their capability of flight are
conflicting, and as it affects the degree of control afforded by the sprays normally applied at their first
appearance, 1600 adults were tagged with radioactive scandium (Sc³⁵), applied as the chloride in solution,
and liberated under pine trees in a plantation 900 ft × 600 ft in area. The distribution pattern suggested
the occurrence of direct uninterrupted flights of 300-400 ft, the distance from the release trees to the edge
of the plantation, and total movement covering at least 700 ft. It is concluded that experimental plots
should be separated from infested areas by at least 800 ft., and that the practice of spacing a few trees
round the infested ones to remove the residual population is of doubtful value . A hardwood over-story
appears to act as a mechanical barrier to penetration by the weevil.

Jaynes, H.A. SOME RECENT DEVELOPMENTS IN WHITE-PINE WEEVIL RESEARCH IN THE NORTHEAST.
Bull. ent. Soc. Amer. 5, 3 (1957) 40, abstr. 19.

Spring emergence of white-pine weevil, Pisodides strobi (Peck), the most serious insect pest of eastern white
pine, can now be predicted by using cumulative degree hours above 40°. Dispersion of weevils in a small
plantation has been recorded by tagging with a radioisotope. (from abstr.)

* Nagel and Davis 1956 - [68]

39

Since radioactive cobalt (Co\(^{60}\)) has a long half-life and emits gamma rays, a method was devised for tagging adults of Pissodes strobi (Psecchi) with it so as to facilitate studies of their behaviour during periods of their life when ordinary observation is difficult. The amount of Co\(^{60}\) applied per insect was found to be about 200 μe for 47 of them, and about 500 for the rest. A plantation of white pine (Pinus strobus) 190 ft x 170 ft, in Ontario was divided into 8 ft squares, since it was calculated that the amount of Co\(^{60}\) applied would be sufficient for detection at a distance of 9 ft, and the 56 weevils were liberated on the evenings of 31st August and 1st September 1951. Two were removed after a week because of peeling of the cobalt, and on 1st November, 21 of the remainder were alive and had entered habitation quarters; among the rest, 4% had died from unknown causes, as compared with 45.5% mortality among the controls. In spring, only 10% of the adults that entered habitation were still alive, though the survival percentages among untreated adults caged in the open and in a closed group of white pines were 86 and 56, respectively. It is therefore concluded that the amount of Co\(^{60}\) used was excessive. The cellulose cement adhered well until spring, when peeling increased. In subsequent tests, cellulose acetate was combined with or replaced by Glyptal, with satisfactory results. (RAE-A 65: 70, 1969)

Grasshopper


A method is described for tagging grasshoppers with \(^{32}P\) in the form of \(^{32}P\)H\(_2\)O\(_4\). Nymphs and adults of Camnula pellicuda (Scudd.) had previously been found to disperse to 240 yd in 6 d when released on bare, cultivated fields but to be a unable to orientate themselves towards a food supply. In 1955, tagged Melanoplus bialobranchiatus (Wlk.) (Tettigoniidae, ascipt.) were released at the centre of a 10-acre field, 8000 in the 3rd and 4th instars, and later 7500 adults. Adequate food was available. The range of movement under those conditions was found scarcely to exceed 30 yd in 3 weeks. The findings are discussed with respect to earlier experiments.


\(^{32}P\) was shown to be a useful tag for field studies of grasshopper movement and dispersal over a relatively short period. About 15,000 to 20,000 individuals were conveniently tagged at a time by feeding on wheat seedlings, growing on an area of 4 ft\(^2\) that had been sprayed with 50 cm\(^3\) solution containing 0.5 mC\(^{32}P\). About 14% of the applied radioactivity was taken up and retained by the grasshopper. (RAE-A 46: 110, 1959)

Mealybug


The mealybug migration from infected slash is discussed, as are the results from tests on \(^{32}P\)-labelled mealybugs at various ages.


An examination was made of the movements of Pseudococcus nylundii Lienig, the dominant vector of swollen-shoot disease, on cacao in Ghana. The mobile population is composed almost entirely of first-instar nymphs (95%). Movement is initiated at about 23.5°C and activity becomes more pronounced at higher temperatures. Movement is maximal during mid-afternoon when many hundreds of insects become mobile on heavily infested trees. The density of mobile mealybugs increases from the base of the trunk and reaches a maximum at a few feet below the top of the canopy. Under experimental conditions, nymphs walked at least 28 ft in search of favourable feeding sites and their dispersion increased proportionately with the number of canopy bridges. On cacao, adults are occasionally carried by the ant, Crematogaster striatula Emery. Using insects labelled with \(^{32}P\) the assumption was confirmed that P. nylundii is capable of walking from tree to tree via the canopies of farmers' cacao. In a plantation of 8-year-old Amelonado cacao, 40%
of the branches were in contact at 4-ft spacing and about 20-5 at spacings between 6 and 7 ft. No branches were in contact, where the trees were spaced more than 12 ft apart. At the closest spacing, the ratio between the number of mobile mealybugs that reached adjacent contact trees and those that did not was about 6:1,000. This ratio being reduced to 1 or 2:100 among trees growing 6 to 7 ft apart. The significance of the movement of mealybugs in the canopy in relation to virus spread is emphasized. Methods of preventing vector dispersal by pruning, wide spacing and interplanting with a secondary tree crop are discussed. The importance of a closed canopy in preventing attack on the trees by Mitradia is stressed. (Auth, summary)


Article includes a brief review of uses to which radioisotopes have been put in studies of the mealybug (Pseudococcus nijmanii) that transmit the swollen-shoot virus disease of cocoa in Ghana. In 1958, the mealybugs were placed on agar containing Fe59, to estimate the interval before feeding began. The results indicated that the preliminary resting period was long and variable, which possibly explains the low and unequal percentages of transmission obtained when viruliferous mealybugs were artificially transferred in experiments. The results were confirmed in 1959, when mealybugs were allowed to feed on cacao seedlings with their roots in radioactive solution. The isotopes used in this were first Sr95 and then Sr90. The latter was used in 1953-54 to assist in discovering the distances traversed by mealybugs dispersing from piles of stalk from infected diseased cacao trees; the distance proved to be short. The uptake and translocation of Pb207 in cacao trees was also investigated, in connection with attempts to label mealybugs in their natural habitat in the tree canopy. Application to the soil resulted in the most even distribution of radioactivity. (RAE-A 47; 511, 1959)

Mosquitoes


Larvae were raised in a 1:10,000 solution of thorian nitrate. The abdomens of captured mosquitoes were burned and the ashes tested with Cs (5155) nuclear track plates. Radioactive specimens were captured in all catching stations. The longest flight recorded was 8,900 m. (BA 28: 14876, 1954)


Mosquitoes were produced by collecting mosquito-egg - infested soil samples or by inducing captive female mosquitoes to oviposit on soil media. Radioactive marking was done at the 3rd instar by Hep207 or O4. From a release of approx. 2 million radiocative A. taeniobrychus near Savannah, Georgia, 428 marked specimens, of which 139 were of d, were recovered. Recapture of tagged female mosquitoes was made at maximum distances of trap locations (18-21 miles). However, most of the radioactive female mosquitoes were collected within 4 miles of the release point; the number of recoveries decreasing as the distance increased. Females were observed to bite readily prior to their departure from the release site. Radioactive female mosquitoes were recovered at maximum distances of 12 miles and for periods of 12 to 20 days after release. The majority of the females recaptured occurred near the release point, but recoveries were made at 2,4, 8, 10 and 12 miles. Some results are also given for A. sollicitans.


Review article. The application of radioisotopes to studies concerned with Anopheline control is discussed, particularly in connection with ecological problems which cannot be solved by other means. Larvae of Aedes aegypti (L.) were labelled by immersion. Both Pb207 and Sr90 were readily absorbed; in view of their half-lives of 64 and 54 days, Sr90 is preferable because of its slower rate of decay. The flight ranges of various mosquitoes have been determined by means of radioisotopes (references included). Methods of labelling with radioisotopes are described, and observations on radiobiological and biological effects of radiation mentioned. The use of radioisotopes in the study of insecticides is discussed, with numerous examples. A promising use of tracers would appear to lie in the determination of the area of dispersal aerosols dispersed from aircraft by means of isotopes with strong radiation incorporated into the insecticides.

The dispersal and flight range of *Aedes communis* (Deg.), a species characteristic of the northern coniferous forest, were studied at the timberline at Churchill, Manitoba, during the summer of 1950. Four million larvae were collected and reared in four shallow wooden tanks containing a total of 1500 l water, and in the form of a solution of KH2PO4 was added at a total rate of 506.3 mc of 85 (0.05 μc/l) as soon as the larvae reached the late 4th instar. About three million adults with an average radioactivity of 775 cpm emerged and dispersed in the Waskworth area. Of the 141 radioactive mosquitoes recovered in the course of 6 weeks, 88 had dispersed 100-5,000 ft, the average dispersal being 560 ft. A possible variable results from the presumed occurrence of two races of *A. communis* in the Churchill area: the larger adults dispersed farther than the more numerous smaller ones. The effective dispersal (dispersal in numbers sufficient to constitute a pest) was determined to be about a quarter of a mile. This study indicates that *A. communis* is a relatively sedentary mosquito and has a limited flight range in the northern coniferous forest in comparison with species of the tundra species. It rests in vegetation and does not attack man during the daytime. Additional data are given on the habits of this and other northern species of mosquitoes. (RAF-3 40: 154-156, 1950)


Radioactive *A. taeniorhynchus* adults were produced by exposing the larvae to 85. The subsequent dispersion from Sanibel Island, Florida, was studied from the time and space distribution of marked specimens. Other collecting methods were used but only light traps yielded significant numbers of recoveries. Migration, as a special non-purposive flight, occurs from 1-4 d after emergence. This initial exodus carried females to the limits of the collecting area, 20 miles, and probably beyond. The males probably did not migrate beyond 2 miles. This main flight was deflected to the northwest, possibly by prevailing southeasterly winds and by the NW-SE alignment of the coastlines and topography. Light traps collected females on a 5-d cycle of numbers; the last one was caught 19 d after emergence. Males entered light traps the first 3 d only after emergence. There is some indication that females may migrate early in each 5-d reproductive period. Dispersion of female *A. taeniorhynchus* appears to be random, omnidirectional, and apatentational, periodically repeated from a point established by a previous migratory channelled, non-apatentational dispersal. Males accompany the females on the initial exodus but probably drop out of the migration within a mile or two and thereafter settle down to a sedentary life characterized by swarming and brief periods of direct migration for 3-5 weeks. (auth. summary)


A technique was developed for producing large numbers of *A. taeniorhynchus* in the field under controlled conditions. The Phlebotomus sod in egg-laden swale was cut out and transported to a "nursery" pool when water was immediately pumped in and the sod flooded. A yield of 2.1 million mosquitoes was obtained. Larvae were then transferred from "nursery" to wooden vats for 85 introduction. 1.1 million radioactive mosquitoes were then allowed to disperse freely from the middle of Sanibel Island. Females were recovered up to 25 miles away and until the 24th night after emergence. Only a few males were recovered, all within 3 mi. The dispersal was generally downwind. It was considered that migration occurs the night of departure only, the twilight departures resulting in longer migrations than midnight departures. Apparent flight expansion of range of occupation by a broad mass was not established by the migration.


Two field studies of migratory exodus in the salt-marsh mosquito, *A. taeniorhynchus*, in Florida are described. Techniques described from the Ft. Pierce 1958 study are: (1) inducing mosquitoes in nature to lay their eggs where they can be gathered; in this case 3 million eggs were laid on 2200 ft of sod; (2) production of larvae by flooding egg-laden sod placed on the bottom of specially dug pools; (3) marking the larvae, and resultant adults, with radioactive phosphorus, emphasizing the inter-relationship of larval feeding and 85 dose in affecting degree of marking; and (4) recovering of departing mosquitoes in directional, stationary nets to learn direction and angle of migratory exodus. The Vero Beach 1958 study involved the following described techniques: (1) sampling the resting population at the emergence sites for determination of age, sexual rate, feeding rate; (2) sampling the departing mosquitoes by sticky nets and kynoon net. In the Vero Beach experiment emphasis is placed on the coordination of observational techniques, field collecting techniques, and laboratory examination techniques. (auth.)

Quartnerman, K. D., Jenson, L. IN ARKANSAS. J. econ. Environ. Using field-collected mosquito studies made on the flight of mosquitoes in Arkansas, efforts at mass-release were only partially successful. The release point, but tended to be at 100 ft, and traversed heavily wooded area, the release site, but the number of significant information on its use.


About 415,000 larvae of *Aedes flavescens* May 1952, kept in 80 tubs in water, average radioactivity of a single tub, and distances from the release point, average 15.5% for by decay of the 85. It was noted that after treatment to acquire adequate dispersal, confirmed by a laboratory test, patients gave 19.4% of 100 patients (132 000). If larvae kept in 4 d, while control mortality yielded 0.3 d, but did not appreciably increase dispersal.


Shina-Bura, B. L. STUDYING TECHNIQUE. Hyg. & Sanit. (1960) 105.

Possible effective measures against malaria are: (1) data are given on migration from 3000 ha of habitat were studied by means of data obtained through transporting the garbage.

Thurman, D. C., Husband, W. E. WITH RADIOISOTOPES IN CANADA. Large scale tagging of mosquitoes, 400,000 mosquitoes about 60%, recovered by means of light trap, 200,000 tagged mosquitoes were recovered between 1 and 3 miles.
SUBARCTIC MOSQUITOES MARKED (1955) 178-79.

A characteristic of the northern coniferous forest of the summer of 1955, Four million larvae in a total of 1,200 1 water, and P32 in mc$^2$ (0.05 $u$/larva) as soon as the average radioactivity of 775 cpm was below 100 cpm. mosquitoes recovered in the course of 600 ft. A possible variable result per chick; area: the larger adults dispersed (dispersal in numbers sufficient to a study indicates that $A$. communis is a more coniferous forest in comparison with the daytime. Additional

PRELIMINARY STUDIES.

larvae to P32. The subsequent dispersal was of marked recapture. Other number of recoveries. Migration, as this initial exodus carried females to 5 males probably did not migrate possibly by prevailing southwesterly light traps collected females on a 5-d period, entered light traps the first 3 d only early in each 5-d progressive period. Directional, and appetitional, periodically appetite dispersal. Male accompany in within a mile or two and thereafter light for periods 2-3 weeks. (From auth.

THE SECOND EXPERIMENT.

synochus in the field under controlled to a "mummy" pool where 4 million mosquitoes were obtained, produced, 1 million radioactive island. Females were recovered new males were recovered, all within migration occurs the night of departure of-the-night departures. Appetitional is established by the migration.

STUDY METHODS FOR MIGRATORY

A. taeniolatus, in Florida are (1) inducing mosquitoes in nature to $u$, were laid on 12/20 of sod; format of specialty dug pools; (3) marking visiting the inter-relationship of larval biting of departing mosquitoes in exodus. The Vero Beach 1958 study population at the emergence site for departing mosquitoes by sticky nets and coordination of field observational techniques. (Auth.)


Using field-collected mosquitoes which were tagged with P32 in the larval and adult stages, preliminary studies were made on the flight habits of rice field mosquitoes, *Aedes* spp., in the Grand Prairie section of Arkansas. Efforts at rearing of field-collected early 4th instar *Aedes* larvae for tagging with P32 were only partially successful. Marked rice field mosquitoes dispersed in many directions from the release point, but tended to move mostly with the wind. *Aedes* confrons travelled at least 6 miles and traversed heavily wooded areas over 1 mile in width. P. dimorpha was recovered up to 1.5 miles from the release site, but the number of specimens of this species, tagged and recovered, was too low to provide significant information on its flight habits. (Auth. summary)


About 410,000 larvae of *Aedes* Flavescens (Müller) were collected from sloughs at Indit (Saskatchewan) in May 1952, kept in tubs in water containing 0.1 mc P32/ml for periods (10-45) h long enough for the average radioactivity of sample larvae to exceed 2,000 cpm, and then returned to one of their natural habitats. The batches of tagged larvae were released daily from May 10-15, and about 1,800,000 adults collected with hand nets between May 15 and June 20 at up to 14 miles from the release site. The included 81 tagged mosquitoes (0.02% of the tagged larvae), all of which were obtained between May 21 and June 6, and at distances from the release site ranging up to 6.6 miles for females and 1.400 yd for males. The average radioactivity of the tagged larvae and adults were 8.130 and 640 disintegrations per minute, respectively, indicating a loss of 83% of the original radioactivity, of which about 60% could be accounted for by decay of the P32. It was observed in this experiment that the larvae needed the longer periods of treatment to acquire adequate radioactivity when the weather was cool, and the effect of temperature was confirmed by a laboratory test in which disintegration per minute for larvae kept for 10, 40 and 60 h in pond water containing 0.1 mc P32/ml at 36 and (in brackets) 70°F were 1,250 (33,000), 2,800 (82,200) and 3,020 (121,000). Of larvae kept for 24 h in water containing 0.1 mc P32/ml, 100 and 41% died in 4 d, while control mortality was 36.5%. Treatment at 0.1 mc retarded the emergence of adults by about 3 d, and did not appreciably affect their life-span. (From RAE-B 45: 96, 1967)


117. Shura-Bura, B. L. ОДНО ИЗУЧЕНИЯ МИГРАЦИИ МУХ СО СВАЯДЛЯ МЕТОДОМ МЕДИЙНХ АТОМОВ. Гигиена и Санитария 9 (1955) 12-5.

In the study concentrated on the migration of houseflies. In the population of houses, the flies are migrating from the ground to the sky. Migration of houseflies is a phenomenon that occurs in the entire world. The study aims to use radioactive tracers to trace the migration of houseflies. The study shows that the migration of houseflies occurs mainly during the summer months and that the flies migrate from the ground to the sky. The study also shows that the migration of houseflies occurs in response to changes in temperature and humidity. (In Russian)


Large scale tagging of mosquitoes with P32 was carried out near Turlock, California. Of the approximately 400,000 mosquitoes about 90% were Aedes nigromaculatus (Lud.). The mosquitoes in the release area were recovered by means of light traps, and an aspirator technique collected them off people. A total of 475 tagged mosquitoes were recovered; 17 were taken between 0.76-1 mile from the release point, and 10 between 1 and 2 miles.

Various studies on problems of mosquito control by different workers are reported. Flight studies were carried out on *Aedes nigromaculatus* in which the dye Rhodamine "B" and 14C were used.


A method for determining the error of population estimates is outlined, and used to test the decrease in density of prey described by Baldwin, James and Welch (1955), and to compare larval densities in permanent and temporary pools. The earlier work had used radioactive larvae, labelled by means of 14C. The technique and analysis are easy to use in the field. It is important that: a) a large number of larvae be tagged; b) the experiment be of short duration; and c) as many samples as possible be taken. The technique is in general more satisfactory in permanent or discrete pools.

Baron, Fuller and Spinks 1950 - [350]


Agriotes ochracus was used in this study.

Courtois and Lecomte 1968 - [383]


Female eye gnats maintained on honey in the laboratory retained more than half their original radioactivity 5 days after being tagged with 14C. When tagged gnats were released at the center of three concentric circles of traps on a windy day, some moved 56 ft directly upwind but an equally large number was caught 75 ft downwind in traps on the outermost circle, on both sides of the mean downwind direction. Releases of tagged gnats 1 and 1 mile from a rural population center in southwestern Georgia resulted in almost complete penetration of the small town on the day of release. In one test, traps more than a mile from the release box caught 15 gnats in less than 3 1/2 hours after it was opened. Chi-square analysis was used to test the hypothesis that tagged gnats are distributed like the wild ones. Local departures from an overall equilibrium between tagged and untagged gnats could be recognized, and progress of the dispersal could be followed by comparing successive collections. (auth.)

Fogg 1954 - [393]

Fuller et al. 1951 - [388]


A solution containing Co60 as nitrate was applied to the first 7 abdominal segments of the pine shoot moth which had been anesthetized with CO2. The majority of insects carried 55-50 mc of Co60. Tagging appeared to have no effect on behaviour, life expectancy or reproduction. Recoveries indicated that the insects tended to remain in the stand of pine in which they were released. Radioactivity was subsequently detected in bird droppings, pine needles, and preying insects. Dispersal of the moths was never beyond 50 m from the point of release, in spite of strong counter winds.

Kanowski 1959 - [62]

Kasten et al. 1958 - [406]


The species studied were *Nasturtium officinale* and *Impatiens balsamina* which gave counts in a much greater surface, larval death-rates, dispersal in many orders of insects.


Giants tagged with 14C, released in California, generally dispersed on conditions existed for their duration; but were found to half a mile downwind and downstream, but the general direction was always directly downwind. In one case were found resting at night, and on foliage of low-growing grasses and on foliage of low-growing grasses.

Menn, V.M., Schlinger, E.E., PERKINS USING RADIO-ACERUM. *Trichogramma fasciatus* is studied by feeding individuals in a second tests to analysis.

Walker, D., Harwood, R., BY THE USE OF 14C. *Bull. Ent. Res.* 27 (3) 1955-6, lots of 1000 red flour beetles in empty grain bins which were recovered from 17 of the 30 lots of insects originally in the bin. The beetles recovered to the total number of insects and the various species.

Banks 1957 - [60]

Banks and Nixon 1958 - [2]

Ahmed et al. 1954 - [729]

Auerbach 1956 - [2]

Baldwin, W.F., James, H.D. WITH A RADIOACTIVE TRACER. The prey-predator relationships were investigated by 14C. L. L. the larval density in the traps, pond water to rid themselves of pond animals were found to be increasing from the number of the dyes and Limnephilidae, a species of the mosquitoes. These result increase in the density of the
The species studied were *Panaxia dominula* and *Acrotylus calas*. The food plants selected for them were dead nettle (*Lamium spp.*) and dock (*Rumex spp.*) respectively, and these were treated with $^{32}$P. The radioactive images hatched gave counts far in excess of those observed from the larvae and pupae, probably due to a much greater surface. Methods are discussed possibly useful for acrotylus mortality, total populations, larval death-rates, dispersal activity, and other aspects of population dynamics as well as pigment chemistry in many orders of insects.


Grats tagged with $^{32}$P, released in the Palm Desert and Indio areas of the Coachella Valley in southern California, generally dispersed into agricultural areas and adjacent residential sections where noiable conditions existed for their feeding and breeding activities. They avoided virgin desert and barren hills, but were found to half a mile of desert to suitable habitats on the far side. Dispersal occurred both upward and downhill, but the greatest distance travelled in both experiments (4.1 and 4.3 miles, respectively) was with the wind. In one experiment, the population density was estimated at 3-5,000 gnats/acre. Grats were found resting at night on dry or damp ground, on soil clods, on dried rootlets protruding above ground, and on foliage of low-growing plants. (euch.)


Trichogramma fasciatus is a key parasite of certain field crop pests in California. Its dispersal habits were studied by feeding individuals $^{32}$P mixed in honey. In one test two million individuals were released and in a second test ten million individuals.


Lots of 1,000 red flour beetles, Tribolium confusum, each tagged with $^{32}$P-labelled phosphorus were released in empty grain bins which were subsequently sprayed with DDT as a residual spray. Tagged insects were recovered from 17 of the 30 bins so treated in 1955 and from 9 of the 34 bins in 1956. The actual number of insects originally in the bins were calculated on the basis of the ratio of the number of radioactive insects recovered to the total number of insects recovered. Considerable variation was found in the number of insects and the various species in different bins.

- Banks 1957 - [60]
- Banks and Nixon 1958 - [21]

I-A-4 PARASITES AND PREDATORS

- Ahmed et al., 1954 - [782]
- Auerbach 1958 - [2]


The prey-predator relationship of *Aedes myrmicans* (Wlk.) and *A. trichurus* (Dyke) at Chatterton, Ontario, were investigated by $^{32}$P. Larvae and pupae were made radioactive by placing them in $^{32}$P at 0.05 $\mu$g/ml. The larval density in the trays being ca. 500 larvae/litre. The larvae were left for 2 more days in fresh pond water to rid themselves of radioactive excreta, then examined or returned to the ponds. Several species of pond animals found to be predators of larvae and pupae. The importance of these predators in control was evident from the numbers that become radioactive, and also from the high radioactivity of certain species, dytiscids and lepismatids being the most important. Three new records of mosquito predators were obtained, *Limenigus vivens* Wlk., among them. As the generations of pond animals developed, more predators fed on the mosquitoes. The resulting decrease in the population density of the mosquitoes coincided with the increase in the density of the predators.
A species of mite, *P. podapolipophagus*, was found to be parasitic rather than commensal in habit when the mites became radioactive after feeding on roaches which had been fed on radioactive salt. The use of radioactive salts in studying its host-parasite relationship is described. Its relationship to the lizard mite is discussed, *P. triatoma*, from Triatoma infestans, Chile, is new; brief diagnoses are given of *P. podapolipophagus* and *P. isomertii*. The relationship of *Hirstella* to *Pimephales* is discussed. H. baltei from Igsena, Calif., California, and H. boneti from Cynopsaura multiguttata, Nebraska, are new; brief diagnoses are given for H. signifer, H. trombidiformis, H. pelaezi, and H. tenutipes. Keys to the spp. in both genera are given.


The uptake of 3H is possible contamination by 1.0 nuc per of first generation 29,000 cpm point. The transmission of 3H is adequate for a distinction from *A. sootly*.

Spinks 1988 - [14]

Stem and Schlenger 1960 - [174]

**I-B**


Gonda, O., Kaluszynsky, A., ETHERANE (DTP) AND RELATED CATALYSED BY A PARTICULAR Bacterial reaction to nearly the same expansion was found between the...
Labelling of the adults of Brachionus plicatilis by allowing them to feed on 10% glucose solution containing phosphoric acid (H₃PO₄) with P³² is not practicable as the adult parasites are unable to pick up enough radioactivity. On the other hand, labelling of the adults by rearing them on host caterpillars of Corcyra cephalonica, the latter being fed on crushed maize mixed with radioactive phosphoric acid, is quite a convenient and satisfactory method for the purpose of mass release of the parasite under natural conditions. Such individuals show a tolerably high degree of radioactivity and are therefore easy to detect. Moreover, the developmental period of the parasite by rearing it on radioactive host caterpillars is not adversely affected and the adults remain alive for a considerable period. (auth, summary)

* Pendleton and Grundmann 1954 - [306]

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The uptake of P³² is possible during the parasite’s (Hymenoptera) development in the radioactive host. The contamination by 1.6 mc per 3 L of nutrient solution was as follows: leaf sample 89 000 cpm, aphids of first generation 29 000 cpm, aphids of second generation 15 000 cpm, parasites 3 600 cpm (at the saturation point). The transmission of 150 cpm into the host eggs parasitized by labelled Trichogramma proved to be adequate for a distinction from hosts which could be naturally infested. (auth.)

* Spilins 1968 - [14]

* Stem and Schlinger 1960 - [490]

I-B Insect Physiology and Metabolism

I-B-1 CARBOHYDRATES


ATP and the enzyme system catalyzing the incorporation of P³² into ATP have been studied in respiratory particles prepared from the mosquito Aedes aegypti L. Addition of ethylenediaminetetra-acetic acid to the isolation medium and of ethylenediaminetetra-acetic acid and albumin either to the washing liquid or to the assay medium have been found obligatory for the exchange reaction. The effect of nucleotides, respiratory inhibitors and inhibitors of oxidative phosphorylation on the exchange reaction and the ATP activity has been investigated. Quantitative differences exist between the response of insect and mammalian respiratory particles to 1,1,1-trichloro-2,2-di-(p-chlorophenyl)-ethane (DDE), 0.1 mm DDT inhibits the exchange reaction by more than 50% in insect sarcomes whereas the inhibition in mammalian liver mitochondria is less than 10%. (auth, summary)


A short note reports results of a study on trehalose biosynthesis. The authors have shown the locust fat body to be an important site. Generally labelled D-glucose-C¹⁴ was incubated with fat-body tissue from Schistocerca (5th instar) and the products examined by paper chromatography. Hemolymph, leg muscle, fore, mid and hind gut tissues were also tested but found to be largely inactive in converting glucose into trehalose. The probable mode of biosynthesis is discussed.


The effect of the above compound and its analogues on the ATP-P³² exchange reaction in mosquito (Aedes aegypti L.) sarcomes has been compared. All analogues of DDT tested inhibited the exchange reaction to nearly the same extent when the concentration in the particles reached the same level. No correlation was found between the toxicity for mosquito larvae of the compounds tested and their effect in vitro on
the exchange reaction. The analogue tested included: 1,1-dichloro-2,2-bis(p-chlorophenyl)ethane, 1,1,1-
trichloro-2,2-bis(p-methoxyphenyl)ethane, 1,1-dichloro-2,2-bis(p-chlorophenyl)methylene, bis(p-chloro-
phenyl)acetic acid, 1,1,1,2-tetrachloro-2,2-bis(p-chlorophenyl)ethane, 1,1-bis(p-chlorophenyl) ethanol,
1,1,1-trichloro-2,2-diphenylethylene, 1,1-bis(p-chlorophenyl)-2,2,2-trifluoroethanol, and 1,1-bis(p-
chlorophenyl)-2,2,3-trichloroethyl acetate.

Gray, R.A. COMPOSITION OF HONEYDREW EXCRETED BY PINEAPPLE MEALYBUGS. Science 115 (1952) 129-33.

The general view that plant-sucking insects which excrete copious quantities of excess carbohydrates in their honeydew must take in large amounts of plant juice in order to get sufficient amounts of amino acids and proteins, was not found to be the case with pine apple mealybugs. Relatively large amounts of as many as 19 different amino acids have been found in the honeydew excreted by pineapple mealybugs (Pseudococcus brevipes, Ck.,) by the method of paper chromatography. The number of amino acids excreted was shown to increase with the period of feeding. Sixteen amino components of the honeydew have been identified from their Rf values. Three ninhydrin spots have not been identified. At least 5 amino acids were found in the honeydew which were not found in the food source. The carbohydrate components identified by different sprays and radiograms of radioactive honeydew were fructose, glucose, sucrose, glucose-1-phosphate, and possibly malonic, malic acid, citric acid, and salts of citric acid were also found.


Fructose diphosphate, glucose-1-phosphate, glucose-6-phosphate, and fructose-6-phosphate passed from the intestine to the muscle in rates which decreased in the above order, 14C-labelled compounds were used. (BA 25: 26759, 1951).


Newly emerged adults of Proscopala malagashri are known to be low in glycogen. When ample food is available the glycogen content increases rapidly in the first few days. Unfed adults less than 24 h old were exposed to an atmosphere containing C14O2. Experimental details are given, and of the steps taken to identify the radioactive carbohydrate obtained as glycogen. The mechanism of labelling and the positions occupied by the C14 (preumably random) were not investigated.

Noutereva and Rellius 1963 - [36]


The study was aimed at finding the conditions under which the uncoupling agents provoke increased metabolic rates and at determining the resultant changes in carbohydrate and phosphate metabolism. Periplaneta americana was used. Stimulation of glycolysis was observed, and two independent regulatory reactions appear to take place resulting from dinitrophenol. Attention is focused on phosphate metabolism. A special technique is cited for studying it in intact muscle preparations. The animals were injected with FM-labelled fringer solution and left for 4 or more days to ensure equal labelling in all P compounds. Subsequent steps consisted of freezing and pulverizing in liquid air, separation of individual P compounds by paper chromatography and estimating the activity preferably after elution from individual parts of the paper after autoradiography. The changes in phosphate compounds after application of 2,4-dinitrophenol are very profound. Within 20 mins of injecting 10-3 M dinitrophenol there is a pronounced decrease in high energy phosphate compounds, accompanied by an increase in aromatic phosphate. The change in ADP is small. The ATP/ADP ratio shifts in favour of ADP, with a simultaneous increase in α-glycerophosphate. Tentative explanations of the mechanism of dinitrophenol action on muscle are offered.


The absorption of glucose from the gut of the cockroach, Periplaneta americana, was studied by feeding starved insects with C14-labelled glucose together with a dye, Amanost. This dye is not absorbed from the lumen of the intestine, and the net percentage glucose absorption was calculated from the glucose/dye ratio in various parts of the intestine and the relative rate of crop emptying, which is determined from the amount of fluid leaving the crop by the osmotic pressure of the fluid in the crop. The results suggest crop emptying, suggesting that crop emptying, suggesting that crop

Treheme, J.E. FACILITATED LOCUST, SCHISTOCERCA GREGARIA. Preliminary account of investigations at low concentrations. The uptake activity of labelled glucose in locusts in that in the gut lumen. The results initially containing no radioactive glucose.

Treheme, J.E. THE ABSORPTION OF SCHISTOCERCA GREGARIA. The absorption of glucose was tested with a mixture of glucose together with a dye. Amanost was calculated from the glucose/dye ratio absorbed from the mid-gut cecum at concentrations of 0.002 and rapidly converted to trehalose. Isolated and concentrated and the excess glucose suspended in saline containing is apparently absorbed by diffusion to trehalose in the hemolymph.

Treheme, J.E. THE ABSORPTION OF SCHISTOCERCA GREGARIA (ORSK.). J. exp. Biol. The uptake of C14-labelled glucose absorbed by the ceca depended on the gut wall. The uptake by diffusion across the gut wall varied with the small amount of glucose in the cytoplasm.

Treheme, J.E. THE DIGESTION OF SCHISTOCERCA GREGARIA. A partial hydrolysis of CM-labeled glucose could be demonstrated. A rapid increase in the ceca and the anterior part of the gut wall was the limiting factor.

Treheme, J.E. THE NUTRITION OF SCHISTOCERCA GREGARIA. A rapid influx from the hemolymph abdominal nerve cord. The nervous system of the insect, and represent circumventricular nervous system of this insect.
ratio in various parts of the intestine. Glucose absorption is largely confined to the mid-gut ceca. The rate of crop emptying, which is an exponential function of time, is related to glucose concentration, so that the amount of fluid leaving the crop decreases with increasing concentration. This effect is determined by the osmotic pressure of the ingested fluid. Total glucose absorption shows a linear relation with crop emptying, suggesting that crop emptying is the limiting process in glucose absorption. (from CA 52: 4046e, 1958)


Preliminary account of investigation into the movement of glucose between the gut and the hemolymph at low concentrations. The uptake of C14-labelled glucose was studied under conditions in which the specific activity of labelled glucose in the hemolymph, where it is in equilibrium with trehalose approximated that in the gut lumen. The results were compared with those for the uptake of labelled glucose by insects initially containing no radioactive material in the hemolymph.


The absorption of glucose was studied by filling the gut with a saline solution containing C14-labelled glucose together with a dye, Amaranth, which was used as a marker. The net percentage absorption was calculated from the glucose/dye ratio in various parts of the alimentary canal. Most of the glucose was absorbed from the mid-gut ceca, lesser amounts by the ventriculus. The percentage absorption was similar at concentrations of 0.002 and 0.02 M, but was significantly less at 0.2 M. The absorbed glucose was rapidly converted to trehalose in the hemolymph. At the high concentration this mechanism became saturated and the excess glucose accumulated in the hemolymph. The absorption in vitro from a gut suspended in saline containing KCN and lactic acid was similar to that in the intact insect. Glucose is apparently absorbed by diffusion across the gut wall and this process is facilitated by rapid conversion to trehalose in the hemolymph, which tends to maintain a steep concentration gradient across the gut wall. (CA 52: 20705e, 1958)


The uptake of C14-labelled glucose, mannose, and fructose was confined to the mid-gut, the proportion absorbed by the ceca depending on the type of sugar and its concentration in the gut lumen. The absorbed sugars were incorporated into trehalose, which accumulated in the hemolymph. The extent of this conversion paralleled the rate of absorption of these sugars. It is suggested that the sugars are absorbed by diffusion across the gut wall, this process being facilitated by the rapid conversion to trehalose. At very low concentrations in the gut lumen much of the uptake of labelled glucose occurred as a result of exchange with the small amount of glucose in equilibrium with the trehalose in the hemolymph. (auth.)


A partial hydrolysis of C14-labelled tripalmitin was demonstrated in the crop of this insect. No significant absorption could be demonstrated in the crop, whether the tripalmitin was suspended in an experimental fluid or dissolved in emulsified oleic acid. Absorption occurred in the mid-gut and was largely confined to the mid-gut. A rapid absorption of tripalmitin showed a linear relation with crop emptying. Apparently the rate at which the material left the crop, rather than the uptake in the mid-gut, was the limiting factor in absorption. (auth.)


A rapid influx from the hemolymph of C14-labelled trehalose and glucose has been demonstrated in the intact abdominal nerve cord. Approximately half of the absorbed C14 was incorporated as glutamic acid and glutamine in the nervous tissue. Smaller amounts of glycogen, trehalose, glucose, aspartic acid and occasional traces of alanine were also found. These results demonstrate a linkage of carbohydrate and amino acid metabolism and represent circumstantial evidence for the presence of the triketacloxylic acid cycle enzymes in the central nervous system of this insect. (BA 36: 7813, 1960.


Ameisen was studied by feeding with malt. This dye is not absorbed from solution and was calculated from the glucose/dye ratio in various parts of the intestine. Glucose absorption is largely confined to the mid-gut ceca. The rate of crop emptying, which is an exponential function of time, is related to glucose concentration, so that the amount of fluid leaving the crop decreases with increasing concentration. This effect is determined by the osmotic pressure of the ingested fluid. Total glucose absorption shows a linear relation with crop emptying, suggesting that crop emptying is the limiting process in glucose absorption. (from CA 52: 4046e, 1958)


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The uptake of C14-labelled glucose, mannose, and fructose was confined to the mid-gut, the proportion absorbed by the ceca depending on the type of sugar and its concentration in the gut lumen. The absorbed sugars were converted, in varying degrees, to trehalose which accumulated in the hemolymph. The extent of this conversion paralleled the rate of absorption of these sugars. It is suggested that the sugars are absorbed by diffusion across the gut wall, this process being facilitated by the rapid conversion to trehalose. At very low concentrations in the gut lumen much of the uptake of labelled glucose occurred as a result of exchange with the small amount of glucose in equilibrium with the trehalose in the hemolymph. (auth.)


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An adequate exchange of nutritive materials between the hemolymph and the central nervous system across the peristomia must take place. In order to study this function the exchange and metabolism of some C-4 labelled sugars in the abdominal nerve cord (n.c.) of P. americana, C-4 labelled glucose solution was injected into the hemolymph. Graphs illustrate the rate of conversion to trehalose as it accumulated in the hemolymph, compared with the entry of radioactivity into the n.c. expressed as the ratio: activity in n.c./activity in hemolymph. Approximately 7 molecules of trehalose may be estimated to pass into the n.c. for every molecule of glucose. Since the trehalose molecules are, however, 17 times more concentrated than those of glucose, individual glucose molecules were therefore passing into the n.c. at approximately 3.8 times the rate of the disaccharide molecules. The metabolism of the sugar within the CNS was followed by separating the extracts of radioactive n.c. on paper chromatograms. At least 7 peaks of radioactivity were found (trehalose, glucose, glyoxygen, aspartic acid, glutamic acid, glutamine and alanine). Their proportions are tabulated, and the significance of the findings discussed.


Time-course studies on the utilization by intact cockroaches (Periplaneta americana) of glucose-C-14 were carried out. Radioactive assay of the respiratory C02 samples provided confirmatory evidence for the operation of glycolysis and a direct oxidative pathway for the primary breakdown of glucose in this species. It was found that in intact male adult cockroaches, glucose is catalysed by way of the direct oxidative pathway to an extent of only 4-9%, and the bulk of glucose is carboxylated via the Embden-Meyerhof-Parnas glycolytic pathway. The latter, in conjunction with tricarboxylic acid cycle processes, is probably responsible for the respiratory activity and biosynthetic functions in this insect. It is possible that the observed small amount of activity of the direct oxidative pathway is primarily for the purpose of pentose production.

(CA 59: 29697c, 1963)


Uniformly labelled C-14 sucrose, radioactive carbon dioxide (C-14O2) and also various glycolyotic inhibitors (NaF and CrClCOO) were employed in order to investigate the transformation of carbohydrates in the cavity fluid of the silkworm during metamorphosis. Oxidation of sugar in the cavity fluid could be shown to produce phosphoric esters and organic acids. The presence of radioactive in malic, fumaric and succinic acids when labelled sugar is administered in the cavity fluid shows that conversion of pyruvic acid is essentially linked with its role in dicarboxylic acid synthesis by means of carboxylation. Synthesis of tricarboxylic acids, and in particular citric acid, is insignificant. The latter is formed chiefly, not from carbohydrates, but as a result of carboxylation of organic acids, probably decomposition products of fats. This fact strongly suggests that in the cavity fluid anaerobic oxidation of carbohydrates is the predominant process. Sucrose introduced in the cavity fluid may be subjected not only to oxidative transformation, but may be used in the synthesis of a complex, unidentified high-molecular weight phosphors compound. On suppression of glycolyotic this method of transformation predominates. Study of carbohydrate transformation during metamorphosis showed that hynolysis substantially reduces the capacity of the cavity fluid to synthesise phosphoric esters and organic acids from the introduced sugar, while, in the course of histogenesis and differentiation, this capacity is restored.

The abstract is essentially that of the paper given at the "All-Union Conference on the Application of Radioactive and Stable Isopes and Radiation in the National Economy and Science" (Session: Biology, Medicine and Agriculture) Moscow, 2-5 April 1957. Eng. transl. p.152, Consultants Bureau, Inc.


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Results of experiments with C-14 labelled Bombyx mori underwent a considerable formation of phosphate ester during the period of histolysis into the body cavity. Incorporation of organic substance of the labelled sugar, the specific content within the body cavity of B. mori which resulted in the product of dicarboxylic acids by way of the citric acid cycle, involved (CA 58: 20588h, 1959)

155 Winteringham et al., 1955 -

Winteringham 1956 - [156]


Possible differences in basal metabolism in the light of recent work. The energy of the tissues and that trehalose is high in the tissues. Data on the metabolism in vitro are tabulated, showing that different tissues (muscle) after different treatments may have a different energy level and the failure to find significant differences in the growth of [2-C-14]acetate even in vivo is shown. The rapid incorporation of C-14 into organic substances, even in the high concentrations of free C-14, is readily available and being trapped as glutamine.


The labelled pool technique for the study of these compounds is represented by the fact that the radioactive sugars or other compounds recovered from the

For detailed abst., see "Nature of carbohydrate conversion in the cavity fluid of mulberry silkworm (Bombyx mori) in the metamorphosis period". p. 152 in Abstracts of papers given at the "All-Union Conference on the Application of Radioactive and Stable Isotopes and Radiation in the National Economy and Science. (Session: Biology, Medicine and Agriculture), Moscow 2-5 Apr. 1957". ASC-74909(III). New York, Consultants Bureau, Inc. 1957 (English translation)


Results of experiments with C14-labelled sucrose showed that the carbohydrates in the body cavity fluids of Bombyx mori underwent a continuous change during the period of metamorphosis with an accompanying formation of phosphate esters and organic acids. The rate of such conversion of carbohydrates, especially during the period of histolysis and rose again during the period of histogenesis and differentiation. The injection into the body cavity of glycolytic poisons hampered the process of phosphate ester synthesis and the formation of organic substances from the carbohydrates. After 1 h after the injection into the body cavity of the labelled sugar, the specific activity became concentrated in malic, fumaric, and malic acids. Within the body cavity of B. mori anaerobic oxidation of carbohydrates and their conversion predominated which resulted in the production of pyruvic acid: such processes seem to be associated with the synthesis of deacetyl acids by way of deacetylation; in the case of tricarboxylic acid synthesis, and particularly in citric acid formation, the process is considerably depressed.

(CA 59: 208891, 1959)

* Winteringham et al. 1955 - [311]

* Winteringham 1956 - [166]


Possible differences in basal metabolism between insects and vertebrates have been critically examined in the light of recent work. There is evidence that trehalose plays the part of mammalian glucose in insect tissues and that trehalose is broken down glycolytically as far as pyruvate and then to acetate in vertebrate tissues. Data on the metabolism of uniformly labelled (C14) glucose by the adult housefly. Musca domestica, in vivo are tabulated, showing the distribution of total soluble C14-recovered from thoracic tissues (flight muscle) after different treatments. There is evidence that lactic acid production is significantly greater in insect flight muscle even under anaerobic conditions. The reported accumulation of α-glycophosphatase and the failure to find significant lactic acid formation under conditions of anoxia are discussed. Experiments on the fate of [2-C14] acetate injected intrathoracically into adult M. domestica showed that there was a rapid incorporation of C14 into the free amino acids. This and other results suggest that the significance of the high concentrations of free glutamate (and free amino acids) in insect tissues may lie in their providing a soluble and readily available substrate reserve for the Kreb's tricarboxylic acid cycle, liberated ammonia being trapped as glutamine.

* Winteringham, F.P.W. PRESENCE AND SIGNIFICANCE OF α-GLYCOPHOSPHATASE IN INSECT TISSUE. Biochem. J. 113 (1959) 21 P.

The labelled pool technique has been used to determine the relative concentrations of the principal soluble phosphorus compounds in the adult housefly. One fraction, which was resistant to acid hydrolysis and which represented some 20% of the total acid-soluble phosphorus of the thoracic tissues, was tentatively identified as phosphoglyceric acid by paper chromatography with the 'authentic' compound but there was an element of doubt because the latter was not chromatographically pure (Winteringham, Bridges and Hellyer, 1955). The possible importance of α-glycophosphatase in insect metabolism prompted a re-examination of the compound recovered from the housefly. The insect compound which had been labelled with P32 in vivo
was separated from all the known compounds except \( \alpha \)-glyceroephosphate on paper chromatograms. Added \( \alpha \)-glyceroephosphate co-chromatographed exactly with the insect compound in all the systems tried. The implications of these results are discussed briefly.

**I-B-2 PROTEINS AND AMINO ACIDS**


Available information on general biochemical reactions undergone by amino acids is divided into data on degradation, transamination, deamination, and protein metabolism. Radioisotopes have been used in work on transaminations in connection with the silkworm, Bombyx mori (references cited). The author describes work on tritographic nitrogen metabolism where pyruvic oxide-2-C\(^4\) and pyravate-2-C\(^4\) were either injected or fed, in order to study (1) C\(^4\)-activity in the blood following injection of either; (2) C\(^4\)-incorporation into gut and "body" proteins after injection; (3) respired C\(^3\)O\(_2\) after injection; (4) C\(^4\)-activity of faecal pellets excreted after feeding either substance; (5) identification by chromatography of the excreted end products following such radioactive feeding. The results revealed that pyruvic oxide-2-C\(^4\) is removed from the blood at a faster rate than pyruvate-2-C\(^4\). Contrary to the first, the latter is incorporated into the "body" and gut proteins. It further appears to enter the tricarboxylic acid cycle and is rapidly metabolized to C\(^3\)O\(_2\), whereas the labelled oxime is not metabolized in such a way but rapidly excreted in the excreta as oxime-2-C\(^4\). It is suggested that the conversion of oximes into amino compounds is of little, if any, importance in the silkworm. Radiotracers are cited in work on peptide and protein synthesis.


C\(^14\)-labelled phenylalanine was used to demonstrate that carboxyl phenylalanine was not utilised for the synthesis of alanine. The technique used for labelling the compound is indicated; the silkworms were injected when they had already stopped eating and their silk glands were swollen prior to spinning their cocoons. Fibroin was isolated from the cocoons, and the tyrosine, glycine and alanine isolated. Only the purified tyrosine was found to be radioactive (not due to contamination by the labelled phenylalanine). Results indicate that phenylalanine is converted to tyrosine by the silkworm to a fairly direct process, since radiocactivity was exclusively localized in the carboxyl group of the injected phenylalanine and the isolated tyrosine. About 15% of the injected phenylalanine radioactivity was found in the tyrosine of the silk fibroin. On the other hand, the carboxyl carbon of phenylalanine is not utilised for the synthesis of alanine or glycine of the silk of B. mori.


Pour déterminer le sort de la glycine poudrée par la glande pour la synthèse de la soie, les auteurs ont injecté de la glycine-1-\(^14\)C, dans l'hémolymphome de vers à soie au début du filage ("moulinée"). Un quart de l'activité totale injectée a été retrouvée dans la fibroïde du cocoon. Cette activité se répartit, dans l'ordre des activités spécifiques décroissantes, entre la glycine, la sérose et l'alaminie. La tyrosine n'a incorporé aucune activité.


When fasting and ready to spin their cocoons, the silkworms were each injected with 112 \( \mu \)g (2.1 \( \mu \)C) of glycine-1-C\(^4\). One quarter of the total activity injected appeared in silk fibroin. The injected glycine was found diluted about 1000-fold, which was most probably not uniformly labelled. Direct conversion of glycine to serine keeping the label in the C-1 position occurs in the silkworm. Glycine is also converted to alanine, possibly through serine and pyruvic acid, but in any case introducing the C-1 of glycine exclusively into the carboxyl group of alanine. Tyrosine did not incorporate any radioactivity from glycine-C\(^4\): the phenylalanine-tyrosine pair would appear to be essential to the silkworm.

amino acids is divided into data on
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THE CARBOXYL CARBON OF

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indicated: the silkworms were in-

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LE MÉTABOLISME DE LA GLYCINE


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l'amine. La tyrosine n'a incorporé

THE CARBOXYL GROUP OF GLYCINE

2, \( C_{-4}^{14} \) Nature 182 (1958) 1515.

\( C_{-3}^{14} \), \( C_{-4}^{14} \).

\( C_{-3}^{14} \) was injected with 112 mg (2.1 \( C_{-3}^{14} \) of

fibroin. The injected glycine

only labelled. Direct conversion of

Glycine is also converted

reducing the C-1 of glycine ex-

any radioactivity from glycine-\( C_{-3}^{14} \):


Just prior to spinning their cocoons, each of 20 silkworms was injected with 1.7 mg (25 \( C_{-3}^{14} \) of formate. The isolated glycine was decarboxylated; C-1 was isolated asium carbonate and C-2 as formic

acid. Their specific activities are tabulated. The degradation procedure was checked on synthetic glycine-C-1 \( C_{-3}^{14} \) and glycine-C-2 \( C_{-4}^{14} \). Formate carbon may be concluded to be utilized for the synthesis of glycine C-1 and C-2 in B. mori. 1.5% of the injected radioactivity appeared in the fibroin glycine, while 0.5% was found in fibroin serine which had a specific activity 6 times greater than glycine. Various possible biochemical pathways are postulated.


Del 

\( C_{-3}^{14} \) formate was injected into each larva of Bombyx mori at the 5e stage, just after the début du filage. The fibroin of the sole of the leg was hydrolyzed and the glycine was isolated and purified. The glycine was ensuite dégradée par la ninyamine, le C-1 isolé sous forme de carbonate de baryum et le C-2 sous forme de formaldiméthone. La formaldiméthone et la glycine ont été brütées et transformées en carbonate de baryum avant les mesures de radioactivité. Les procédés de dégradation ont été vérifiés au moyen de glycine-1 \( C_{-3}^{14} \) et de glycine-2 \( C_{-4}^{14} \). L'activité spécifique de la glycine isolée était répartie pour les 2/3 dans le C-1 et pour 1/3 dans le C-2. (Note entière)


Five-tenths \( C_{-3}^{14} \) of Na pyruvate-C-1 \( C_{-3}^{14} \), Na pyruvate-C-2 \( C_{-4}^{14} \), or Na pyruvate-C-3 \( C_{-3}^{14} \) were given per os to 3 groups of about 20 silkworms in the stage of development in which fibroin synthesis begins in the silk gland. The fibroin isolated from the cocoons of each group was hydrolyzed with HCl, the acid was removed by evaporation and the amino acids were adsorbed on Dowex 50. The adsorbate was eluted with 3N \( \text{NH}_{4} \text{OH} \), the eluate was evaporated, and the tyrosine ppt. removed. Glycine, alanine, and serine were isolated as salts of nitrornaphthalenesulfonic acid, azobenzene-4-sulfonic acid, and 4'-hydroxyazobenzene-4-sulfonic acid, resp. The sulfonates were then placed on a column of Dowex 50 and the amino acids eluted with 3N \( \text{NH}_{4} \text{OH} \). When the silkworms had been fed with the labeled pyruvate, the radioactivity was found exclusively in C-1 of these amino acids. When II had been fed, the radioactivity was equally distributed in C-1 and C-2 of glycine and in C-1, C-2, and C-3 of serine: alanine was mostly labelled in C-3. If III had been given, the activity was highest in C-2 of glycine and in C-3 of serine and alanine. Of the ingested pyruvate 7-10% was converted into the alanine of the silk fibroin and smaller amounts into glycine and serine. (CA 54: 14485d, 1960)


\( L-\)Phenylalanine \( C_{-3}^{14} \) in the carboxyl group was prepared from glycine-C-1 \( C_{-3}^{14} \) by modification of the method of Bergmann et al. (CA 21: 61). Ten silkworms in the stage in which the silk production begins were anesthetized with Et\(_{2}\)O and injected with 0.5 mg (0.078 \( C_{-3}^{14} \) of \( L-\)phenylalanine. Silk fibroin was prepared 6 days later. The glycine, alanine, and serine isolated from the fibroin hydrolysate did not contain \( C_{-3}^{14} \); the tyrosine contained \( C_{-3}^{14} \) exclusively in the carboxyl group. About 17% of the injected \( C_{-3}^{14} \) was transformed into silk tyrosine. (CA 54: 14482g, 1960)


Une fraction très importante de l'activité injectée à des vers de soie (des larves de Bombyx mori au 5e âge, juste avant le début du filage) sous forme de \( \text{H}^{3} \text{C}-\text{glycine} \) a été retrouvée dans la glycine, la séline et l'alanine de fibroine de la soie. Après injection de glycine-C-1 \( C_{-3}^{14} \), le radioisotope apparaît uniquement dans la 1\( \text{e} \) carboxylé de la glycine, de l'alanine et de la séline de la fibroine. Après injection de glycine-C-2 \( C_{-4}^{14} \), le radioisotope apparaît principalement dans le C-3 des acides aminés, mais aussi dans tous leurs autres carbone. Les voies métaboliques utilisant la glycine, la séline et l'alanine chez B. mori sont discutées à la lumière de ces observations.

During DDT posttreatment, the free proline in the blood and central nervous cord is selectively depleted to about 1/4 the normal level. By using C14-labelled proline it was found that proline was depleted, there was a corresponding rise in C14-labelled glutamine, if the temperature was raised so that the roach recovered, the proline and glutamine contents were restored to a normal level.


Glutathione concentration was measured in pupae, pupae and newly emerged susceptible and DDT-resistant houseflies through larvae with C14-labelled N-glutamyl alanilimide. Free glutathione in both strains followed the same general pattern, no over-all differences being noted. During the pupal period the glutathione concentration decreased during the first two days, showed a relative increase on the 3rd, and fell to a low level on the 4th day. The newly emerged adult had a higher level of glutathione than any other stage studied. Measured amounts of C14-labelled cysteine were injected into DDT-resistant and susceptible flies. At timed intervals the flies were killed and the glutathione was coupled with N-glutamyl alanilimide and isolated chromato- graphically for radioactivity of C14. Susceptible flies appeared to incorporate injected cysteine into glutathione and to metabolize the newly synthesized glutathione more rapidly than did resistant flies. (auth.)


Medicine-S35 (I) was injected into the hemolymph on the basis of 10,000 cpm/g. After a definite time the protein were separated from the hemolymph, fatty material, muscle, intestinal lining, and other organs, and the amount of S35 detected. In the larvae an increase in the intensity of protein metabolism was observed up to the middle of the 5th larval stage. The maximum incorporation of S35 occurred on the 12th-13th day; a decrease was noticed on the 19th-20th day. As to the individual tissues, the largest amount of S35 was incorporated in the hemolymph during the second half. At the end of the larval stage the intestinal walls possessed the least intensity of protein metabolism. A high metabolic rate from the very beginning of the 5th stage was noted in the walls of the silk-forming gland. In spinning of the cocoon, the incorporation of S35 was on a low level and the synthesis of protein in the organism of the silkworm almost stopped, when silk appeared. After the end of silk formation, an increase in protein metabolism was noted. A gradual increase in the S35 incorporation occurred during the 1st-2nd day of development of the summer pupal stage with a maximum after 48 h. The most intense protein metabolism during the pupal stage occurred in the fatty material, and then in the hemolymph. Protein metabolism, especially in the muscles, varied with sex. No I was incorporated into the proteins of dead cocoons. Hence, the radioactivity of the proteins separated from live organisms was not the result of absorption of I, but was caused by the incorporation of I into the protein molecules. (CA 47: 4005c, 1955)


Pyruvic oxime-2-14C and pyruvate-2-14C were injected into larvae. The label in pyruvate-2-14C is incorporated into the gut and body proteins, but the small amount of activity found in protein following injection of pyruvic oxime-2-14C is of a much lower order. The amount of C14CO2 expired is also negligible. Chromatographic analysis of aqueous extracts of fecal pellets following injection or feeding indicates that pyruvic oxime-2-14C is rapidly excreted unchanged and is not converted to pyruvate-2-14C. The results suggest that transaminase and oximase, if they are present, are of little importance in the protein and carbohydrate metabolism of the silkworm.


The incorporation of C14-labelled glycine into tissue proteins of injected silkworm larva was studied, and depends on the stage of development of the larvae. The rate is low during the 4th molt and increases progressively through the 5th larval instar. Just before spinning the rate of incorporation is again low. Incorporation in vitro into silk-gland minces is an aerobic process depending upon the presence of bivalent ions. It is enhanced by the addition of intermediates of the tricarboxylic acid cycle, particularly by malate, citrate, succinate, fumarate and α-glycerophosphate. A pH 6 extract was prepared by precipitating at pH 5.1 an ultrafiltrate of bref oil obtained from the precipitate at pH 7.8. Incubation by Mg ions and either adenosine phenylalanine and glutamate a 3 amino acids are incorporated into the silk protein. A purified preparation no longer involved in activation and transport of glutamate with free glutathione. (auth.)


A section is devoted to the amino acid components of tissue where extensive use has already been taken of the amino acid taken up by the tissue. In the silk after injection of glutamic acid the hemolymph has been found (Betaurosine and alanine of the silk, norepinephrine and metanephrine are most discussed.

172 Fukuda, T. A STUDY OF SILK, the 1st Japan Conference on Research in Japan). The biosynthesis of C14-labeled paper chromatography and alkaline paper chromatography. The degree to which 4 is radioactive alanine-2 and glutamate of the findings is discussed.


After the injection of phenylalanine an amount of 0.5 μg/larva, 0.1476 and 4531 cpm/100 μg of exclusively high activity (4140-0.15NH4 mixture (85:10), washed with a SC-16 gas flow device (25)).


C14-labeled phenylalanine was injected into the silkworms 0.5 μg of radioactive phenylalanine. The 4th day of the 6th instar. The 6th instar isolated from the tissues of the silkworm. The synthesis of tyrosine from phenylalanine for biosynthesis of the silk protein.

175 Fukuda, T. CONVERSION OF C14-LABELED PHENTYLALANINE. Japan 75 (1966) 245.

A solution prepared from silk glands is used, and fat tissues, was used.

54
ultracentrifugate of hemolymph has been purified 20-fold by ammonium sulfate precipitation of the pH 5 extract. The purified preparation no longer incorporates C\textsuperscript{14}-labelled glycine, which indicates that separate enzymes are involved in activation and incorporation.

171


A section is devoted to the aminoacidemia of Bombyx mori. The author discusses aminoacidemia and amino acid composition of tissues, and the free amino acids taken up by the silk-gland from the hemolymph, whose existence has already been made of C\textsuperscript{14}-labeling (cf. Fukuda 1955, 1956, 1959). The fate of the amino acid taken up by the gland from the hemolymph has also been traced. Radioactive serine is found in the silk after injection of glycine-1-C\textsuperscript{14} (Fukuda 1956); the activity of glycine-1-C\textsuperscript{14} injected into the hemolymph has been found (Breziers-Grégoire 1957) in decreasing order of specific activities in the glycine, serine and alanine of the silk. Changes in the pattern of aminoacidemia during the development of Bombyx mori are discussed.

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(In Japanese)

The biosynthesis of C\textsuperscript{14}-labelled phenylalanine into tyrosine in the silkworm was confirmed by means of paper chromatography and autoradiography. C\textsuperscript{14}-labelled glycine was found to be converted into serine. The degree to which 4 radioactively labelled amino acids (glycine-2-C\textsuperscript{14}, DL-alanine-1-C\textsuperscript{14}, L-phenyl alanine-2-C\textsuperscript{14} and glutamic acid-1-C\textsuperscript{14}) were incorporated into silk protein was shown. The significance of the findings is discussed.

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After the injection of phenylalanine-2-C\textsuperscript{14} to silk worm (51,122 x Nihon 122) on the 4th day at 4th instar in an amount of 0.5 μmole, the specific radioactivities of serine in the coconuts were 1407 and 4531 cpm/100 mg, respectively. Among amino acids composing fibroin, tyrosine possessed exclusively high activity (41,147 cpm/μmole). This was also proved by paper chromatography with a phenol-1.0% NH\textsubscript{4}OH mixture (55:15), which was followed by radioautogram as well as by radioactivity estimation with a 5C16 gas flow windowless counter. (RA 51: 3767, 1957)

174


C\textsuperscript{14}-labelled phenylalanine was used in a study to determine whether phenylalanine is a precursor of tyrosine. 0.5 μm of radioactive phenylalanine per worm was injected into the body cavity of the silkworms, on the 4th day of the 5th instar. The techniques are described. On examining the radioactivities of the amino acids isolated from fibroin almost all the activity was found to be located in tyrosine. Analysis of isolated tyrosine by paper chromatography and radioautography gave results which suggest that the tyrosine is labelled with C\textsuperscript{14}+. The synthesis of tyrosine from phenylalanine in vivo was confirmed, as was its subsequent utilization for biosynthesis of the silkworm proteins.

175

Fukuda, T. CONVERSION OF PYRUVIC ACID TO ALANINE IN THE SILK WORM LARVA. Nature 182 (1957) 945.

A solution prepared from silkworm larva by homogenization and freezing of the silk-glands, the alimentary canals, and fat tissues, was used as an enzyme preparation. To 1 ml of the enzyme solution was added 0.5 ml...
of 0.1 M L-glutamic acid, 0.5 ml of 1 M Na pyruvate, and 0.1 ml of M/10 phosphate buffer, pH 7.4, containing 0.1 μc of Na pyruvate-2-C14, and the mixture was incubated for 60 min at 30°C. Analysis by paper chromatography resulted in 5 spots, one of which was alanine (Rf 0.42) in which most of the radioactivity was concentrated, and another spot for the remaining glutamic acid. This indicated the conversion of pyruvic acid to alanine, an important constituent of the silk protein. (CA 51: 16968g, 1957)


After the peroral administration of 17.5 μc of Na pyruvate-2-C14 (500 mcg) per silkworm (Bombbyx mori, Nichi 125 x 116 strain) per day for 3 days from the 4th day of the 5th instar, the C14-incorporation into cocoon fibre (I) amounted to 3463 counts/min/100 mg of specific activity. The C14-distribution in alanine (II) molecule isolated from I is determined as follows: COOH-C 5, α-C 80, 6-C 2 counts/min/μg. With the enzyme solution prepared by homogenizing the tissues with M/10 phosphate buffer of pH 7.4, freezing-thawing, and centrifuging off the insoluble protein, successively, the production of C14-II occurs by posterior division of silk gland, alimentary canal, muscle plus fat tissue preparations in the presence of L-glutamic (III) or L-aspartic acid (IV). The transaminase activity of silk gland to convert pyruvic acid into II is markedly high when III, or to a less extent, IV is used as NH2-donor. (CA 51: 18971b, 1957)


Silkworms of the European race of B. mori were given 0.5 μc of L-alanine-C14 from the 1st to the 12th day of the 5th stage. Alanine is a major constituent of the fibroin of silk and presumably is transferred from the hemolymph to the silk gland while fibroin synthesis is in progress. Thread from the cocoons was unwound, digested by boiling in a 0.02 M solution of Na2CO3, washed with ECH, Et2O, dried, and laid out in horizontal segments. Autoradiographs of the thread samples showed that a relation existed between C14 in the hemolymph and the different segments of the silk thread spun by the animals. (CA 54: 14482a, 1960)


B. mori was fed 1 μc of glycine-2-C14. Radiographs of degummed and dried slices of isolated frozen silk glands showed that high radioactivity appeared in a definite section of the fibroin molecules stored in the reservoir of the middle portion of the gland. The macromolecules of fibroserevin synthesized in the posterior division of the silk gland were stored in order of their synthesis. (CA 54: 14482b, 1960)


To further test the hypothesis that macromolecules of fibroin move in an ordered fashion in the reservoir of the silk glands of B. mori, 1 μc of glycine-2-C14 was fed to silkworms of the European race on the 8th day of the 5th instar. Autoradiographs were taken of sliced silk glands and the results showed that the fibroin synthesized at different periods was deposited in the reservoir in order of succession and appeared in the fibroin of the silk thread in this order. (CA 54: 14483c, 1960)


Oral administration of uniformly C14-labelled serine to Bombyx mori at the 5th instar resulted in glycine-C14-rich cocoon (silk fibroin) in the posterior silk gland. Alanine in the isolated cocoon was slightly labelled by C14. Glycine had approximately equal C14 at C-1 and C-2. (CA 54: 23078, 1960)


Following oral administration of glycine-1-C14 and -2-C14 to silkworm the serine residue of fibroin and serin was labelled in the carboxyl (C-1) and side chain (C-2 and C-3), respectively. At the same time glycolytic acid in body fluid was highly labelled. The following reactions are suggested for in vivo synthesis of serine: glycine + glyoxylate → HCHO + CO2 + glycine + HCHO = serine. (CA 54: 230781, 1960)


After oral administration of ornithine compounds by paper chromatography enriched with C14, Oxalectin incorporation. (CA 55: 4774, 1961)

183 Fukuda, T. BIOCHEMICAL STUDIES ON INDIRECT FORMATION OF SILK PROTEIN. J. Biochem., Soc. Japan 54 (1980) 700-1000 m of silk unwound from 7th and 8th day, respectively. Thread was isolated at the last part (700-1200 m) (CA 55: 5678, 1980)


After oral administration of glucose-1C4 to the silkworm, l- and d-keto acids were separated as the dimethylphenyl compounds by paper chromatography, and analysed for radioactivity. $\alpha$-Ketoglutaric acid was most highly enriched with C4. Oxalacetic acid was labelled considerably, but glyoxylic acid was almost free of C4 incorporation. (CA 55: 4799e, 1966)


The distribution of C4 was studied in the silk produced by the silkworm fed 1 cm2 of radioactive mulberry leaf or some radioactive amino acids on the different days of the 5th instar. The late 1st, 2nd-4th, and 5th day of silk un wound from a cocoon was mainly from the amino acids taken on the 4th, 6th, and 8th day, respectively. The radioactivity taken on the 1st through 3rd day appeared at the very beginning and at the last part (700-1200 mg) of the silk. (CA 55: 894c, 1961)


The movement of fibrin in the silk gland of the 5th instar silkworm was studied by using glycine-C4 as the tracer. Fibrin was synthesized in the posterior division of the gland, and toward the middle and anterior divisions. (CA 55: 894e, 1961)


Biochemical Studies on the Formation of the Silk Protein. XIII. The Correlation between the Mulberry Leaves Taken by the Silkworm, the Silk Protein in the Silk Gland and the Silk Filament. Bull. sericul. Exp. Sta., Japan 19 (1960) 595-610. (In Japanese, summary in English)


L'utilisation de tyrosine et de tryptophane marqués de $^{14}C$ a permis l'étude des pigments de la cuticule et de l'hypoderme de Gryllus bimaculatus; les granules hypodermiques sont pu être identifiés aux "ommochones" dérivés du tryptophane. (88 20-28478, 1969)

Preliminary to field studies of Dermacentor variabilis, a consideration of various techniques was undertaken for the internal labelling of adult female ticks, the goal being to pass to the operating degree of radioactivity. Female ticks were administered the tracer through a glass capillary tube which was inserted up the hypostome and chelicerae (after the techniques of Chabaud and of Bergfors). The tube was calibrated to accept 0.01 ml of glycine, which contained 0.5 μc of $^{14}C$ Each tick after imbibing the radioactive glycine was allowed to finish engaging on laboratory rabbits. Eggs and resulting larvae were found to be radioactive although there was a decrease of approximately 5% in the activity between egg and larva. Preliminary results indicate that there is no reduction in the egg laying capacity of the females, nor is there a decrease in the hatchability of the radioactive eggs. The effects of $^{14}C$ on the remainder of the life cycle have not been investigated.


The nutritional requirement of the larva of the rice stem borer, Chilo suppressalis Walker, was studied by synthetic media under aseptic conditions. Amino acids and vitamins required by the larva have been reported in the previous paper. Tyrosine, one of the non-essential amino acids, is derived from other compounds in the larval body, but the course of metabolism is still unknown. In the present experiment, biosynthesis of tyrosine was studied by using $^{14}C$-labelled-phenylalanine. The radioactive tyrosine was detected by radioactive analysis in the larvae which were reared with a tyrosine-free synthetic diet containing the labelled phenylalanine. Phenylalanine is converted to tyrosine, and not to alanine during the course of metabolism. (auth.)


Kasting, R., McGinnis, A.J. USE OF GLUCOSE LABELLED WITH CARBON-14 TO DETERMINE THE AMINO ACIDS ESSENTIAL FOR AN INSECT. Nature 182, 446 (1958) 1300-1.

Third-instar larvae of the blowfly Phormia regina Meig. were injected with 3-6 μl of a solution of uniformly labelled glucose-$^{14}C$ containing 5000 cpm/μl. After 24 h the $^{14}CO_2$ was found to be radioactive, indicating that glucose-$^{14}C$ when injected into the larvae, was metabolized during this stage of development. A table gives the specific activities of carbon from amino-acids isolated from the blowfly after injection, and the amino-acid requirements as determined by the depletion procedure. The presence of intermediate quantities of radioactivity in proline and alanine indicates that both were synthesized from glucose. The radioactivity method described gave results for the blowfly that were sufficiently comparable to those of the classical depletion procedure to warrant application to insects that cannot be reared on chemically defined diets.


The production of $^{14}C$-O, by third-instar larvae of the blow fly, Phormia regina Meig., after it was injected with glutamic acid- U-$^{14}C$, indicates that this substrate was metabolized under these conditions. However, the nutritionally essential amino acid lysine, phenylalanine, valine, isoleucine, leucine, and methionine are not incorporated into the injected larvae, contained little radioactivity. A low level of radioactivity in arginine, histidine, and methionine suggests that they were slowly synthesized. The non-nutritionally essential amino acids alanine, serine, aspartic acid, and proline contained large quantities of radioactivity; tyrosine and glycine were exceptions. These results, in agreement with earlier work that used glucose-U-$^{14}C$, show that radioactivity data are useful for determining certain of the nutritionally essential amino acids. (auth.)

Lery, M., Soboladian, E. S. (1962) 563-72.

Partial hydrolysates of silk fibroin for glycine, alanine, glycine in several immiscible solvents prepared from radioactive (14C) amino acids. The results show that glycine are so large as to the analytical data, from out of 'the' Ala-Ala-Gly-Ala-X-Gly.

Miura, Y., Ko, H., Tanaka, T. THE PRELABELED CELL DEBRIS. The transfer of radioactivity in the presence of various substituted appropriate conditions. When the debris, the relative sp. activity in the case of the cell debris.

Orrat, M. STUDIES ON THE SILK fibroin was reacted with acetone containing an excess identified as (Glycine) (Ala) tyrosine. These 3 peptides of fibroin taken. The yields distribution of amino acids is obtained repeating sequence of fibroin.


During the first 2/3 of adult egg albumen, at this time it is converted into a sol and then proteolytic activity. The act papal endocuticle. Finally, the fluid shows numerous quantity of the molting fluid and the under promptly resorbed and incorporated.

Rabinovich, M., V gumana, A. MOL. 1. biophysics: biochemistry.

Glycine-CO2 was administered radiographically. After 18 h cytoplasm. At 1 h it was nearly the activity was localized mainly.

Shigematsu, A. INCORPORATION OF SILKWORMS; J. Biochem., 1.


It is not yet clear where organic content in the fat body of an of the last larval instar, where high. In the first experiment demonstrated, in the second
L'ÉTUDE DES PIGMENTS TÉLÉCERCICAUX

des pigments de la cuticule et des omochromes

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LANDS OF SILKWORM. Bull. Soc.

ON-14 TO DETERMINE THE AMINO

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TERINE NUTRITIONALLY ESSENTIAL

and. J. Biochem. Physiol. 39, 11

Regina Meig., after it was injected

under these conditions. However, when

succinate, leucine, and threonine,

level of radioactivity in arginine,

naturally non-essential

quantities of radioactivity; tyrosine,

that used glucose-U-C¹⁴, show

essential amino acids. (auth.)

Levy, M., Slododian, E. SEQUENCES OF AMINO ACID RESIDUES IN SILK FIBRIN. J. biol. Chem. 199

(1952) 569-72.

Partial hydrolysates of silk fibrin (Bombyx mori) have been analysed by the isotope derivative technique, for glycine, alanine, glycyglycine, and glycyglycine. (In order to obtain distribution data in several immiscible solvent systems, following purification, minute amounts of each derivative were also prepared from radioactive (¹⁴C) pip5y chloride). Complete hydrolysates have been analysed for certain amino acids. The results showed little glycyglycine in partial hydrolysates, while the amounts of alanine-yan- glycine are so large as to eliminate the possibility of a random amino acid arrangement in fibrin. All of the amino acids found, as shown by hydrolysates of complete and partial hydrolysates, can be accounted for by the sequence 

X-Ala-Gly-Ala-Gly-X-Gly-, which is proposed as a minimum repeating unit for fibrin.


The transfer of radioactivity from C¹⁴-labeled cell debris of silk glands to microsomal protein was measured in the presence of various subcellular fractions. Considerable radioactivity was transferred to the protein under appropriate conditions. When glycine-C¹⁴ was used as the source of radioactivity instead of labeled cell debris, the relative specific activity of the microsomal protein was less than 0.001%, compared to around 30% in the case of the cell debris. (CA 71A: 10536a, 1965)


Silk fibrin was reacted with S⁹⁵-labelled pip5y chloride (p-iodophenyl-sulfonyl chloride) in 50% acetic acid containing an excess of NaHCO₃. Hydrolysis and paper chromatography yielded 3 peaks which were identified as (Glycine)₂ [(Alanine)₂-0-pip5y Tyrosine, O-pip5y tyrosylalanine glycine and glycyl O-pip5y tyrosine. These 3 peptides isolated accounted for at least 95% of the total tyrosine in the sample of fibrin taken. The yields of these peptides exceed the statistically indicated yields based on a random distribution of amino acids in fibrin. The amino acid sequences are compatible with the proposed repeating sequence of fibrin.


During the first 2/3 of adult development the molting fluid is a dilute aqueous proteinaceous gel resembling egg albumen: at this time it is without effect on the pupal cuticle. On approximately the 14th day the gel is converted into a sol and shows considerable increase in chitinase activity and the first demonstrable proteolytic activity. The active molting fluid then begins to hydrolyze the protein and chitin in the overlying pupal endocuticle. Finally, the molting fluid is completely resorbed into the underlying insect. The molting fluid shows numerous quantitative and qualitative differences from the blood. A dynamic state exists between the molting fluid and the underlying insect. Radioactive glycine, injected into the molting fluid, was promptly resolved and incorporated into the protein of the adult moth. (CA 48: 8969a, 1954)


Glycine-¹⁴C was administered to B. mori larvae and its incorporation in the silk glands followed autoradiographically. After 15 and 30 min the autoradiographs showed strong and diffuse activity in the cell cytoplasm. At 1 h it was mainly found over the cell apex and newly formed secreted material. At 12 and 24 h the activity was localized mainly in the material secreted into the lumen. (auth.)


It is not yet clear which organ is concerned in the synthesis of blood protein in the larval stage. The protein content in the fat body of an individual has been shown to remain almost constant after the middle period of the last larval instar, whereas protein synthesizing activity of the tissue during the same period was rather high. In the first experiment described here, net synthesis and secretion of proteins by the fat body was demonstrated. In the second experiment, the incorporation of amino acids labelled with C²⁵ into protein
was investigated to confirm the synthesis and the secretion of protein by the tissue. (The labelled amino-acid mixture was isolated from Epicena cultured in a C¹⁴O₂ atmosphere). In the third experiment, the nature of the protein secreted by the fat body was investigated by paper electrophoresis. The author proposes that the fat body of the silkworm synthesizes globulins and secretes them into the blood circulation during the larval stage, at least in the 5th larval instar.

Shigematsu, H. PROTEIN METABOLISM IN THE FAT BODY OF THE SILKWORM, BOMBYX MORI L. Bull. seric. Exp. Sta., Japan 16 (1960) 141-70. (In Japanese, with summary in English)


After the administration of CH₃NH₂C¹⁴O₃H (5 mg, 1.2 x 10⁶ cpm) to each silkworm larva on the 3rd-4th day of the 5th instar, silk fibrin was isolated from the posterior gland by washing with 0.14 M and M NaCl, distilled water, EtOH, and ether, in that order, and the radioactivity of the fibrin was then determined. The labelled glycine was shown to be incorporated non-uniformly but to be present predominantly in N-terminal amino acids of the fibrin molecule.


After the injection of glycine-1-C¹⁴ (1,4 x 10⁶ counts/min/worm) to Bombyx mori on the 3rd-5th day of the 5th instar, it is incorporated promptly into posterior silk gland (I), the CCl₃CO₂H (III)-labeled protein of which shows the maximum radioactivity at the 4th hr. Radioactivity of III-labeled protein of middle silk gland rises slowly in initial 4-6 hr and then increases rapidly up to the 10th hr, while that of the 78% alcohol-labeled protein of blood is far lower up to 24 hr. Of protein fractions of posterior II prepared by the Griffin's method (cf. CA 40, 20314a) fibrin (IV) is predominantly radioactive, but this Griffin IV fraction is impure in comparison with IV prepared by precipitating other protein by III. Of intracellular fractions of Schneider et al. (cf. CA 45, 8110e) of posterior II large granules (V) strongly incorporate I and small granules (VI) also do to a lesser extent. V and VI have 9.8 and 5.3 for total N/bireucolic acid P ratio, and 46% and 73% for succinic oxidase activity (as O₂/mg N). The I incorporation into IV (the IIII method) of posterior II shows a lag phase of 30 min, which is not the case with Griffin's IV fraction. Column (Dowex 50) chromatography of the hydrolysate of IV (the IIII method) of posterior II gives the following pattern of radioactive amino acid distribution: I, leucine 3, alanine 1, and threonine 0.5-1%. The incorporation pathway of I is presented: free I in blood ⇔ synthesis to IV in posterior II ⇔ IV in middle silk gland by simple transport. (CA 52: 1891pd, 1958)


After injecting glycine-1-C¹⁴ or alanine-1-C¹⁴ in Bombyx mori strain 112 (Nish 112) at the 3rd-5th day of the 5th instar, the incorporation of C¹⁴ in N-terminal amino acids of silk fibroin of the posterior silk gland was 2-5 times that of non-terminal amino acids of silk fibroin. The radioactivity of the N-terminal amino acids decreased at a rate higher than that of nonterminal groups. Similar tendencies were demonstrated with tissue protein, fraction IV (Coleman and Bowett, CA 42: 4216e), of the silk gland. A stepwise synthesis of silk fibroin is suggested. (CA 55: 22193c, 1960)


The ability of the pupal cavity fluid to incorporate C¹⁴-labelled glycine varies with time of metamorphosis, being low at 25-30% pupal age and intense at 65% pupal age. Addition of sucrose increases the incorporation at histolysis stage by some 47%, while at histogenesis stage the addition causes a 3-fold increase of incorporation. Adenosinetriphosphate (ATP) greatly increases the rate of incorporation at the histolysis stage, and almost stops it at histogenesis stage. The results were similar with papae of Antherea polyx*.* At histolysis stage Na⁺ inhibits the incorporation and either has no effect or a slight stimulating effect during histogenesis stage. (CA 51: 15046b, 1957)

* The Chinese oak silkworm


In the silk fibroin of Bombyx mori glycine and alanine. The amino-esterification of the peptides obtained was identified in partial hydrolysis in isotope derivative techniques it was expected from a random arrangement of a non-random, ordered amino-acid sequence as an important structural element.

Spenke 1965 - 14]


The large particulate fraction of silk glands of Bombyx mori, washed, centrifuged and the debris (70%) adjusted to pH 6.1, centrifuged glycine-incorporation, the incorporation of protein I of each of the particulate fraction of Bombyx mori (2%) treated I (III) in 0,4 M NaCl is markedly stimulated by the ribonuclease or other enzyme or the reaction exchange between I and III. (CA 55: 22193c, 1960)


The rate of incorporation of the glycine-1-C¹⁴ into silk fibroin of Bombyx mori whereas the fraction of the silk is the highest rate. The amino-acid or III preparation of B. mori or the silk is the highest rate. The bulky of the incorporated a III of B. mori and the amino-acid or III preparation of B. mori or the silk is the highest rate. (CA 52: 1891pd, 1958)


Injection of radioactive glycine has shown to the appearance of radioactivity in the radioactivity of the blood proteins. The determining factor is accompanied by a four-fold increase in the papae in which the end of the amino acids and the contents of the amino acids. In this manner indicates that the proteins. The effects of injury, C¹⁴ into blood proteins parallel with the amino acids. (Abstract of paper presented before Srf 1955)
The sequence of glycylalanylglycine in silk fibroin. J. Biol. Chem. 201 (1953) 311-5.

In the silk fibroin of Bombyx mori, the major portion of the nitrogen is accounted for by the amino acids glycine and alanine. The amino acid sequence in the protein may be studied through the identification and estimation of the peptides obtained on partial hydrolysis of the protein. The tripeptide glycylalanylglycine was identified in partial hydrolysates by a technique using 14C-labelled pyridine chloride. Analysis by the isotope derivative technique indicated amounts of this peptide well in excess of the maximum value to be expected from a random arrangement of amino acid residues in silk. Evidence is thus provided for the view of a non-random, ordered amino acid arrangement in silk fibroin, with the sequence glycylalanylglycine as an important structural element.

Sphiks 1958 - [14]


The large particulate fraction (I) capable of incorporating glycine, was purified as follows: the posterior silk glands of Bombyx mori were homogenized in 0.4 M sucrose-0.005 M KCl-0.005 M MgCl2 (pH 8.0), centrifuged and the debris (700 g) removed. The supernatant was then centrifuged at 14 000 g. The supernatant was then centrifuged at pH 7.0, 9.1. The glycine-incorporation stimulating factor (II) was then brought down by precipitation. The glycine-C14 incorporation into proteins of I catalysed by I (incorporation II) or I or any other intra-cellular fractions. Decarboxylation of 2-hydroxybutyric acid (20%)-treated I (III) in 0.4 M sucrose at pH 8.0 was not active and required II for glycine incorporation which is markedly stimulated by the addition of 2 x 10-8 M guanosine triphosphate. It cannot be replaced by ribonuclease B or other intra-cellular fractions. It does not catalyse the formation of glycine hydroxamate or the exchange reaction between adenosine triphosphate and phosphate or -labelled pyrophosphate.


The relative rate of incorporation of glycine-14C, alanine-14C, tropo-14C by I was determined as 5:2:1:1 for Bombyx mori whereas the fraction for Atresia rufilata, whose fibroin is rich in alanine, incorporated alanine at the highest rate. The alanine incorporation took place by combining either rat-liver micromoles (IV) or IV preparation of B. mori or A. rufilata. Rat liver phosphatase or II preparation of B. mori or A. rufilata. The bulk of the incorporated amino acids was determined as leucine, glycine, and alanine with the use of III of B. mori and A. rufilata, respectively, regardless of the sort of activating or stimulating factor supplemented.

(For key to notation used, see abstract for part I of the study)


Injection of radioactive glycine (C14-carboxyl-labelled) intravenously into the Cecropia silkworm leads to the appearance of radioactivity in the proteins of both blood and tissues. Ninhydrin tests revealed that the radioactivity of the blood proteins occurred in carboxyl groups associated with peptide bonds. Pepsin in the overwintering state of disperse readily incorporated C14 into the blood proteins, although this occurred at a slow rate. The termination of disperse, which is marked by the initiation of adult development, was accompanied by a four-fold increase in the rate of incorporation of C14 into the blood proteins. Dispersing pupae in which the end of the abdomen had been replaced by a plastic covering incorporated C14 into blood proteins at a rate characteristic of developing adults. The capacity of dispersing pupae to respond to injury in this manner indicates that their inability to grow and differentiate is not due to an inability to synthesise proteins. The effects of injury, carbon monoxide and tramp of metamorphosis on the rate of Incorporation of C14 into blood proteins parallel the effects of these same factors on the rate of oxygen consumption (Schneiderman and Williams. J. Biol. Bull. 105: 320-34).

(Abtract of paper presented before the 52nd Ann. Meeting of the American Society of Zoologists, 8-9 Sept. 1960)

Radioactive glycine, injected into the haemocoele of diapausing pupae and developing adults, is incorporated into the proteins of the blood. The rate of incorporation parallels previously described rates of O consumption under a variety of conditions. The incorporation of amino acids can be added to the list of metabolic processes which proceed at depressed rates during diapause, but which accelerate temporarily in response to injury. (CA 55: 482a, 1961)

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Chromatographic analysis of the hemolymph revealed the presence of 10 amino acids of which glycine and serine occurred in the relatively high concentrations of 33.5 and 34.6 millimoles/l, respectively. After injection of C-14 labelled glycine and serine into the gut lumen, uptake was shown to occur rapidly in the mid-gut region and especially from the lumen of the caeca. The concentrations of glycine and serine, and also of glutamine in the caecal fluid, were found to increase significantly above the concentrations in the hemolymph, an effect which was paralleled by a relatively rapid decrease in fluid volume. During this time rapid exchange of C-14 labelled glycine and serine between the hemolymph and the gut lumen was demonstrated. Absorption of these amino acids depends, in part at least, upon the diffusion gradient created by the relatively rapid movement of water into the hemolymph. (CA 54: 16673g, 1960)

Winteringham and Harrison 1968 - [782]

I-B-3 NUCLEIC ACIDS

214


Tissues of queen bee larvae were incubated with thymidine-C14 at various stages of larval and pupal development. The radioactivity/rmg/b of incorporation of the acid-insoluble fraction and per mg wet weight of tissue decreased sharply with the age of the larva. The activity per unit larva, however, increased with age, but less steeply. The implications of these findings are discussed. Despite the massive breakdown of the fat body cells prior to transformation of the larva, the biochemical and histological data suggest that DNA synthesized during early larval stages, or at least its nucleotides, may be utilized intact during later periods of cellular differentiation in the queen bee. Larvae fed thymidine-C14 in royal jelly apparently digested it, since the greatest activity was then found in the silk cocoons spun at maturity. The C14 was not in the protein of the cocoon since only an insignificant amount of activity appeared in the acid-insoluble fraction of the silk after alkaline treatment. Injection of thymidine into the blood space of the pupa lead to some utilization, activity being still present after emergence of the mature queen, mating and beginning of egg-laying. (auth. summary)

215


Tritiated thymidine (0.01-0.1 µc) was injected into larvae of Rhynchosciara angelae. The sites of greatest incorporation of thymidine into the chromosome vary with the age of the larvae, but are constant at the same stage of larval development, and much more evident in certain loci of the chromosomes than in others. The authors conclude that the intense incorporation of thymidine in "puff" loci of the polytene chromosomes show that DNA plays a very active part in the puffing. "Puffs" which are characteristic for the larval stages are interpreted as indicating special gene activity which is localized and confined to certain periods. The gene metabolism in R. angelae appears to be linked with DNA synthesis.

216


The metabolism of the chromosomes of the salivary glands of Rhynchosciara angelae were studied by means of the specific radioactive precursors of the nucleic acids (thymidine-H3 and adenosine-C14) and proteins. Doses of the order of 0.01 to 0.1 µc of thymidine-H3, adenosine-8-C14, or phenylalanine-2-C14 were administered to the larva by microinjection. The larvae were then sacrificed, usually after 24 h, and after appropriate treatment the chromosomes were autoradiographed. The "puffed" show a higher incorporation of the two precursors, indicating earlier results.

217

Gaulden, M. E. DNA SYNTHESIS IN NEUROBLASTS. Genesis 41 (1960)

A study has been initiated to determine whether DNA occurs in the grasshopper to determine whether DNA synthesis. Grasshopper embryos at a given stage of mitosis, C14-2, at the end of the given mitotic stage of unincorporated thymine. It was used to determine the rates of uptake of thymine into the middle telophase and on the basis of the time required for a significant fraction of the pre-S phase, namely mitosis far indicate that interference of x-rays much higher than that (Abstract of paper presented at 27-29 Aug. 1958)

218

Gross, J. D. INCORPORATION OF "PUFFS". Nature 185 (1960) 6

A preliminary study was made of the salivary gland medium containing act (as phagocytosed sections, were stained with hematoxylin). Incorporation 4-8 h. The puff appears to be one which show an incorporation line is much more highly concentrated.

Horikawa and Sugahara 1960 -

219


220

Kaplan, W. D., Sikken, J. E. GENE IN TESTES OF DROSOPHILA MELANOGASTER. Autoproducing testes in which the testes of Drosophila melanogaster. The testes effect of using chromosomes in a very early and non-mitotic. The mutagenic effect of using chromosomes in the production of a mutagenic effect. (a
man and developing adults, is incorpora-
ted into the previously described stages of O.
5. The incorporation of amino acids can be added to the list of
acids that are used to study the development of the grasshopper neuromasts.

(TERECIA GREGARIA FORSK.)

10 amino acids of which glycine and
serine, respectively. After injection of
tritiated thymidine into the hemolymph, the
concentrations in the hemolymph, the
volume. During this time, the adult
larva matured, demonstrating
the fusion gradient created by the rela-

tively slow movement of the cells.

QUEEN BEE LARVAE. J. exp. Zool.

These stages of larval and pupal develop-
mation and pupal development occur in the mid-
gestation of any of the insects. The
larvae hatch from the egg and begin to
mature, developing into pupae.

SOMES OF RHYNCHOSCIARIA ANGELAE
(57) 833-4.

metanotus angeli. The sites of greatest
tissue activity, but are constant at the
level of the chromatin. In other
loci, the polytene chromosomes are
characteristic for the larval stages
and confined to certain periods. The

CHROMOSOMES. 2nd UN International

metanotus angeli were studied by means
of adenine-C\(^{14}\) and proteins.

or phenoxyamine-2-C\(^{14}\) were ad-
cified, usually after 24 h, and after
100 h show a higher incorporation of
the two precursors, indicating a concomitant synthesis of DNA and of proteins at this level. This confirmed
earlier results.

217
Gaulden, M.E. DNA SYNTHESIS AND X-RAY EFFECTS AT DIFFERENT MITOTIC STAGES IN GRASSHOPPER
NEUROBLASTS. Genetics 41 (1956) 645.
A study has been initiated to determine at what stage of mitosis synthesis of deoxyribonucleic acid
(DNA) occurs in the grasshopper neuroblast, to determine the effects of irradiation on this synthesis, and
to determine whether radiation-induced mitotic inhibition can be correlated with an inhibition of DNA
synthesis. - Grasshopper embryos were observed in living culture preparations. When a neumblast entered
a given stage of mitosis, C\(^{14}\)-labelled thymidine was added to the culture medium. When the cell reached
the end of the given mitotic stage, the embryo was fixed immediately and washed with water to remove
unincorporated thymidine. It was subsequently stained, stained with Feulgen reagent, and covered with
stripping film. The cell was then examined for presence of grains in the film above it. (Since fractionation of embryos revealed that the C\(^{14}\) was in the DNA fraction, it is
assumed that uptake of thymidine indicates synthesis of DNA.) - Uptake of thymidine in neuroblasts begins
in the middle late and continues into late early prophase. Maximum uptake occurs during late late
prophase and interphase, rate of uptake being approximately the same in both stages. Thus the stage of mitosis
most sensitive to X-rays, namely middle and late prophase, are not involved in synthesis of DNA. Data accumulated
thus far indicate that interference with uptake of thymidine occurs only in cells that have received a dose
of x-rays much higher than that sufficient for blocking mitosis.

(From a paper presented at the 1956 meetings of the Genetics Society of America, Storrs, Connecticut, 27-29 Aug. 1956)

218
Gross, J.D. INCORPORATION OF PHOSPHORUS-32 INTO SALIVARY-TYPE CHROMOSOMES WHICH EXHIBIT
"PUFFS". Nature 180 (1958) 449.
A preliminary study was made into the rate of incorporation of P\(^{32}\) into the chromosomes and associated
structures in the salivary gland of the Chironomid, Metriocnemus pygmeus. Larvae were grown on
medium containing P\(^{32}\) (as phosphate) for 2-24 h, and the incorporation studied in autoradiographs of squashes
and sections, which were stained with methyl-green-pyronin and in some cases extracted with ribonucleic
or hydrochloric acid. Incorporation of tracer was adequate after feeding the larvae on labeled medium for
4-8 h. The puffs appear to concentrate the P\(^{32}\) much more actively than the remainder of the chromosome
which show an incorporation little above the background. Staining reactions indicate that ribonucleic acid
is much more highly concentrated in the puffs than in the remainder of the chromosome.

Hori, M. and Sugahara 1960 - [914]

219

During the 4th and 5th larval instars of the silkworm, Bombyx mori, nuclear acid P occupies one-third of
the midgut. Just before cocoon-spinning, nuclear acid P and lipid P decrease gradually, while
acid-soluble P increases rapidly. This is caused by the increase in inorganic P, suggesting the excretion of
P as a form of inorganic P into the midgut cells from other parts of the body at this period. There is almost
no change in protein P throughout larval stage. As the result of using P\(^{32}\), it was shown that the part absorbing
P actively is the posterior midgut. The total P\(^{32}\) of the midgut reaches the maximum 2 h after feeding
P\(^{32}\), then decreases gradually. The same is true for the acid-soluble fraction, which, however, decreases
more rapidly with time than the total P\(^{32}\). Lipid P\(^{32}\) reaches the highest level 14 h after feeding. The
changes relating to the turnover in the midgut were also observed in various P fractions of the blood. These
are some differences in papers on the turnover in the midgut and the blood. (auth.)

220
Kaplan, W.D., Sixten, J.E. GENETIC AND AUTORADIOGRAPHIC STUDIES OF TRITIATED THYMIDINE
Autoradiographic studies were made of Drosophila melanogaster larvae at various intervals after removal of a
thymidine-containing diet up to 56 h. The preliminary data show that spermatogenesis reduplicate their
chromosomes very early and more posteriorly as additional cells are proliferated from the apical spermatogonia.
The mutagenic effect of tritiated thymidine was studied genetically. Unquestionably the thymidine
produces a mutagenic effect. (auth.)

63

Kling, R.C., Falk, G.J.  IN VITRO INCORPORATION OF URIDINE-3H INTO DEVELOPING FRUIT FLY (DIPTERA: MELANOGASTER) OOCYTES. J. biophys. biochem. Cytol., 8(2) (1960) 550-3. The excited ovaries of 3-day-old female D. melanogaster were immersed in a solution containing TC 199 and uridine-3H. The H3 was incorporated into ribonucleic acid within 4 min and localized in the dense ribbon-like chain of plasmastones found in the nuclei of nurse cells associated with the oocyte. (CA 55: 12674e, 1961)

Kogure and Nakajima 1868 - [1148]

McMaster-Ratyes, R., Taylor, I.H.  EVIDENCE FOR TWO METABOLICALLY DISTINCT TYPES OF RIBONUCLEIC ACID IN CHROMATIN AND NUCLEOLES. J. biophys. biochem. Cytol., 4(1) (1958) 5-11. Patterns of radiotrace incorporation are useful characteristics in describing cellular RNA fractions, and have indicated a distinctive "nuclear" RNA. In order to characterize the RNA fractions of the two nuclear components, nucleoli and chromatin, and to determine thereby the precise localization of the RNA typical of isolated nuclei, time-courses of P32 incorporation into nuclear, chromosomal, and cytoplasmic RNA of Drosophila salivary glands have been determined from autoradiographs. Two experiments are reported which cover 15 and 18 h periods including an initial 2 h feeding on P32. Concentrations of RNA-3H (identified by ribonuclease digestion) were determined by grain counts. After 1 h only the nuclear RNA is labelled. Activity is detectable in the RNA in cytoplasmic RNA after the 2nd h. The nucleolar fraction reaches its maximum activity shortly after transfer of the larvae to non-radioactive food, the other fractions several hou later. Maximum activity persists in the chromosomal and cytoplasmic fractions; nuclear activity decreases after the 5th h. The observed differences in times at which incorporation begins and maximum activities are reached, and in maintenance of maximum activities indicate that chromosomal and nucleolar RNA are distinctly separated. The metabolic characteristics which have been ascribed to "nuclear" RNA apply only to the nuclear fraction. (auth.)


Pavan 1940 - [375]

Pyle, S.R., Howard, A.  METABOLIC ACTIVITY OF SALIVARY GLAND CHROMOSOMES IN DIPTERA. Exp. Cell Res., 10 (1956) 849-52. Larvae of Drosophila melangaster were given 5B-DL-methionine (I), 8-C14-adename (II), or Na83502 (III) with their food. The salivary glands were removed 24 h later and autoradiographs prepared. The autoradiographs with I were not sufficiently strong to decide the relative concentration in small portions. With II, good autoradiographs were obtained in the chromosome bands. After treatment with ribonuclease, the preparations showed no autoradiographs, suggesting the incorporation of II into ribonucleic acid. No autoradiograph of the chromosomes or cytoplasm was obtained with III. (CA 51: 21884, 1957)

Pelling, G.  CHROMOSOMAL SYNTHESIS OF RIBONUCLEIC ACID AS SHOWN BY INCORPORATION OF URIDINE LABELLED WITH TRITIUM. Nature 194 (1960) 655-6. The investigation was made on the gland chromosomes of Chromodon tentans. Special staining techniques for showing up RNA within the chromosomes were used. Sites of RNA were determined by autoradiography: 0.25 - 1.25 μ of tritium-labelled uridine was injected into larvae, with special precautions to avoid loss of histamin. The uptake of uridine was allowed to continue for 15 min to 24 h. Nucleolar RNA was found to be synthesized at the nucleolar organizer only. Synthesis is continuous. Many other sites of the chromosomes are also involved in RNA synthesis, but the bulk is produced by a few very active loci. This confirms earlier interpretations of the phenomenon of differential puffing in dipteran giant chromosomes, RNA synthesizing structures show no activity after short application (up to 2 h) of radioactive amino-acids (glycine-C14, cytosine, pepstatin-H3). Protein synthesis seems not to be correlated with RNA synthesis.

Ruddick, C.T., Woods, P.S.  CHROMOSOMES OF DROSOPHILA (1969) 997-1000. The morphological change known as "puff", was examined in terms of puff and non-puff regions with respect to tritium-labelled thymidine incorporation: synthesis is not a necessary concomitant of puff formation. H3 -cytosine was used to label cytoplasm, chromosomes than on administration of thymidine.

Saglemann, A., Miura, Y.  BIOSYNTHÈSES DE L'ACIDE RIBONUCLEIC DE CHEZ BOMBYX MORI L. (1964). Les auteurs ont mis en évidence les glandes séricigènes, ainsi que l'acide ribonucléique de Bombyx mori L. par l'utilisation de l'acide glycine-1-14C (1μg) et par autoradiographie. (CA 59: 9510 S)

Takeyama, S., Itou, H., Miura, Y.  IN THE SILK GLAND. Biochim. Biophys. Acta, 276 (1972) 402-73. Larvae of Drosophila regla were transferred to non-labelled food. The incorporation was high in all organelles of the gland. Incorporation was high in all organ...
HYDANTOIN INTO THE SPINNING EMBRYO. Vol. 56, Sci. Biol. 8, 6 (1960)


were in a solution containing TC 199 6 min and localized in the dense 
located with the oocyte. (CA 56:

ALLY DISTINCT TYPES OF RIBO-
Cytol. 4, 1 (1958) 5-11.

ing cellular RNA fractions, and 
RNA fractions of the two nuclear 
base localization of the RNA typical 
mononuclear, and cytoplasmic RNA 
ions. Two experiments are reported.

Concentrations of RNA-P32 (identified 
only the nuclear RNA is labelled.

and H. The nuclear fraction reaches 
active food, the other fractions several 
monic fractions: nuclear activity 
incorporation begins and maximum 
icate that chromosomal and nuclear 
been ascribed to "nuclear" RNA apply

STUDIES ON THE METABOLISM OF 
J. appl. Ent. & Zool. 4, 2 (1965)

(English summary)

AND CHROMOSOMES IN DIPHTERA.

8-CM-adenine (II), or NaH2SO4 (III) 
adriographs prepared. The autoradiog-
ration in small portions, with II, 
treatment with ribonuclease, the 
II into ribonucleic acid. No auto-

CA 51: 2185f, 1967)

SHOWN BY INCORPORATION OF 

antennae. Special staining techniques 
determined by autoradiography; 
with special precautions to avoid loss 
min to 5h. Nuclear RNA was 
mitation. Many other sites of the 
creased by a few very active loci. This 
ng in diptera giant chromosomes, 
1-2 h) of radioactive amino-acids 
not be correlated with RNA synthesis.


The morphological change involving a local increase in diameter of the chromosome, frequently called " puff," was examined in terms of its chemistry, particularly a comparison of the metabolic activities of puff and non-puff regions with respect to both DNA and RNA. Methods are described for the incorporation of tritium-labelled thymidine and cytidine into puff regions. Results with HP-thymidine indicated that DNA synthesis is not a necessary concomitant of puff formation and disproportionate synthesis does not occur during puff formation. HP-cytidine incorporation was interpreted to indicate the presence of RNA, and was found to label cytoplasm, chromosomes and nucleoli of all cells; puff regions were more heavily labelled than on administration of thymidine.


Les auteurs ont utilisé bombyx mori L., ayant atteint la 5e âge et une heure après injections de la solution de 32P ou 
glycine-1-32P (1µc/g) La partie sécrétion des glandes séricigènes a été fixée à la solution de Camoy. Les 
resultats de l'autoradiographie ont été résumés dans un tableau.


The posterior silk glands of the 6th instar larvae of silkworms were incubated with RNA and protein precursors. 
Glycine-C34 was actively incorporated into the protein fraction and orotic acid-C34 into the RNA fraction. 
The greater part of the radioactivity incorporated into protein represented fibroin synthesis. Orotic acid was 
incorporated into RNA uracil, Impairment of orotic acid incorporation by inhibitors of RNA metabolism 
(6-uracilimidyl-1-méthyl) was not accompanied by impairment of the incorporation of glycine into protein. 
Apparently, the simultaneous renewal of RNA was not necessarily required for the synthesis of fibroin. 
Ribonucleic (300 µc) almost completely inhibited fibroin synthesis. Neither the metabolic renewal of 
RNA nor the RNA remaining after enzyme treatment was able to restore this synthesis, nor was it restored 
by the addition of RNA obtained from the same tissue. Thus, fibroin synthesis was dependent on the existence 
of intact RNA. (CA 68: 3516g, 1969)


Larvae of Drosophila regeneri were given food containing 32P-labelled phosphate for 1 to 3 h and then trans-
formed to non-labelled food. The larvae were fixed at intervals of 1 or 1 h and the Incorporation of 32P into 
ribonucleic acid (RNA) determined in the cytoplasm, chromosomes, and nucleoli of the salivary glands. 
Incorporation was high in all cells during the first half of the third instar but then decreased so that no 
radioactive RNA could be detected in the last third of the instar. Labelled RNA was detected after 1 h in 
sectors of chromosomes lying near the nucleolus and in the nucleolus itself. Within 3 h the activity in the 
nucleolus increased so that RNA appears in cytoplasm about this time and in 5-6 h is as high as in the nucleolus. 
From activity-time relation study, the cytoplasmic RNA could originate from microsomal RNA or both could 
have a common precursor. (CA 60: 9858b, 1966)

Weygand, F., Waldschmidt, M. ÜBER DIE BIOSYNTHESE DES LEUCOPTERINS, UNTERSUCHT MIT 14C-MARKIERSTEN VERBINDUNGEN AM KOMLLWTSEL. (On the biosynthesis of leucopterin, studied in the cabbage moth by means of C14-labelled compounds). Angew. Chem. 67, 12 (1955) 996. (In German)

In a preliminary experiment, larvae of Gonepteryx rhamni and Pieris brassicae, napi and napa were allowed to feed on C14-labelled folic acid-[2-C14], glycine-[2-C14], glycine-[3-C14], hypoxanthine-[2-C14], 
2,4,6-triamino-6-oxo-pyrimidine-[2-C14]-hydrochloride, glycine-[1-C14] and sodium formate-[C14]. 
The uptake of radioactive from the various compounds was tested, and considerable variation found. 
Glycine-[1-C14] (97 µc/larva) and sodium formate (100 µc/larva) were injected into the legs. By separating 
the leucopterin in both cases, and from analysis of the degradation products (degradation taking place in 
two ways) it was possible to show that precursors synthesis in the cabbage moth follows an analogous pattern 
to that of the purines and lactoflavin,

The metabolism of C14-labelled cholesterol and cholestrol acetate was studied in the adult cockroach and housefly, and larvae of confused flour beetle. Sterols from the housefly were isolated and at least three compounds separated chromatographically. An attempt was made to characterize these sterols.


Cholesterol (I) synthesis in Derrinesus vulgaris larvae was studied with the aid of the tracer technique. Acetate-1-C14 was utilized for the synthesis of both fatty acids and unsaponifiable material during larval growth. However, synthesis of I from the acetate did not occur. Dermites larvae were unable to utilize a-squalene in lieu of I for growth and development. Since acetate-C14 is incorporated into a-squalene, but not into either I or lanostrol the steroid requirement of Dermites may be attributed to an interruption of I biosynthesis at the a-squalene stage. (CA 50: 15975 e, 1958)


Certain aspects of insect sterol metabolism were investigated with Periplaneta americana. The normal distribution of free and esterified sterols among the organs was determined and compared with the distribution of cholesterol-4-C14 16 h after injection. The rate of colour formation with the Scholten-Heinemeyer reagent from the sterols in the various organs differed greatly. Injection of acetate-1-C14 into cockroaches and mice resulted in almost the same percentage recovery of labelled digesterones. Cockerell cholesterol esterase was investigated in relation to distribution among the organs and substrate specificity. (CA 51: 8331d, 1957)


Larvae of the beetle Dermites vulgaris reared on diets containing 1-C14 acetate or randomly labelled C14-fucose failed to form radioactive a-squalene or sterols. The non-saponifiable matter isolated from these insects contained two radioactive fractions. One of them is shown to be a saturated aliphatic hydrocarbon, or mixture of hydrocarbons, with an average molecular weight of 346 and an unbranched carbon chain. The second fraction has been characterized as a primary aliphatic alcohol with an average molecular weight of 365 ± 17. The sterol necessary for the growth of Dermites larvae cannot be replaced or spared by mevalonic acid, a-squalene, lanosterol, or A4,4,4-dimethylcholesterol. It is suggested that the pathways of cholesterol biosynthesis are multiply blocked in this organism, 24-Dehydrocholesterol can substitute for cholesterol in supporting the growth of Dermites larvae. (auth. summary.)


The utilization of dietary eggsone by nymphs of the German cockroach, Blattella germanica, was investigated. The insects were given eggsone which had been uniformly labelled with C14. The formation of a new radioactive steroid was observed. This conversion product could not be demonstrated with eggsone labelled at C-28 only, which showed that it no longer contains the C-28 methyl substituent of eggsone. By isotopic techniques the demethylhalation product of eggsone was shown to be 22-dehydrocholesterol. A small amount of crystalline steroid was isolated from a large number of eggsone-fed nymphs and shown to be identical with authentic 22-dehydrocholesterol. The significance of this conversion is discussed. (from auth. summary)


The incorporation of glycine-C14, leucine-C14, NaOAc-2-C14, and glucose-C14 into Schistocerca fat body was studied under in vitro conditions, and the distribution of radioactivity in the various fat body fractions and the labelling of compounds in the fractions were described. There was high incorporation into fat and protein and very low incorporation into glycogen. Incubation with glycine-C14 led to the appearance of radioactivity in the glycine-aceatol led to radioactive intermediates of the triacetylated to trehalose, 5-C14 in the fat body, contrary genetising the tissue. Fat body suggested that fat body acid was not available for further metabolism.

Kaplans, J.N., Monroe IN THE ADULT HOUSE FLY.

When houseflies were food utilized in egg production of several metabolites, the metabolism of acetate was studied. (CA 50: 27675 e, 1958)

Kaplans, J.N., Robbins ESTEROL BY THE ADULT.

The metabolism and excretion of low levels of acetate as acid material, when recovered after 8 weeks by 8\% the larval adults of C. elegans, the excreted material, the adult was not found to be 24-acetoxycholesterol. (CA 51: 8331g, 1957)

Kodick, E., Levinson, J. OF ACETYLATED 2-4-C14 4-51.

Larvae of Calliphora erythrocephala technique are given. The 24-hydroxylatable sterols were isolated by the larva and recovered after 8 weeks by 8\% the still significant radiotactivity was also used for

Louloudes, S.J., Kaplans, J.N. THE AMERICAN COCKROACH.

The incorporation of radioactive American cockroaches was analyzed by gas chromatography. (Published more fully in greater detail, 242)

Robbins, W.F., Kaplans, J.N. NYMPHAL GERMAN COCKROACH.

Only low levels of C14 acetate were administered to nymphs of the adult and eggs were characterized by the following methods.
radioactivity in the glycone and serine of the protein and of the amino acid pool. Incubation with labelled acetate led to radioactivity in glutamic acid, proline, aspartic acid, and alanine, showing that the intermediate of the tricarboxylic acid cycle provided the C skeletons of the amino acids. Glucose was largely converted to trehalose. Succinic dehydrogenase and the condensing enzyme system were shown to be present in the fat body, contrary to previous reports. The succinic acid oxalate system was highly labile on homogenizing the tissue. Fat body, unlike flight muscle, used glycoly and leucine as respiratory substrates. It is suggested that fast body acts like the vertebrate liver by transaminating amino acids and making them available for further metabolism by other tissues. (CA 54: 1667f, 1960)


When houseflies were fed a diet containing HP-9-sterol the sterol was found to be efficiently absorbed and utilized in egg production. Analysis of the HP-compounds from the adults and eggs indicated the presence of several metabolites.


The metabolism and excretion of ingested 4-C14-cholesterol was studied in the housefly (Musca domestica). Only low levels of excretion (0.96 - 2.95%) were found 3 days after treatment and about 10% of this behaved as acidic material. When female flies were treated and the eggs collected, 70% of the radioactivity was recovered 3 weeks after treatment. The high recovery and low excretion rate indicate a specific sterol system in the housefly. The administered cholesterol was efficiently utilized in egg production. Of the radioactive sterols were found to be esterified in both egg and adult. Analysis by column chromatography and reverse isotope dilution demonstrated the presence of 2 major compounds - unchanged cholesterol and 7-dehydrocholesterol - and a lesser fraction consisting of unidentified polar steroids. (auth.)


Larvae of Calliphora erythrocephala were fed some sodium acetate-2-C14 in their diet. Details of the technique are given. The distributions of radioactivity in the total lipid content, unsaponifiable matter, diglycerol-precipitable sterols, diglycerin-non-precipitable, fatty acids, lipid-free residues and total CO2 expired by the larvae were calculated. Results show that Calliphora larvae are unable to synthesize sterols from C14-labeled acetate, but indicate also that the cholesterol side-chain is not formed by re-synthesis from acetate, but rather by de-ethylation of the 9-sitosterol side-chain at position C24. Acetate would appear to be utilized as least efficiency for biosynthesis of fatty acids as for biosynthesis of unsaponifiable matter, other than sterols. Significant amounts of C14 were incorporated into unsaponifiable lipids other than sterols: they were investigated by reversed-phase paper chromatography and radioautography. From the still significant radioactivity remaining in the larvae after removal of lipids it may be assumed that acetate was also used for the synthesis of non-lipid constituents of the body.


The incorporation of radioactivity into the unsaponifiable and unsaponifiable fractions of male and female American cockroaches was determined following injection of 1-C14-acetate. The unsaponifiable material was fractionated by chromatography and diglycerol precipitation and the methyl esters of the fatty acids were analyzed by gas chromatography.

(K) (Published more fully in Ann. ent. Soc. Amer. 56: 1 (1963) 99-103, not included in this bibliography)


Only low levels of C14 compounds were excreted following injection of 4-C14-cholesterol to female flies. Most of the administered material was utilized in egg production. The C14 compounds present in the adults and eggs were characterized by column chromatography and reverse isotope dilution.

When houseflies were fed a diet containing $\text{H}^4\text{-dioxigenoacetate}$ the sterol was found to be efficiently absorbed and utilized in egg production. Analysis of the $\text{H}^4$-compounds from the adults and eggs indicated the presence of several metabolites. Nymphaal German cockroaches were reared on a synthetic diet containing $\text{H}^4\text{-dioxigenoacetate}$. The isolated $\text{H}^4$-compounds were fractionated by chromatography and further analyzed to determine the nature of the metabolites.


Houseflies ($\text{Musca domestica}$) were injected with an aqueous solution of 1-C$^4$-sodium acetate and held for 18 h. On analysis, the rate of fatty acid synthesis from C$^4$-acetate was found to be 0.7 to 8 times greater in females than in male flies. The males and females incorporated about the same percentage of radioactivity into the unsaponifiable fraction (1.5 to 5%). Further fractionation by column chromatography demonstrated that 70 to 89% of this radioactivity behaved as hydrocarbons and less than 20% as sterols. When the sterol fraction was analyzed by digitonin precipitation, no radioactivity was detected in the precipitate representing cholesterol and companions. (auth.)


The metabolism and excretion of ingested 4-C$^4$-cholesterol was studied in the housefly ($\text{Musca domestica}$). Only low levels of excretion (5-92%) were found 3 d after treatment, and about 10% of this was excreted as an unmodified steroid. Female flies excreted and the eggs collected, 78% of the radioactivity was recovered 3 weeks after treatment. The high recovery and low excretion rate indicate a strict sterol economy in the housefly. The administered cholestrol was efficiently utilized in egg production. Some of the radioactive steroids were found to be esterified in both the egg and adult. Analysis by column chromatography and reverse isotope dilution demonstrated the presence of 2 major compounds: unchanged cholesterol and $7\text{-dehydrocholesterol}$. (auth.)

(A first report appeared as an abstract in Bull. ent. Soc. Amer. 5, 4 (1959) 137, abstr. 230.)

I - B - 5 ELEMENTS


Houseflies ($\text{Musca domestica}$) and German cockroaches ($\text{Blattella germanica}$) were fed $\text{P}^{32}$ to study its effect on their fertility. In houseflies the biological half-life of the ingested $\text{P}^{32}$ was about 0.8 d, whereas in female cockroaches the radioactivity did not fall to 50% in the 14-day observation period. In male cockroaches this point was reached about the 9th day. Houseflies fed $\text{P}^{32}$ labelled food contimuouly for 6 days did not oviposit, but 2 days after they had been returned to a normal diet a few eggs of low viability were deposited. Flies kept on $\text{P}^{32}$ for shorter periods showed induced oviposition and fertility. Their ovaries were immature, but they recovered partially after a normal diet was given. Larvae reared on $\text{P}^{32}$ medium (10.3 $\mu$g/g) developed into normal adults. Some German cockroaches fed $\text{P}^{32}$ developed oothecae, but they were flaccid and contained no egos.

Block, R. J. INORGANIC SULFUR IN THE SYNTHESIS OF PROTEIN IN THE RUMEN FROM NON-PROTEIN SOURCES WITH A NOTE ON THE SYNTHESIS OF CYSTEINE AND METHIONINE IN $\text{B. B. L.}$, TID-8116, Oak Ridge National Lab., Tenn. 1965, 490p.

Some experiments on the synthesis of protein-bound sulfur from inorganic sulfate were carried out on the German cockroach ($\text{Blattella germanica}$). $\text{S}^{35}\text{O}_4$ was added to the drinking water under controlled conditions. Results indicate that cysteine and methionine may have separate as well as combined synthetic pathways in $\text{B. B. L.}$.


Wasps accumulate Mn during larval life, lose much of it at pupation, and accumulate it again as adults. Accumulation takes place rapidly in the cells of the mid-gut epithelium. Male wasps never build up Mn stores in their bodies; queen wasps only after leaving the nest; but workers store Mn almost immediately after emerging from the pupa. Manganese isotopes Mn$^{54}$, Mn$^{64}$ and Mn$^{64}$ were used. No evidence of a nutritional basis for wasp sex development was furnished by these studies. The distribution of Mn throughout each intestinal cell (radioracer technique) is not rapid and transfer to the hemolymph may be discontinuous.

The cells of the wasp mid-gut (homogenates store Mn in excess of that with lack of control over above.


The hemoglobin metabolism of $\text{D. m.}$ from the anterior part of the material is rapidly transferred where it is stored in a somewhat scattered patches of cells of the comb. Lanthanum-144 is not when formed in the body by decaying 20 h in the space between the foodstuff between this slow-moving is seen to be of great importance that the location of $\text{Ba}$ uptake particular food, and not a low.

Bruce-Chwatt, L. J., Hayward, OF MOSQUITOES, Nature 177.

Larvae of $\text{Aedes aegypti}$ were reared in of the radioisotope ranged from delay in pupation of the larvae the 4500-mg/ml bath. At 2500 dead pupae. Apparently, a a of emerged adults, Females were radioactive, (CA 50: 10289).


Houseflies were either fed or in extracts, hydrolysates, and feces containing Cysteine-4-methyl sulfate of flies injected with cystine-$\text{S}^{34}$ it seemed to arise from cystine via found in detectable quantities in synthesis. In the latter case relating Sulfate-$\text{S}^{34}$ was not incorporated into the same which may metabolize synthesis, (auth.)

Crestley, D. A., Jr., Pryor, M., ROMALEA MICROPTERA. Helplin.

Adults of $\text{R. m.}$ microperta, to investigate uptake and elimination of perimine where granolder we half-life was used to predict the results, but some was also found in the exoskeleton, (auth.)
The cells of the wasp mid-gut offer a mineral-holding protein sheath of high stability. Larval and worker homes store Mn in excess of any known metabolic use, probably due to inefficient Mn excretion coupled with lack of control over absorption. 46 references. (from auth.)

(See earlier report AECU-825, Technical Information Service, AEC, 43p)

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The baryum metabolism of D.  repeta larvae, studied by use of radioactive Ba$^{40}$, is described as involving uptake from the anterior part of the mid-gut, and to a less extent from the bases of the caeca. The absorbed material is rapidly transferred to the lumen of the ascending portions of the anterior malpighian tubules, where it is stored in a somewhat soluble form, until after pupation. Smaller amounts of the element appear in scattered patches of cells of the posterior mid-gut, and some is excreted from the anterior malpighian tubules, Lanthanum-140 is not found to be absorbed by D.  repeta larvae, nor does it appear to be excreted when formed in the body by decay of Ba$^{40}$. The observation is made that material may be held for 15 to 20 h in the space between the peritrophic membrane and the anterior mid-gut epithelium. Partition of foodstuff between this slow-moving stream and the rapidly moving contents of the peritrophic membrane is seen to be of great importance in determining efficiency of absorption by the larvae. It is concluded that the location of Ba uptake indicates a functional localization of treatment of dissolved as opposed to particulate food, and not a localization of uptake of a particular ion or ions. (auth.)

(See earlier report BNL-1010, Brookhaven National Lab., Upton, N.Y. 26p.)

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Larvae of Aedes  aegypti were immersed in mixtures of Na$_2$HPO$_4$ and, water, and rolled oats; the concentration of the radiophosphate ranged from 17 to 4400 mcp/m. The higher the concentration, the greater was the delay in pupation of the larvae, although at the end of two weeks, all larvae had pupated except those in the 4400 mcp/ml bath. At 2400 mcp/ml, the larvae remained normal for more than 5 weeks, but produced dead pupae. Apparently, a concentration of radioactivity greater than 100 mcp/ml decreased the number of emerged adults. Females were (average) 1.6 times heavier than the males, but were 2.5 times more radioactive. (CA 50: 10286g, 1956)

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Houseflies were either fed or injected with S$^{35}$-labelled cysteine, cystine, methionine, taurine or sulfate. Extracts, hydrolyzates, and feces were then analyzed by chromatography and autoradiography for radioactive metabolites. Cysteine-sulfinic acid, a key intermediate in sulfate formation, appeared on chromatograms of flies injected with cysteine-S$^{35}$. There appeared to be two pathways for the synthesis of taurine. Taurine seemed to arise from cysteine via hypotaurine. When methionine was the precursor, hypotaurine was not found in detectable quantities but there was an increase in cysteic acid, a recognized intermediate in taurine synthesis. In the latter case relatively more taurine-S$^{35}$ was formed than when cysteine-S$^{35}$ was administered. Sulfate-S$^{35}$ was not incorporated into soluble organic compounds. Taurine-S$^{35}$ gave rise to three unidentified metabolites, one of which may be isothiouronic acid. The results indicate that houseflies possess an active transsulfuration system. (auth.)

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Adults of Romalea microptera, the eastern lubber grasshopper, were fed cesium-137 in bean plants to investigate uptake and elimination of this isotope. A biological half-life of 4 to 5 d was obtained. In experiments where grasshoppers were allowed to feed repeatedly on cesium-contaminated food, the biological half-life was used to predict the equilibrium values. Most of the ingested Cs$^{137}$ was concentrated on muscular tissue, but some was also found in the digestive tract and reproductive organs. Only trace amounts were found in the exoskeleton. (auth.)

A study on Culex molestus which, in the larval or pupal stage, had been placed in solutions containing NaH2PO4 with an activity of 0.106 µCi/ml showed the radiation to be detrimental to the lifespan, sex organs, and reproduction rate of the mosquitoes. The general average activity of adult females appears to be 2.5 times higher than that of males. Pupal activity was found to be proportional to the initial uptake of the larvae. Larval saturation occurred on the 4th and 5th day (32,000 cpm).


Phosphorus was used in chemical and isotopic studies to trace the changes in the metabolism of phosphorus compounds in the tissues of the larvae and pupae of the oak silk worm. Intensity of the phosphorus metabolism at the beginning of the 5th larval stage of the caterpillar decreased, increased towards the middle and dropped again towards the end of that stage. The intensity of phosphorus metabolism reached its minimum on the 8th day of development of the non-diapause pupae. The intensity of phosphorus metabolism in the diapausing pupa reached its maximum on the 8th day.

(Fort abstract see Rezerat, Zhir. Biol. No. 4/22, 1956)


Fats do not affect the start of diapause in the oak tree silk worm. During the diapause only the metabolism of low molecular weight P compounds is observed. Intensity of glycine metabolism in the tissues of summer and hibernating larvae differs from the 1st of days of larval existence. (CA 60: 6691, 1958)


(See abstract for Demyanovskiy and Rusakova 1956.)

In the summer larvae the P metabolism decreases up to the 8th day of life when it increases again. In winter larvae only the low molecular weight P compounds participate in metabolism and the intensity of P metabolism in all tissues except muscle tissue increases towards the 8th day of life and decreases towards the end of larval development.


It was shown with labelled methionine that the protein metabolism in the diapausing pupae of the oak silk worm was on a high level in all tissues and especially in the muscles. The addition of vitamin B6 had no noteworthy effect on the metabolic rate of the proteins; there was a slight augmentation in the rate of fat metabolism. (CA 62: 2286f, 1958)


Third-stage larvae of Wuchereria bancrofti and Onchocerca digitata were obtained with a radioactivity that would enable them to be traced in the definitive host. This was 178 S counts/min in the case of the S. digitata larvae. The larvae had been produced in the respective vectors, Culex pipiens fatigans Wied., and Anopheles gambiae Wlk., which had been kept for one to several days during the second to third larval stages in baths of 90 (orthophosphate) of activity 1 µCi/ml. C. p. fatigans females were allowed to feed on human volunteers infected with W. bancrofti, and A. gambiae on cows infected with S. digitata. In spite of the large dose of radiation to which the filarial larvae were exposed in the mosquito their development was not seriously affected. The distribution of 35S in mosquitoes, pupae and infective filarial larvae were studied by means of autoradiographs. The highest amounts were found in the thoracic region of the male and in the ovarian region of the female mosquito. (From Helmi, Abstr, 26, 2: 90-1, for 1957)


A simple method of radioactive phosphates are obtained in individuals with non-active food. 32P and 33P was then counted. The results indicate that radioactive phosphates in the body. The loss of 32P from the pupal stage to the adult stage of blowflies is high as 99% of the original 32P is shed as phosphates in the adult body tissues have a lower activity level than in the pupa. (Service, AEC)


The distribution of 14C in different parts of the beetle. The internal organs were removed by dissection and counted. In the thorax, abdomen, and muscles, 8-9% of the 14C was in phosphatogenic form. The glycogenic system is known to be labeled.


Nymphs of Carausia pellucida were treated with an aqueous solution of 14C-acridine. The solution was fed to the nymphs after 14C-acridine was very high. The results indicate that radioactivity through muscle tissue was now treated. On the basis of results, it is to be readily detected with the aid of autoradiographs. (ACRIDINE FOR INSECTIONS)


Mulberry leaves were labeled with 32P in them. A series of experiments of the radioactivity were fed, these were failed in leaves sprayed on. The ingested radioactivity can be also tested and variations can be carried out in the spring and autumn (ca. 32P).

Gamo, T., Nihiyama, H. INFLUENCES OF RADIOACTIVE ISOTOPES UPON THE PHYSIOLOGY OF INSECTIONS. p.60-70 (Research Reports of the Faculty of Agriculture, University of Tokyo, Summary in English)

Ca32P2O7 was administered orally in the females. (32P) in the hungry state Ca32P2O7 was more quickly absorbed in the nervous system, sexual gonads.

A simple method of radioactive labelling of lucilia sericata larvae is described. More uniform count levels are obtained in individuals which have fed entirely on radioactive foods than in those which first fed on non radioactive food. The radioactive count rates of the larvae are correlated with larval live weight and the counting rates of resulting imagines correlated both with corresponding larval counting rates and with imaginal live weight. The loss of 32P in the larvae due to causes other than decay of the isotope is traced from the prepupal stage to 3 weeks after emergence. The first and major loss occurs at emergence, when about 10% of the original 32P is shed as empty puparium and meconium. Adult losers about 1%, per day. The distribution of 32P in the adult body of L. sericata labelled in the larval stage has been determined. The abdominal tissues have a lower activity than the rest of the body. (abstr. 147 in TID-3078, Technical Information Service, AEG)


The distribution of 32P in different parts of the body of Dendroctonus pseudotsugae Hopk., and its incorporation into phosphorylated intermediates was studied. Adult bark beetles were allowed to feed on 2,5% glucose solution containing 2.5 μC/ml 32P-labelled phosphoric acid for 2 days. Only 3% of the total radioactivity was removed by washing. Dissection showed that about 16, 14 and 35% of the remainder were in the head, thorax, and abdomen, and 6, 6 and 9% in the prey and wings respectively. In the alcohol extract, about 85% of the 32P was in phosphorylated intermediates, and in the water extract more than half was in the inorganic form. The glycolytic cycle is considered to be present in the beetle, since most of the phosphate esters that are known to be intermediates of glycolysis were found.


Nymphs of Camilla pellucida (Scud.), allowed to feed in the first instar for 24 h on wheat seedlings sprayed with an aqueous solution containing 100 μC in the form of phosphate ion, retained sufficient radioactivity for it to be readily detected with a portable Geiger counter throughout their development. Loss of radioactivity through excretion was very great at first, but decreased steadily and almost ceased 14 days after treatment. Loss of radioactivity through moulting was negligible. The survival of treated grasshoppers was as high as that of untreated ones.


Mulberry leaves were labelled with 32P by spraying with H32PO4, and silkworms were allowed to feed on them. A series of experiments were carried out in which groups of 100 worms were tested. Various levels of radioactivity were fed, the feeding of radioactive material starting at different larval stages. Counters were fed on leaves sprayed only with unlabelled phosphoric acid. The cocoons were weighed in each case. The ingested radioactive caused reduction in silk production. The results are tabulated. The hemolymph was also tested and variations in the radioactivity of different cell types observed. Experiments were carried out in the spring and summer.

Gamō, T., Nishiyama, H. SOME OBSERVATIONS OF BIOLOGICAL INFLUENCES OF RADIO-ACTIVE ISOTOPES UPON THE PHYSIOLOGICAL FUNCTIONS OF THE SILKWORM. (1) ON THE ABSORPTION OF Ca44 ADMINISTERED THROUGH THE MOUTH INTO SEVERAL TISSUES OF THE SILKWORM AND ITS INJURIOUS EFFECTS UPON THE RESPIRATORY FUNCTION. Shimbun Daigaku Sen Igakubu Kenkyu Hōrutsu (Research Reports of the Faculty of Textile and Sericulture, Shinshu University) 6 (1966) 37-41. (In Japanese, summary in English)

Ca44Cl2 was administered orally either (1) in the course of feeding mulberry leaves, (2) in the surface or (3) in the hungry state. The maximum quantity of absorbed Ca44 was found in the blood in (2). In the hungry state Ca44 was more quickly absorbed into blood than in the other two cases. Uptakes of Ca44 by the nervous system, sexual organs, fatty tissue, muscle, and the silk gland were measured 50, 30, and 20.
60 min after administration of Ca**Cl**₂. The nervous system generally took up the largest amount of Ca**²⁺**, and the sexual organs, muscles, and fatty tissue followed successively in this order. The injurious effects of Ca**²⁺** were asayed by measuring the O₂ consumption per unit weight of the silkworm larvae, pupa, and imago.


Ca**Cl**₂ solution was administered orally to silkworms at various growing stages, and variations in the blood picture were studied. Prothromocyte number was most extensively influenced by this administration and decreased to an average of 15% of the original value. The decrease in phagocytes was 63%, globule cells 67%, and eosinocytes 57%. The effects of radioactivity were greater in male than in female silkworms.


Attempts were made to show some sexual differences in the destructive influences of radiation upon the number of hemocytes of the silkworm. Just moulted silkworm larvae of the fifth stage were administered 0.1 cc of 0.2% solution Ca**Cl**₂ or 0.3% solution of H**²**³**³**O through the mouth. It was concluded from the results that the largest damage of Ca**²⁺** and H**²**³**³**O was inflicted on the prothromocyte, especially in the male silkworm. (NSA 15: 209A0, 1961)


The practical importance of such data for pollution problems is stressed. The elimination of radioactive substances (here, Sr**²⁺**, Ru**⁶⁷**, Cs**¹³**, Ca**⁴⁰**, from aquatic insects [Culex pipiens pipiens L., and Halesius intermedius Zett.), was, like accumulation, found to proceed in different ways, and to depend on the chemical element and the species. Mosquitoes eliminated Sr**²⁺** most slowly, caddis-flies Cs**¹³**, the accelerating effect of the addition of EDTA (the sodium salt of ethylene diamine tetra-acetate acid) was studied and confirmed except for Sr**²⁺**. Two tables list concentration and desorption in larvae, in clear water and EDTA.


The desorption of radioactive isotopes from mosquitoes (Culex pipiens pipiens L.), caddis flies (Halesius intermedius Zett.), and mollusks (Aplexa hypnorum L.) was studied in order to determine the remaining time in live organisms after they are transferred from contaminated media to clean water, and also to find the effect of water-soluble complex ethylene diamine tetra-acetate (EDTA) on incorporated radioisotopes. The tests were made in lake-water filled aquaria contaminated with Sr**²⁺**, Ru**⁶⁷**, Cs**¹³**, and Ca**⁴⁰**. The results show that EDTA aids the adorption process except for Sr**²⁺**. The uptake and desorption of Sr**²⁺** is slowest in mosquitoes; Cs**¹³** is the slowest in caddis flies; and Ca**⁴⁰** is the slowest in mollusks. An intensive adsorption of Sr**²⁺** and Ca**⁴⁰** was observed during the first 2-4 d, after which it was stabilized; desorption of Cs**¹³** was much slower. In spite of a high percentage of desorption, the organisms carry a considerable amount of the radioactive substance into the clean water. (NSA 14: 209A0, 1960)


In experiments, the following data were obtained on the concentration of various radioisotopes of EDTA on the content and fate of radioactive isotopes of Sr**²⁺**, Fe**⁵⁷**, Co**⁶⁰**, Zn**⁶⁵**, Sr**⁴⁰**, Fe**⁵⁷**, Co**⁶⁰**, and Ca**⁴⁰** in the water. EDTA is a powerful complexing agent, which affects the absorption and retention of radioactive isotopes in various organisms. EDTA also affects the absorption and retention of radioactive isotopes in the digestive system of various organisms.


Investigations on P**³**-labeled middew indicate that the chief site of absorption of P**³** in the intestine of grasshoppers is the hindgut. The chief site of absorption is the hindgut. Most of the P**³** is absorbed in the hindgut, but some is also absorbed in the midgut.
ON THE BLOOD CELLS OF SILK-WORM (Larvae) (In Japanese)

Stages, and variations in the blood by this administration and 
decocytes was 85%, globule cells 67%, than in female silkworms.

INFLUENCE OF RADIOACTIVE-RAYS ON THE SEXUAL DIFFERENCES 
NUMBER OF NEMOCYTES OF THE FEMALE LARVAE.

fluences of radiation upon the fifth stage were administered 
throughout. It was concluded from the decocytes, especially in the male

DESCRIPTION IN SOME AQUATIC 
Enclones (Onentology, Vienna 
ches Museum, Vienna). Vienna,

The elimination of radioactive 
Culex pipiens L. and female 
ways, and to depend on the 
caddis flies C. L. The accelerated 
Radium (tetra-acetic acid) was 
sorption in larvae, in clear water

CERTAIN REPRESENTATIVES OF 
(Russian)

(Russian), caddis flies (Halesus 
order to determine the retaining 
water, and also to find 
incorporated radioisotopes,

Ru, Ag, Ra, Co, and Cr). The 
rate and desorption of Ra is 
slowest in mollusks. An intensive 
newing that it was stabilized; desorption 
organisms carry a considerable

1. 6. О ВЛИЯНИИ ЭТИОЛОГИЧЕСКИХ 
СВОЙСТВ ВОДОЯЗЫЧЬЕВ

ИЗМЕНЕНИЯ ПИЩЕВАРИТЕЛЬНОЙ СИСТЕМЫ 
Culex pipiens pipiens. 
них действия водоносящих 
инsectes.

Gesova, A. B., Timofeeova-Roskovska, E. A., Timofeev-Rosovsky, N. V. THE EFFECT OF ETHYLENE-
DIAMINETETRAACETATE ON THE ACCUMULATION OF DIFFERENT ISOTOPES FROM AQUOUS SOLUTIONS 

Results are discussed on the effect of the EDTA complex on the accumulation of 11 radioisotopes by type of 
small red blood cells of the Heterobasid of Ceriph of Culex pipiens pipiens. The EDTA effect is based on the general physico-chemical 
the action of water-soluble complexes on the mineral metabolism in fresh-water organisms,

Groch, D. S., Sullivan, R. L. THE RATE OF RADIOPHOSPHORUS INGESTED BY HABROBRACON FEMALE.

The distribution of radioisotopes was studied in female wasps. Habrobracon juglandis, after a single 
feeding of RHD in honey. The biological half-life of RHD in egg-laying females is 3-5 d. 60% of the RHD lost 
appeared in the deposited eggs. The radioactivity of eggs rises to a peak the second day after feeding and 
drops sharply to a relatively low plateau. Radioactivity measurements were also made on excreta and 
various parts of the wasp. (CA 48: 6033g, 1964)

Hafner, T. H., Henry, S. M., Block, R. J. THE SULFUR METABOLISM OF INSECTS. V. THE ABILITY 
OF INSECTS TO USE SULFATE IN THE SYNTHESIS OF METHIONINE. Contr. Boyce Thompson Inst. 26, 6 

Na2SO4 was administered to 13 species of insects. The Japanese beetle, Popillia japonica New., was 
able to utilize the sulfur of Na2SO4 for the synthesis of methionine and other divalent sulfur-containing 
compounds. Of the remaining insects only the cockroaches, known to contain intracellular symbionts, 
were able to effect this reduction.

Hassett, C. C. RADIOPHOSPHORUS IN MOSQUITOES (Aedes aegypti). (abstr.) Fed. Proc. 9, 1 pt. 1 
(1960) 68.

Data are presented showing paths of absorption of RHD and its distribution in the tissues of Aedes aegypti, as 
studied by autoradiographs and by Geiger-tube counting techniques. (B. Ag, 14: 5840, 1950).

Hassett, C. C., Jenkins, D. W. THE UPTAKE AND EFFECT OF RADIOPHOSPHORUS IN MOSQUITOES.

Throughout most of the laboratory experiments the yellow-fever mosquito, Aedes aegypti, was used, 
but additional tests were made on the A. Aedes aegypti, and the culicine mosquito, A. quadrimaculatus. All species became radioactive under treatment. The degree of radioactivity of the 
adults depended on the age of the larvae at the time of treatment, the concentration of radioactive 
adults for large-scale uses was treatment of late third- and fourth-instar larvae with about 0.1 μg of RHD 
per larva in 1 ml of water. Both higher and lower concentrations of RHD resulted in adults with lower radioactivity. 
Females contained about three times as much phosphorus as males. The larvae are able to 
concentrate RHD at least 75 times its concentration in the medium, P enters the mosquito larvae through the 
gress, from ingested food, through the anal gills, and perhaps through the integument. Removal of the 
anal gills retards the uptake of phosphorus but does not affect the final level. The distribution of the entering 
RHD is general throughout the organism, with somewhat heavier concentrations in the Malpighian tubules and 
in parts where rapid metabolic processes are occurring. Radiation effects were noticed at relatively low 
concentrations of RHD in the rearing medium (0.06 μg/ml) in the earlier instars. Resistance increased with 
age, but at concentrations above 5.0 μg/ml practically no adults emerged. Radiation effects, such as 
relegation or inhibition of growth, and death occurred at high concentrations. Mating and egglaying 
occurred normally in adults reared from larvae in RHD solutions of 1.0 or less μg/ml. Adult mosquitoes were 
also made radioactive by feeding them on RHD-labelled substances, such as animal blood, raisins, flowers, 
and sugar solutions. (from auth, summary)

Hassett, C. C. UPTAKE OF RHD BY PERiplANETA AMERICA: PASSEAGE THROUGH THE FOE-, MID-, 

Investigations on RHD-labelled phosphates introduced into the intestine of the cockroach show that the 
mixture is the chief site of absorption. Other factors affecting movement of phosphate ions through the 
test has been examined. KCN, for example, has no inhibitory effect; low temperatures decrease 
rate of passage.

73
corporation of inosine sub- spi- apeptic conditions and at a

Hitchey, J.D., Cotry, V.P., 3D.
LEISM OF CYSTEINE-34 BY
189-200.

S4-labelled cystine fed to
hydrolysat and extrac std
peaks o radioactivity after
retained in the body and pa-
af after it was formed, File

Hoeve, H., Mysen, W.C.,
MADERAD (abstr.), Ent.

Irwin, R.L.B., Spinks, J.W.

Eggs of Canton Special stock
Alternate radioautographed
PA were heavy in fat body
centrations of PA occurred
PA in early pupal stages, the
in the adults, the gonads, s

Iyengar, R., Panigel, M.
DOMESTICUS. C.R. Acad.

Plussieurs gérations de Dros-
la grande partie du phosphate
s des cinq premiers jours de
La auteurs ont poudre le
rapide des phosphates. On s
ondra de la souse-
contenants d'une solution
3e partie et l'aille poisse-
lubes de Malpighi qui ob-
excitation. Par la suite, la

Khedovats 1959 - [337]

King, R.C. STUDIES WITH
ADULT D. MELANOGAS
155, 1 pp.

The turnover of phosphorus
studied utilizing 3P6. The he-
adult D. simulans males are
by two phase systems. The
because their fast phase has
slowly than females because

(This work is followed up in)

Heller, J., Kojnacki, T.
PYROPHOSPHATES IN THE HAWK-MOTH, CYCLOCEPHALUS. III. TRACER

A study is reported on the incorporation of 32P-labelled orthophosphate in the pyrophosphates of the ejaculatory duct of the adult male. Data is presented which proves the enzyme found by Heppel and Hillman in bovine sperm to be present in the genital passage of C. euphorbiae.


The genital pouch and the spermduct of the male moth are rich in pyrophosphate which originates from nucleotide phosphor. When 32P is injected into the abdomen of males immediately on hatching or 3 days prior to the male metamorphosis is found in the same location. After mating, the pyrophosphate is not rediscovered in the egg.


The intermediary metabolism of inorganic sulfur into organic compounds in cockroaches was investigated by either feeding or injecting Na2SO4 into Blattella germanica (L.) and Periplaneta americana (L.).

The possible role of the gut microorganisms and the intracellular symbionts of B. germanica on the metabolic pathways was studied by determining the 35S-labelled compounds developed in normal insects and artificially reared insects containing the symbionts and in cockroaches freed of symbionts. In both normal and aspecfic insects the 35S was found primarily in glutathione, cystine, methionine, and methionine sulfoxide and only in limited quantities in taurine, sulfate, and several unidentified compounds. In symbiont-free B. germanica the 35S was detected only in sulfate and two unidentified compounds. (auth.)

(See earlier report in Bull. ent. Soc. Amer., 5, 3 (1959) 141, abstr. 277 under "Sulfate utilization and the role of intracellular symbionts in cockroaches (Orthoptera: Blattidae)."


The labelled-pool technique of Winteringham (1956) was applied to the study of 32P-labelled compounds in Periplaneta americana nerve extracts. Seven days after injection of 400 μc of carrier-free 32PO43-

The abdomen of each cockroach was opened and part of the ventral nerve cord dissected free from all other tissues. Only actively conducting cords, as indicated by electrical monitoring, were used. The cord was raised clear of the animal on hooks, the whole preparation flooded with liquid nitrogen and a cord sample rapidly transferred to a glass homogenizer immersed in liquid nitrogen. Six to ten samples were extracted three times with N-formic acid in 0.5% aqueous ethanol and the combined extracts analyzed and resolved into five fractions (I-V) by ascending paper chromatography at 5°C in the acetone/formic acid/water solvent of Burrows, Gryllis & Harrison (1955). Some constituents have been tentatively identified by co-chromatography. The amounts of 32P in fractions II, III, and IV, measured by radiometric scanning (Winteringham, Harrison & Bridges, 1962), have been expressed as percentages of the total 32P in the three fractions. Where DDT was used 100 μg was applied topically in 5 μl of acetone 24 or 48 h before dissection. Animals showing early (Tremulous) and later (Pronounced) signs of DDT poisoning were used. Results and identifications are discussed.


Adult male and immature B. germanica (L.) can utilize inorganic sulfate for the production of both cystine and methionine. The sulfate ion was provided in the form of trace amounts of H32SO4 which was offered ad libitum at 0.0126 molar/ml. The procedures followed for chromatography and radioactivity are described. The two amino acids appear to be synthesized by independent enzymes. The degree of utilization depends on the developmental stage of the test animals: growing nymphs use sulfate at a more rapid rate than do adult males. The rate of utilization also depends on whether or not the insects are reared asexually. The in-
The metabolism of inorganic sulfur into methionine and cystine can be carried on to a moderate degree under asptic conditions and at a high rate under non-aseptic conditions.


Figures and labels are not included in the text representation.

The distribution, concentration, and turnover of phosphorus in the tissues of Drosophila were studied utilizing tracer techniques. Data are presented in tabular form on the distribution of $^{32}P$ in various tissues of totally labelled adult flies of both sexes. (NSA 7: 5011, 1953)


Male flies of D. melanogaster (I) and D. simulans turn over phosphorus more slowly than females. Both sexes of I turn over about half of their phosphorus by a fast phase and half by a slow phase. Tissue studies of I indicate that the majority of P is in the thoracic region, with large amounts in the hemolymph and head; 94% of the P in the female reproductive system occurs in the ovaries. Large amounts of P occur in the various parts of the male reproductive system with 69% of this P in the testes. During development, over 99% of the total P resides in the metamorphosed insect: 1% remains in the pupal case. The hemolymph of freshly hatched adults of each sex is quite low in P, but it rises with feeding. Calculated values are given for P turnover in a 24-h period by various regions of the adult body of each sex of I. (CA 48: 721R, 1956)


(See article in Amer. Nat. 88 (1954) 155-8)

The paper describes striking differences in the uptake of $^{32}P$ by adult of two related species of Drosophila (melanogaster and simulans) feeding on different yeast species (Saccharomyces cerevisiae, Candida albicans, Debaryomyces maltoclasti, Hansenula nubiloica, and Schizosaccharomyces pombe). It was found that phosphorus uptake by both species is increased on medium containing live yeast. The rate is increased more in females than in males. Phosphorus uptake is sometimes strikingly different for flies of different species feeding on the same yeast.


$^{32}P$ was employed as a tracer in a study of the phosphorus metabolism of yeast by adult Drosophila. Data are presented on the incorporation of P into tissues and eggs. P excretion, the relationship between endogenous and exogenous P and differences in P turnover demonstrated in male and female Drosophila. Female flies weighing 1.5 mg each, when fed $^{32}P$-labelled Saccharomyces cerevisiae ingested about 6 x $10^{-5}$ mg P per d per fly. An equal amount was lost during the day.

(See also INL-1979, Brookhaven National Lab., Upton, N. Y. 1954, 28p.)

King, R. C., Robinson, A. C. DISTRIBUTION OF CALCIUM IN ADULT DROSOPHILA MELANOGASTER. Science 125 (1957) 546.

Autoradiographic studies of Ca$^{40}$ localization in adult and larval stages of D. melanogaster indicate rapid transfer and storage in the excretory organs of the insect. It is concluded that the insect requires only trace amounts of Ca and that the concentration in the chonesomes is no higher than that in the cytoplasm and body fluids. (CA 51: 10772c, 1957)

The uptake of $^{35}S$ by silkworm larvae was studied, and the role of the digestive tract in phosphorus metabolism discussed.

Kogure, M., Yoshida, R. THE SILKWORM AND THE RESEARCH OF the Research Committee on Insecticide. 5th instar silkworms were fed with time and the concentration gland, Malpighian tubules, of the silkworm, together with one or possibly among the organs of Periplaneta. (In Japanese)

The fate of radiolabeled dibenzothiazole to the body. Periplaneta americana, the squash bug, Anasa tristis, the roach, Periplaneta americana, the cabbage caterpillar, Macroglossum stellatarum, the mustard green leaf beetle, Pterostoma secundalum, and the American cockroach, Periplaneta americana, together with one or possibly among the organs of Periplaneta. (In Japanese)

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The radioactive isotope was injected into the silkworms with $^{32}$P solutions. The distribution and time of the injection of $^{32}$P is discussed for various tissues (alimentary canal, silk gland, external gland, Malpighian tubes) and for blood and salivary gland, followed injection and also after administration of $^{32}$P-labelled mulberry leaf. Results on the uptake and translocation of $^{32}$P in mulberry trees (seedlings) are also summarized.


The fate of radioiodide was investigated in several insects: Aeschna sp., a dragon fly; the American cockroach, Periplaneta americana (L.); the German cockroach, Blattella germanica (L.); a cicada, Tibicen sp.; the squash bug, Anasa tristis (DeGeer); the larger cabinet beetle, Trogoderma versicolor (Cres.:); the loofhrot, Megacyllene robiniae (Pom.); the greater wax moth, Galleria mellonella (L.), the grey hair-bine caterpillar, Bouchardia egle (Druy); a mud wasp, Sceliphron semitorridum (Druy:); the yellow fever mosquito, Aedes aegypti (L.); and the housefly, Musca domestica (L.). Iodide, iodine, 2(-or 4)-monolodido-histidine, 3-monolodido-tyrosine, 3,4-diodotyrosine, and thyroxine have been recovered from various tissues together with one or possibly two unidentified iodocompounds. Isolation of the iodine intermediates varies greatly among the organs of Periplaneta and within the class Insecta. (from author summary)


The distribution and metabolism of certain radioiodine compounds and radioiodomethane within Periplaneta americana L. were investigated. In vitro metabolism studies supported the findings reported in part I, and further demonstrated that thiosulphate and thiosulphonate do not inhibit the extraction of iodine absorption. The biological half-life of iodine in cockroaches was estimated at 23-37 h. An examination was made of the in vivo metabolism of $^{131}$I-labelled monolodido-histidine and iodide, and of the excretory products. Distribution studies with radioiodide revealed that the cuticle was able to absorb iodine from the blood and the entire alimentary tract absorbed iodide more efficiently than the other internal tissues. Thiosulphate and resorcinol did not decrease the ability of cuticle to absorb iodine from the blood; they did, however, promote the concentrating ability of other most of the tissues. The fumigant, methyl iodide, was concentrated by the cuticle and hindgut, apparently undergoing rapid excretion. Compared with radioiodide, radioiodomethane was concentrated from the blood by the cuticle, muscle, nerve cord and Malpighian tubules. Distribution studies with labelled monolodido-histidine, diiodotyrosine and thyroxine indicated rapid excretion via the Malpighian tubules and the hindgut. (from author summary)

Lödick, M., UBER DIE AUSWAHL VON RADIOAKTIVEN, SEKUNDÄREN Natriumphosphat bei LUCANUS CERVIS L. (On the uptake of radioactive secondary sodium phosphate by Lucanus cervus L.) Z. vergl. Physiol. 34 (1952) 308-324. (in German)

The uptake and distribution of orally administered Na$^{32}$P solutions in the wings, legs and antennae of Lucanus cervus L. was investigated. Relative concentrations of radioactivity in different organs, and the effects of the level of the initially administered dose and of time are discussed. Use is also made of autoradiography. Thus, in addition to studying the distribution of radioactivity in the above organs, autoradiographs were further made of various fragments, muscle fibres, ovarioles, fat bodies, the intestine with the Malpighian tubules, the thoracic ganglion and the brain. The results are discussed.

Lödick, M., UBER DIE RADIÖTATIVER STRAHLENDEN DES INSEKTENFLÜGELS NACH FÜRÜERUNG MIT $^{32}$P-DINATRHEXHYDROPHOSPHAT. (Studies on the radioactivity of insect wings after feeding with $^{32}$P-labelled disodium hydrogen phosphate). Zool. Anz. Suppl. 16 Verh. dtsch. zool. Ges. 1953 412-7. (in German)

Different methods were used for labelling various insects by means of $^{32}$P-labelled Na$^{32}$P (direct feeding, via a radioactive bait, via an artificial membrane, etc.). The orthoptera, coleoptera, lepidoptera and heteroptera examined showed a distribution of radioactivity which corresponded to the system of veins in the wings. In the coleoptera examined (Lucanus, Melolontha and various carabidae) the elytrae were much more radioactive than the hind wings. The relative hemolymph distribution within the wing is discussed.
Among the orthoptera (Phyllocephala, Blatta and Gryllotalpa) the difference between the wing pairs is not so pronounced. In heteroptera (Rhodius and Triatoma) radioactivity originates almost entirely from the corium portion. Lepidoptera studies (e.g. Inachis (Vanessa) io L.) showed an apparently similar distribution in both wing pairs. Results of other workers are discussed.


Distribution was tested by means of autoradiography and a G-M counter. Both pairs of wings showed practically equal radioactivity, essentially concentrated in the veins of the wings. Radioactivity increases immediately after ecdision, followed by a drop. Dissected organs such as the intestine, the Malpighian tubules, muscles, fat bodies, the central nervous system, and chitin and the haemolymph were also tested for their activity, the intestine (in contrast to the Malpighian tubules) and muscles showing high values. The time for radioactive food to pass through the intestine of the larva is 1 24 to 3 minutes. Experimental results on pupae of Delphila euborae L. are also recorded, and some work on orthoptera and coleoptera, the orthoptera being intermediate to coleoptera and lepidoptera with regard to the localization and relative distribution of radioactivity from the wings. Details are given.

The following were studied: orthoptera: Phyllocephala germanica L., Blatta orientalis L., Gryllotalpa gryllotalpa L., Coleoptera: Carabus borusiniz L., Carabus auratus L., Carabus unicolor L., Melolontha vulgaris L., lepidoptera: Delphila euborae L., Vanessa io L.


The uptake, distribution, and excretion of copper by larvae of four species of Drosophila, D. ananassae, D. melanogaster, D. repleta, and D. virilis, were followed by determining activities of whole and dissected larvae at intervals after the feeding of Cu⁶⁵ in various media, at a series of copper concentrations.

(Abbreviated paper presented at the symposium meeting of the National Academy of Sciences, 5-7 Nov. 1961, Yale Unv., New Haven, Conn., USA)


A review article. For this bibliography, the sections dealing with autoradiographic localization of minerals are of interest. Autoradiographic studies of iron metabolism in larvae of various species of Drosophila (virilis, repleta, melanogaster, funebris) by means of Fe⁶⁵ showed some tissues to contain considerably higher iron concentrations in the nucleus than others. Results obtained with Cu⁶⁵ on the uptake, distribution and excretion of copper (D. repleta) are reviewed, and correlations between copper and fluorescence discussed, Radiocalcium gave no indication of nuclear localization in D. repleta. Work with radiobismuth is also mentioned. New methods and techniques and their possibilities are discussed.


The autoradioscope Cu⁶⁵ was produced by neutron irradiation. The uptake of copper by larvae of species of Drosophila (repleta, ananassae, melanogaster) traced by Cu⁶⁵ is proportional to the copper concentration in the medium over the range 0.25-100 μg Cu/g. Above this level uptake falls off, rates of excretion as well as distribution in the tissues have also been determined. From these data factors relating copper content of larvae to copper concentration in the medium have been calculated. Both counting and autoradiographic methods demonstrate that a large fraction of the tissue copper of Drosophila is in a form which is not demonstrable with autoradiographic techniques. Further support is lent to the hypothesis, previously advanced, of a profound difference in copper metabolism between two of the major subgenus (Drosophila and Sophophora) of this genus. It is shown that Cu⁶⁵ ingested as part of the yeast cell is absorbed without an opportunity of mixing with stable tonic copper simultaneously ingested. Thus there appear to be at least two pathways of copper uptake, one for tonic, the other for bound forms. (From auth. summary)
ence between the wing pair is not
originates almost entirely from the
neon a apparently similar distribution

GENOMENEN 9p-DINATRIUM-
A 10 L. (On the distribution in the
key up on the larval stage).

301
Both of the wings showed
the wings. Radioactivity increases
the intestine, the Malphigian
and the haemolymph were also tested
and muscles showing high values.
It 194 ± 3 minutes. Experimental
the work on orthopedia and coleoptera,
to the localization and relative

Phalaenopsis L.

Harausus L., Carabus ulrichii

302
Sasaki, R. SOME OBSERVATIONS ON THE BIOLOGICAL INFLUENCES OF RADIOACTIVE ISOTOPES UPON
PHYSIOLOGICAL FUNCTIONS. In: International Conference on the Peaceful Uses of Atomic Energy,
The absorption of orally administered radioactive Ca\(^{45}\) (as C\(^{45}\)Cl\(_2\) solution) into certain tissues and organs of silkworm larvae (Bombyx mori) was studied on normal 5th instar larvae. Results are tabulated. The nervous system generally took up the largest amount of Ca\(^{45}\), and the sexual organs, muscle and fat tissue followed in that order. The injurious effects of Ca\(^{45}\) on respiration was checked. The distribution of P\(^{32}\) (administered intrahemorrhally or orally) was also investigated; further, the turnover of phosphorus compounds during metabolism, and the role of the alimentary canal in phosphorus metabolism. The excretion of considerable amounts of phosphorus in the later days of 5th instar is due to degradation in the silk glands and alimentary canal, and the diminution of absorption by the larva itself.

303
Semenova, I. M. STUDY OF THE PERMEABILITY OF THE INTESTINE OF SOIL INSECTS TO SALT BY
THE METHOD OF TAGGED ATOMS, FOR EXAMPLE THE LARVAE OF THE CRANE FLY, TIPULA PALUDOSA,
MITIG. (DIPITERA, TIPULIDAE). Zool. Zh. 36, 12 (1957) 1828-30. (In Russian, with summary in English)
Solutions of Na\(^{34}\)H\(_2\)PO\(_4\) and K\(^{34}\)H\(_2\)PO\(_4\) were made in concentrations employed for fertilizers in hydroponics: 0.005, 0.05, 0.5, 0.19. The \(^{34}\)P penetrated the larval cuticle in greater amounts than did \(^{32}\)P. The quantity of isotope permeating the cuticle was related to the concentration in the medium, but the rate of absorption was depressed by the higher concentrations of phosphate. The permeability of cuticle of these larvae was one-sided for the salts tested. (CA 82: 12924 d, 1968)

304
Sivarama Saiyty, K., Radhakrishna Murty, R., Sarma, P. S. ZINC TOXICITY IN THE LARVAE OF THE
RICE MOTHL, CORNEXA CEPHALONICA. Biochem. J. 52 (1952) 488-8.
The levels at which dietary Zn becomes toxic to rice-moth larvae have been determined. At lethal levels (1.0% ZnCl\(_2\) in diet) supplementation of the diet with vitamin B\(_4\) or liver extract checked mortality. None of the B vitamins except thiamine and B\(_4\) was effective in reversing the inhibition of growth induced by 0.4% ZnSO\(_4\). Vitamin B\(_4\) was more effective in prolonging the survival of the larvae than in promoting growth in this condition. Liver extract, as well as its alkaline-stable fraction, partially reversed the inhibition of growth from Zn toxicity. Deoxyribonucleic acid and ribonucleic acid at 0.5–1.0% levels in the diet reversed the inhibition of growth from Zn toxicity completely. Dietary deoxyribonucleic acid did not influence the uptake of Zn\(^{65}\) from the diet. (CA 50: 189146, 1958)

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Slipka, J. INTAKE OF I\(^{125}\) THROUGH CUTICLE OF LARVA OF TIPULA MAXIMA. Biol. Litr. Prague 32
Preliminary experiments were performed in order to explain the metabolism of iodine in its relation to proteins, especially to arthropods, present in cuticle of arthropods. Iodine reacts with tyrosine present in arthropodin, and mono- and di-thio-tyrosine are formed. Living larvae were exposed in water to I\(^{125}\) for 24 h, then fixed in Carnoy's liquid, embedded in paraffin, and cut in sections 10 µ thick. Autoradiographic analysis demonstrated that I\(^{125}\) accumulated in the outermost layer of epicuticle (which is free of chitin). Greatest intensity of β- and γ-radiation was in the region of anal papillae. (CA 48: 72114 d, 1954)
Early and late 4th instar larvae of C. pipiens placed in tap water containing $^{22}$H for 24 h and then removed to plain tap water followed in 24 h by removal of the Malpighian tubes show great accumulation of $^{22}$H in the tubes near the time of pupation, and the amount remains constant during the rest of metamorphosis.

The majority of the $^{22}$H is in material soluble in 10% $\text{CCl}_2\text{CO}_2\text{H}$ and is localized in granules (probably polyphosphate) of 1-5 $\mu$m diameter which appear in the Malpighian tubes near pupation and which show a strong affinity for basic dyes and are soluble in 10% $\text{Cl}_2\text{CO}_2\text{H}$ or 2% $\text{HClO}_4$. Accumulation of $^{22}$H in the granules also occurs if the gut does not show radioactivity; this shows it must be taken up from the blood. In the change from early 4th instar larvae to early pupae the amount of $^{22}$H extracted by $\text{Et}_2\text{O}$ falls (35.4 to 24.7%), while the amount extracted by 2% $\text{HClO}_4$ rises (22.4 to 46.3%), and that extracted by 10% $\text{HClO}_4$ falls (28.8 to 21.0%). It has been shown (unpublished) that the phosphorus arises from histolyzed organs (especially the gut) during metamorphosis and this is taken up from the blood by the Malpighian tubes which are thus active in the regulation of the phosphorus balance.


The influence of DDT (I, Lindane (II), methyl-Parathion (III), and Rotenone (IV)) on the distribution of radioactive phosphate in the different tissues of the cockroach Periplaneta americana, and the incorporation of radioactive phosphate into phosphorylated intermediates in the nerve cord and the femur muscle of the insect were studied. Radioactive phosphate injected into the abdomen of the insect translocated quickly to the head, legs, wings, nerve cord, and femur muscle. The fate of the distribution of radioactive phosphate in the different tissues of the Insect body was similar to that of other insects which consumed orally radioactive phosphate: 6-8 h after the injection, the order of the accumulation of radioactive phosphate in the tissues was gut > nerve cord > legs > head > wings. The radioactive phosphates of intermediates contained in the nerve cord and the femur muscle were traced by paper chromatography, Chromophosphate, ATP, ADP, glucose-1-phosphate, glucose-6-phosphate, fructose-6-phosphate, hexosediphosphate, 3-phosphoglycerate, and 2 unidentified compounds were found in the nerve cord, while the same 8 compounds and 6 unidentified compounds were found in the muscle. In both tissues, most radioactive phosphate esters which are known to be intermediates of glycogen were also found to be present in both tissues, but in relatively small amount. The ratio of orthophosphate-$^{32}$P to ATP + ADP-$^{32}$P was higher in the muscle than in the nerve cord. The incorporation of radioactive phosphate into phosphorylated intermediates in the nerve cord and the muscle was inhibited by treatment with insecticide in the following order: III > I > II > IV. Also, the incorporation of radioactive phosphate into lipids and residual parts in the trichloroacetic acid-insoluble fraction was inhibited by III or I, II and III had a little effect on the incorporation of radioactive phosphate into the above fraction.

(CA 51: 9070, 1957)


The exchange of $^{23}$Na$^{18}$O-labelled sodium between the external medium and the haemolymph and whole body was investigated in the larva of A. aegypti. The time for half exchange was $<60$ h. Most of the exchange of labelled sodium was found to occur through the anal papillae, although smaller amounts entered the haemolymph through the gut and general body surface. Transfer constants were used to describe the resultant turnover of labelled Na in the whole system. The rate of uptake of Na was independent of the external concentrations used in these experiments, K-foms do not compete with Na for uptake, which suggests separate mechanisms for the accumulation of these two ions. The effect of temperature on the rate of uptake of labelled Na was also investigated.


I-metabolism in third instar larvae and pupae was studied by means of a Geiger counter, histochromatography, and filter paper chromatography. The I was concentrated by the skeletal parts of the larva; the tanned larval structure, i.e., hexosyphagnales armature and spinacles, concentrated somewhat larger quantities of I than the untanned larval skin. The tanned paparia likewise showed an concentration higher than that in the untanned larval skin. The pupa, case, in contrast to fresh larval skins, incorporated I non-metabolically when placed in an 1 solution. Data obtained from Geiger counts suggested that I was accumulated by the larval ring gland. A region cribed. Black pigment form. The region is biologically associated with somewhat narrowed endos of a BaO$\text{H}_2$ by scanning the chromatogram with iodine; it is suggested that it (aud.)

Winteringham, F.P.W., L. MUSCA DOMESTICA. (ab.)

The distribution of phosphorus study the biochemistry of insects feeding and killing the insect compounds contained in the food. Subsequent quantitative data radiography demonstrated a

Winteringham, F.P.W., B. WITH LABELED SYSTEMS MUSCA DOMESTICA. L. As disturbance by an insect be of significance in the insect domestica L., was studied by becoming labelled, extracting and resolving them by means of paper chromatography. This paper containing an investigation of the internal distribution found is described.


In order to facilitate interpretation of the soluble phosphorus compounds were studied alone. The two were uniformly labelled with $^{32}$P. The presence of $\sigma$-glycerophosphate normal activity was observed to cause an accumulation of $^{32}$P, a fall in head ATP which caused anaesthesia, injected water thoracic P compounds could be no tropes.

Wyatt, G.R. PHOSPHORUS "Proceedings of the 4th Intern. London, Pergamon Press, 1971." The importance of P metabolism studies on Ctenopoma between the blood and the thoracic pupae in diapause and adult rate of exchange are discussed. Increased above that in diapause to be produced more or less on S$^{32}$P had been injected into pupae acids in insect development,
The Malpighian tubes during feeding in Drosophila melanogaster are filled with food for 24 hours and then removed. During this time, the insect loses a large amount of food in the form of food droplets. The food droplets are then removed and the tubes are examined. The food droplets are then subjected to a series of chemical and physical analyses to determine the composition of the food droplets. The results of these analyses are then used to determine the nutritional value of the food droplets for the insect. 

1. The chemical composition of the food droplets is determined by analyzing the droplets using a combination of gas chromatography and mass spectrometry. The results of these analyses show that the food droplets are rich in carbohydrates, proteins, and lipids. The carbohydrates are mainly in the form of sucrose, while the proteins are mainly in the form of amino acids. The lipids are mainly in the form of triglycerides.

2. The physical properties of the food droplets are also determined. The droplets are found to be highly viscous and have a high density. The high density is due to the presence of a high amount of food droplets in the tubes. The high viscosity is due to the presence of a high amount of lipids in the droplets.

3. The nutritional value of the food droplets is determined by analyzing the droplets using a combination of nutritional assays and dietary assays. The results of these assays show that the food droplets are a rich source of nutrients for the insect. The food droplets are rich in proteins, carbohydrates, and lipids. The proteins are rich in essential amino acids, while the carbohydrates are rich in simple sugars. The lipids are rich in essential fatty acids.

4. The food droplets are also analyzed for their ability to support the growth of the insect. The results of these analyses show that the food droplets are able to support the growth of the insect. The food droplets are able to provide the insect with all the necessary nutrients for growth.

5. The food droplets are also analyzed for their ability to support the development of the insect. The results of these analyses show that the food droplets are able to support the development of the insect. The food droplets are able to provide the insect with all the necessary nutrients for development.

6. The food droplets are also analyzed for their ability to support the reproduction of the insect. The results of these analyses show that the food droplets are able to support the reproduction of the insect. The food droplets are able to provide the insect with all the necessary nutrients for reproduction.

The results of these analyses show that the food droplets are a rich source of nutrients for the insect. The food droplets are able to support the growth, development, and reproduction of the insect. The results of these analyses also show that the food droplets are able to provide the insect with all the necessary nutrients for survival.
In the spring of 1955 about a hundred Bombyx mori larvae were injected with polyhedral virus suspended in C-labelled amino acids and glycerol (about 10 µc per larva). Unexpectedly, the B-radiation inhibited the virus multiplication and about 40% of the silkworms overcame the virus infection and developed to adults. These produced eggs which still had enough radiation to be counted readily. The offspring from these eggs as well as the next following generation (in total about 20,000 individuals) were reared. Possible genetic effects of the irradiation are being studied in cooperation with Dr. G. Stelm. About 200 µg radioactive polyhedral bodies were purified from the 60 silkworms which died from polyhedral disease. This material was radioactive to the extent of about 1200 cpm per mg. The virus particles were liberated from the polyhedral bodies and separated from the polyhedral protein, and they gave about 3800 cpm per mg. Several injection experiments with this radioactive virus and polyhedral protein are under way with silkworm and gypsy moth. (auth.)

Les fragments de l'hypoderme ont été fractionnés: omminge, xanthomé en fraction dont l'identification a été effectuée avec l'aide de trypanphane radioactivé.

Polyhedral were labelled with $^{32}$P and intact as well as inactivated $^{32}$P-polyhedral solutions were injected into larvae or pupae. About 0,125% of $^{32}$P is transferred from parental to offspring virus; the isotope in inactivated polyhedral crystals is assimilated in viral particles to almost the same degree. The incorporation of inorganic $^{32}$P into polyhedral also was about 0,1%. Vital P is transferred very feebly from pupa to egg. (CA 63: 223825b, 1965)

No accurate data is, so far, available on the distribution by worker ants of cuticular substances given off by sexually potent animals. Work was done on Formica polyctena Forel, $^{32}$P-labelled orthophosphate being injected by a glass capillary into the thorax. Autoradiography showed that radioactivity was distributed over the entire organism within 48 h. Precautions were taken to ensure that only cuticularly excreted radioactivity would be considered in subsequent measurements. Cuticular excretion in sexually potent animals was confirmed, and followed by an exponential law. Worker ants were rendered radioactive by licking, and being ticked in turn. The distribution of $^{32}$P was examined. Hypoderma gland cells and the gland complex of the metathoracic glands would appear to be responsible for substances excreted by the cuticle.

The ratio of females to males is correlated with the amount of sperm furnished in a single mating. This supply depends upon the condition of the male and the time spent in copula. Males labelled with $^{32}$P-thymidine were used to investigate the site of fertilization.

The speed of mixing in the blood of an injected solution containing $^{14}C$ was determined in the adults of the yellow meal worm, Tenebrio molitor Linnaeus; the squash bug, Anasa tristis (de Geer); and the haliotisn cabbage bug, Mugantia histrionica (Hain). Details of the techniques are given. The times required for uniform mixing of injected radiophosphorus are tabulated for the different species and appendages.


Thrips that are vectors of tomato spotted wilt cannot acquire the virus except by feeding on diseased plants as nymphs, though both nymphs and adults transmit it. The reason for this inability was investigated in tests with Thrips tabaci Lind. In the laboratory; both nymphs and adults were fed on radioactive sucrose solution and on radioactive leaves, and no effective difference was noticed in the amount of insect feeding at the different stages, nor could any physiological differences be detected. Some difference may nevertheless exist in the permeability of the midgut of the two stages, and it is further possible that the virus may be unable to multiply in the tissues of the adult.


Les pigments de l'hypoderme et des yeux du grillon Gryllus bimaculatus de Geer comportent au moins trois fractions: one imagine, xanthophorin et un pigment jaune, auxquelles il faut peut-être ajouter une quatrième fraction dont l'identité avec une rhodoméline est douteuse. L'origine de ces pigments a été étudiée à l'aide de tryptophane radioactif marqué au $^{14}C$. (auth.)


Les expériences réalisées avec des substances marquées au $^{14}C$ montrent que les pigments noir et jaune de la cuticule d'un Insecte (le Gryllus bimaculatus de Geer (Orthoptera)) - dont la formation est chimiquement distrete du processus de dureissement de cette cuticule - résultent tous deux du métabolisme de la tyro sine après la mue.


An improved method for the rearing of houseflies free of microorganisms is described. Eggs are subjected to tryptic digestion for 2 h, rinsed in water, placed in 1% calcium hypochlorite for 2,8 minutes, and rinsed again in sterile water. They are then suspended in 4% formaldehyde or tincture of zincarol chloride, shaken, and finally rinsed with sterile water. Bacteria-free colonies are then reared on a sterile medium prepared from Gainsed dog food and yeast. A procedure for maintaining sterility while adult flies are feeding on a synthetic medium supplemented with isotope-labelled compounds is described. (auth. - M.S.H.)


Autoradiographs prepared of 24-96 h old male and female larvae of D. melanogaster which had been fed standard food containing added radioactive glycine (2) (cf. Austerb, Heredity £ Suppl. 247 (1953)) for varying lengths of time showed that I enter the male and female gonads with equal penetration in all regions. The differential sensitivity shown by genetic techniques appear to be a result of differential response to the presence of I rather than of differential penetration. A positive autoradiograph indicates the presence of C$^1$ atoms but cannot determine the compounds in which they are present. (CA 50: 13308e, 1956)

* Kovář and Talmir 1959 - [412]

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ON RADIOACTIVE PHOSPHATE

virus or fed K$^{32}$O and then given the highest in virus obtained from the disease. Only a small growth of the virus; the infection is in inactive stage. The incorporation of inorganic phosphates from a root-petap egg. (CA 53: 22585b, 54: 12151a).

II AMEDEEN-BEICHEN, DURCHGE-

The most important thoughts presented in the various papers are summarized. A number of these studies included work with radioisotopes (Florkin, Bhideeswar, Fukuda et al., Wyatt, Winteringham and Cattia).


C4-carboxyl-14nulin, injected into the 5th instar Prodexa eridania (Southern Armyworm) larvae, can be recovered quantitatively from the blood, is not bound by the hemolymph proteins, and is neither metabolized nor excreted. A method employing C4-carboxyl-14nulin for the determination of tissue extracellular water, and hence the intracellular water content of insect tissues, is described. The method serves also to measure the total extracellular fluid volume of insects. Values are presented for the intracellular water content of the fat-body, gut and combined internal tissues of the mature Prodexa eridania larva, together with measurements of the total extracellular fluid volume. (Author summary)


Brief review.

Lu, C.-P. EFFECTS OF ATOMIC ENERGY ON SILKWORM AND MULBERRY TREE. J. agric. Assoc. China (Taipei) 18 (1956) 91-103. (Summary in English).

A review of Japanese investigations during 1950-6 on the use of Cs and P32 in varietal and pest-control studies. (CA 52: 4096f, 1958)


A l' aide de colorants vitaux et de %6, il est possible de déterminer le volume des liquides organiques composant l'hémolymphe. Ce volume est beaucoup plus élevé que celui que l'on trouve par "saligna" directe. Il semblerait que les Insectes ne possèdent pas de sang veineux, mais un liquide extra-cellulaire assimilé à l'hémolymphe, correspondant au sang liquide interstitiel des Vertebrés. (58 1-146, 178, 1958)


C4-labelled formate (I) injected into the female cockroach was incorporated into the uride C atoms of the uric acid recovered from the fat body. A rapid decrease in the rate of C14O2 production during the 16-18 h period following injection indicates that I rapidly becomes unavailable for oxidation. No significant amount of I was found in the excreta. Since the activity in the fat body uric acid accounted for only 3-5% of the injected activity, the major portion of the I must be incorporated into urates not located in the fat body or into other metabolic pathways. It is postulated that a transformylase system similar to that found in other organisms accounts for the metabolism of I in the cockroach. (CA 52: 3893a, 1958)


Studies with C4-formate show that the adult cockroach metabolizes injected formate to serine and proline. In vitro studies with fat body tissue show that incorporation of formate into serine occurs primarily in the 6 position and the addition of glycine accelerates this process. Fat body can also incorporate C4-formate into uric acid, the majority of activity appearing at carbons 2 and 8 (urate carbons). (Author)


Larvae of bombyx mori were fed with Mona bombycis leaves, which were previously soaked in CoC12 solution. Vitamin B12(1) was assayed with the Euglena gracilis method on several organs of larvae, and the radioactivity of I fraction measured. A I fraction containing Co was found in the intestinal canal, and the amount of the fraction increased by administering Actinomycetes and or non-labelled Co as the I precursor. It was suggested that I was synthesized by Actinomycetes in the digestive tract of the worm. (CA 52: 11298a, 1958)

Ankermit 1958 - [1]

Comar 1955 - [160]

Jenkins and Hassett 1957 - [260]

Donnelly 1958 - [269]

Foott, W.H. PHOSPHORUS-BRASSICAE (BOUCHÉ) (DIPTERA). Two methods for tagging H. brassicae and consisting of spraying P32; some radioactive eggs were laid, but for a few days span and not all flies in a group occur within a few days. (Author summary)

Freedon, F.J.H., Spinks, J.W. Flies(PATIBRA-SIMILAE) A method for tagging large numbers of work in Saskatchewan during readily detected with a Geiger of a compound containing %32P their development. The treatment laboratory in small containers of granulated iron tube placed in motion by means of a paddle. Field tests, tagged larvae and were returned to the river. The tagged the stream, but only one was more tagged adults was believed

Hoffman, R.A., Lindquist, A. PHOSPHORUS. J. econ. Ent. In 1949 studies on the treatment Oregon, to determine its possible effect on egg production and respond in a medium containing %32P supported the results. It was economical and efficient method.


A method is described for labeling P. patagoniensis (Wied.) [Plasmodium patagoniensis (Wied.)] which was either Low activity was shown by adult %32P than did the males on all days of the feeding period was longer than radioactivity and M. domestica
I-C Insect Labelling

Survey Articles

Comar 1955 [769]
Jenkins and Hassett 1950 [808]
Donnelly 1988 [259]


Two methods for tagging H. brassicae (Bouché) with P32 were developed for studying the dispersal of adults, and consisted of spraying P32-labelled phosphoric acid or of feeding labelled sucrose solution. Although some radioactive eggs were laid, following the first treatment, it was generally found to reduce the life span and not all flies in a group necessarily received sufficient spray. The second method produced a significant count within a few days which was maintained for a considerable period beyond that of feeding radioactive material. Since there was no apparent effect on survival or oviposition, this method was considered satisfactory. It consisted of feeding P32 in dilute 1-1 mc in 100 cc of 5-7% sucrose solution.


A method for tagging large numbers of Simulium spp. for flight-range investigations, devised in the course of work in Saskatchewan during 1950-51, is described. Radioactive larvae, pupae and adults that were readily detected with a Geiger counter were obtained by keeping the larvae for 24 h in a very dilute solution of a compound containing P32 (0.12 mc/ml) and then returning them to non-radioactive water to complete their development. The treatment did not visibly harm the larvae or adults. Larvae were treated in the laboratory in small containers of water that was circulated and aerated with air jets, and in the field in galvanized iron tubs placed in the river and filled to a depth of 8 in with river water, which was kept in motion by means of a paddle wheel on a shaft driven by a larger paddle wheel dipted into the river. In field tests, tagged larvae and pupae were found as far as 250 yd downstream from the point at which they were returned to the river. Tagged adults were taken in cages placed over radioactive larvae and pupae in the stream, but only one was caught in the open, and this only 100 yd from the stream. Failure to find more tagged adults was believed to be due mainly to inadequate collecting methods. (From auth. summary)


In 1949 studies on the treatment of houseflies, Musca domestica L., with P32 were undertaken at Corvallis, Oregon, to determine its possibilities as a means of tagging flies for flight studies, and also to learn the effect on egg production and subsequent generations of flies. A few tests were also conducted with the blowfly Phaenicia sericata (Meig.). The flies were either fed sugar solutions of radioactive phosphoric acid or reared in a medium containing this radioactive material. In the preliminary tests flies were made radioactive by both feeding and rearing, the treatment had some effect on fertility, and when large dosages were fed some radioactivity was carried over into the next generation. Subsequent tests with known amounts of P32 supported the results. It was also indicated that feeding adult flies a solution containing P32 was the more economical and efficient method of tagging with P32. (Auth. summary)


A method is described for labelling adult house fly Musca domestica (L.), Callitroga macellaria (F.) and Lucilia cuprina cuprina (Wied.) (Phaenicia pallidicornis (Shanm.)), the most prevalent flies in trap catches in southeastern Georgia. P32 was either incorporated in ground fish or in milk fed to larvae and to adults respectively. Low activity was shown by adult flies from larvae reared in P32-containing media. Females took up more P32 than did the males on all the feeding routines. Females took up and retained appreciably more P32 when the feeding period was longer than one day, but males did not. C. macellaria attained the highest level of radioactivity and M. domestica the lowest. Adults from 1-6 days old showed only minor differences in initial
uptake of $^{32}P$ with a 1-2 day feeding period. The initial uptake of $^{32}P$ was approximately proportional to the concentration of $^{32}P$ in the various milk solutions within the range tested. Decline in radioactivity was influenced by different diets of the adult flies after $^{32}P$ feeding and may be correlated with the phosphorus content of these diets. Practical tests have shown that tagged flies can be detected in dead samples from trap catches in or on living material at bait stations. The former method is more efficient.

Khudakov, G. D. A METHOD OF TAGGING INSECTS BY GIVING THEM RADIOACTIVE ISOTOPES WITH FOOD. Byull. Moskov. Obshchestva Ispytatel'nykh Prir., Otdel Biol., 64, 3 (1959) 36-45. (Tr. from Russian) *)


Adults of Fannia cancellaria, were allowed to feed for 24 to 48 h on cotton pads saturated with milk or honey water containing concentrations of 0.8, 1.0, 2.0, 2.5, and 5.0 millieuries $^{32}P$/liter. Measurement of radioactivity at daily intervals after feeding showed that the $F$. cancellaria could be satisfactorily tagged for a period of 10-12 d with either honey water or milk containing 2.0 or 2.5 mc $^{32}P$/liter. Feeding for 48 h was not considered necessary. Dosages of less than 2.0 mc $^{32}P$/liter provided insufficient activity. A technique for rearing $F$. cancellaria using a standard CSMA media with twice the normal volume of water, was devised. The method provided unlimited production of adults, the cycle from egg to adult requiring 14 d. Tightly-corrugated cardboard placed over the rearing medium provided a highly satisfactory pupation site.

* King and Wilson 1964 - [391]

MacLeod and Donnelly 1967 - [77]


An account is given of experiments carried out in Ontario in 1950, in a field of early tumpies that was heavily infested with $Hylemya$ spp. early in the season. On 4th July, a dilute solution containing $^{32}P$ was poured on the soil at the base of the plants, so that two lots of 24 plants received total of 0.8 and 0.2 mc $^{32}P$, respectively, and a third lot was left untreated. Half the plants in each series were covered with a cheesecloth cage from 15th July to 14th August, and adults of $Hylemya$ taken in the cages were tested for radioactivity with a G-M counter. 10 taken on the plot treated with 0.8 mc $^{32}P$, 3 (all males) were radioactive, whereas none of 6 taken on that treated with 0.2 mc and none of 3 taken on the untreated plants were radioactive. Net sweeps were made twice in July and six times in August at 4 positions in the field, one including untreated plants and the most distant being about 300 yards away. The Anthomyia taken were killed and examined, but none was radioactive. Examination of one tumpie and the surrounding soil from the heavily treated lot on 19th July revealed 4 puparia and 2 larvae of $Hylemya$, all of which were strongly radioactive. Marking in this way with $^{32}P$ may facilitate the study of the dispersal, local distribution and habits of $Hylemya$ spp. and their parasites. (RAS-A 41: 379, 1959)


Experiments are described in which Callitroga americana were produced, labelled with phosphorus 32, by rearing in artificial medium containing $^{32}P$, and in natural hosts by administering $^{32}P$-labelled phosphoric acid to the host. Several dosages and variations of technique are described. The regional distribution of $^{32}P$ in larvae and adults was determined and the counting rates of eggs and larvae from flies reared on radioactive media are given. Callitroga americana is easily labelled with $^{32}P$. Only minor manipulation is required. For field studies a concentration of 0.2 mc $^{32}P$/g of artificial medium appears to give adequate labelling for positive identification of flies and their egg masses. (auth. summary)

* Roan 1952 - [96]


The authors describe a method for rendering insects radioactive by dipping them in a solution of phosphoric acid prepared from $^{32}P$, with or without a wetting agent, and give the results of experiments in which it was applied to flies. It was also used successfully with wasps, several species of Coleoptera, grasshoppers and leafhoppers, but caused a per insect depended on its

Воронин, М. В. АППАРАТЫ НАУЧНО-ТЕХНИЧЕСКОЙ ФИКСАЦИИ

Виду трудоемкости непосредственного измерения доз радиоактивных веществ в экспериментах, не обходимо использовать приборы, позволяющие проводить измерения с помощью радиоактивных меток.


The difficulties of feeding radioactive cable sometimes. An apparatus, Radioactive solution, in addition, therefore protected from external (Tabanidae) and other flies have been maintained unc

Aragão, M. B., Prota-Pessa (New radioactive method)

The larvae are bred in a nuclear solution. The larvae must be dissected or inoculated (1956)


A method is described in which choria nitrate, were identified of the mosquitoes, Anopheles is described. The results of this study

Dissanathie et al. 1966 - [345]

Dissanathie, A. S., Disana OF WUCHERERIA BANKROVIA

Attempts to obtain radioactive pupae fats were used, radio active Larvae, or, in few cases of strontium chloride to glands. Marking with Sr in bats as giving it in the results, which were not observed ill-effects were considered produced adults of high rac
emerging from the strongest concentration showed signs of retarded growth and the females did not feed. For the production of radioactive infective larvae of W. bancrofti, see Trena, B. Soc. trop. Med. Hyg. 50 (1956) 426. (R-A #47: 67, 1959)


Since larvae of uniform age are suited for tagging with NaH3PO4 solution, laboratory studies were undertaken to determine (a) the rate of egg production of adult females, and (b) the possibilities of delaying egg hatch so that eggs from several days could be combined. Experimental details are given. One million tagged females for dispersion studies can be obtained by (a) the collection of 100,000 pupae in a 2-day period and the rearing of the eggs produced in the first 4 days by the resultant adults, (b) by the collection of about 16,000 egg rafts within a 4-day period and the rearing of the resultant larvae, or (c) by a combination of methods (a) and (b). Based on inclement studies, production values are as follows: 36 egg rafts/100 females in a 4-day period, a mean of 158 eggs/raft, 98% egg hatch, 87% pupation and 92.4% adult emergence, with equal sex division. Exposure of 6- to 8-day-old larvae at concentrations of 100 larvae/l of water surface for periods of 24 h or longer in 0.05 to 0.1 mc NaH3PO4 will yield adults with activity levels detectable for a period of at least 2 weeks.

* Hassett and Jenkins 1951 - [272]


1. V pred polzuxi radioaktivnogo fosfora (v formе NaH3PO4 или K3H3PO4) можно легко пометить даже колоссальное количество мух и комаров на достаточно длительный срок. 2. Маршповая муха легко производит короткий имаго в течение 1-1,5 суток после вылупления из яйца радиоактивностью раствора 1 мкг на 1 мл. 3. Для маршповых комаров яйца весом в 2-3 дня до оккуляриации пожаренны (в количестве 10-20 штук на 100 мл) в бутылке микрофлорой среды, к которой добавлен Р2. Удельная радиоактивность среды доводится до 0,075 мкг на 1 мл. 4. Маршповая муха при помощи радиоактивного изотопа (Ca45) производит незаметно, так как она очень быстро выходит из организма насекомых, ввиду чего радиоактивность их во времени очень быстро уменьшается.


Any quantity of flies (Musca domestica, Calliphora) or mosquitoes [Culex, Aedes (diarmans, cataphylla)] may easily be labelled by means of NaH3PO4 or K3H3PO4. Flies are easily labelled by feeding the imagos sugar solution with added 32P (specific activity 15 mc/ml) for 1-1.5 days. Mosquito larvae, not more than 2-3 days before pupation (10-20 mosquitoes per 100 ml) are placed in a 32P-containing medium rich in microflora. The specific radioactivity of the medium is 0.075 mc/ml. Labelling of flies with Ca45 proved unsuitable since it was quickly lost from the insect body, with subsequent very rapid loss of radioactivity.

* Jenkins and Hassett 1951 - [110]

* Kuper and Pole 1952 - [401]

* Provost 1957 - [112]

* Provost 1960 - [113]


Tagged adults were obtained from 4th instar mosquito larvae (mostly Aedes sphenius (Theo), and A. campesi (D. & K.)) kept for 24 h in a 0.1 mc/ml solution of P32, at a density of 1 larva/ml of radioactive solution. After exposure the larvae could be returned to their normal, non-radioactive habitat for further development. Adults were acquired to retain readily detectable amounts of radioactivity. Field experiments were carried out with the above and, in addition, with A. flavescens (MBII) and A. dorsalis (MBIII) from spring flood pools. The short and reduced mortality caused by larvae assimilating lethal doses...

349 Zhadin, V.I., Ilinskaya, N. TAGGING INSECTS AND FISHES. Sovetskii biotest. Methods of labelling Musca using adding K3H3PO4 or NaH3PO4 solution. The glucose solution and remained easily detectable. (Culex) is also described with radioactivity.

* Zhadin, V.I., Ilinskaya, N. METHODS OF LABELLING MOSQUITOES USING ADDING K3H3PO4 OR NaH3PO4 SOLUTIONS. Sovetskii biotest. 1951. Mosquito larvae with radioactive water (10 ml/larvae) P32 was introduced into the water, larvae developed well, form pupae.


A preliminary note. In order that a detailed study of the action of this new material on insects that live in soil, it was necessary to tag soil-dwelling insects. After applying 0.2 ml of 0.34 M CaH2PO4 with 186 mc/ml of water to soil (5 cm deep), the No.77 greatly increased the survival of soil insects after washing. It was found possible...

* Banks 1954 - [58]

* Banks 1955 - [59]
spatial flood pools. The short exposure method reduced the possibility of over-exposure to surface irradiation, and reduced mortality caused by prolonged artificial lighting conditions. There is also less chance of the larvae assimilating lethal doses of Pt. The simplicity of the equipment and method is stressed.


Methods of labelling *Musca domestica* and *Calliphora vomitoria* by Pt in the larval and pupal stage, by adding PtCl₄ to milk or, for adults, PtCl₂ to a 25 glucose or galactose solution are described. The glucose solution had a specific activity of 1 mCi/ml. Within 24 h all flies were radioactive and remained easily detectable throughout their lives. A Pt-tagging technique for mosquitoes (Ades and Culex) is also described which represents a rather substantial modification of the technique of Jenkins and Hinsen, 1961. Mosquito larvae were obtained from reservoirs and pools, and put into wooden boxes filled with river water (10 ml/larva). At the 3rd or 4th stage, in any case not later than 2-3 d before pupation, Pt was introduced into the water (average specific activity 0.075 mCi/ml, or 0.008 mCi/larva). Under such conditions larvae develop well, form pupae, and later adults whose radioactivity remains high throughout their lives.

**Miscellaneous**


The wireworm, *Ctenicera aestuariensis* destructor Brown, was labelled by inserting a Co⁶⁰ wire into the body cavity of the larvae rather than by feeding. This has proved impractical for several reasons. External application is only appropriate between molts, because activity is shed at each ecdysis. The worm can be followed through a depth of several inches by means of an outside Ge-M counter. The method is applicable to studies on response to different conditions and investigations on other species.


A preliminary note, In order to study the overwintering habits of the boll weevil, *Anthonomus granis* Bob., it became necessary to tag several thousand adults with a material the activity of which could still be detected 5 months after application. The solution used were 1) stock solution: 5 mCi of Co⁶⁰ chloride in 0.2 ml of 0.34 N HCl was diluted to 10 ml with distilled water; 2) working solution: 2 ml of stock diluted with 198 ml of distilled water, giving a specific activity of 6.6 x 10⁸ cpm/ml. A wetting agent ("Tergitol No.7") greatly increased the activity of radioactive solution retained and reduced the amount removed by washing. It was found possible to obtain slow labelling of cotton plants by a Co⁶⁰ solution.
Berwig 1959 - [37]

Bjorling et al., 1951 - [607]


The methods described are suitable for obtaining radioactive host plants of insect populations in the field. All three techniques mentioned suffer from two disadvantages, namely, the translocation of P32 from the point of application is small and the distribution of tracer within the tree is localized. Similar results were obtained with Ca51 and rubidium-86 injected into yellow birch. Future methods will be carried towards methods of root application. These techniques were studied with a view to investigating the movement of the mealsy vector of wooly-shoot disease of caeco. Since the artificial release of labelled insects in the field is unsatisfactory in this case, it is aimed to achieve labelling of insects at their feeding sites under field conditions.


Colloidal radioactive gold, Au198, was added to food. Bees from a particular hive and from neighbouring hives were tested for radioactivity after certain time intervals. Radioactivity was found in nearly all bees of the hive within a few hours, and some bees were occasionally found eating to neighbouring hives. It could also be shown that the flight range was relatively small, and that the bees from each hive had their own narrow circumscribed field of action.


Techniques were devised for applying enough γ-emitter (ca. 0.1 μCi/insect) to forest insects, in this case primarily to Engelmann spruce beetles (Dendroctonus Engelmani Hopk.) to permit their being rapidly located when under the bark of trees or under debris on the forest floor. Na22, Se75Cl2, and NaI125 were used successfully, whereas Ag91mNO2 and Sr90Cl2 were toxic in the amounts required. The insects were apparently unaffected by the treatment.

Donnelly 1968 - [259]


In the course of investigations in Ontario on the dispersal of adults of Hylemya brassicæ (Bech.), two methods of tagging the flies with P32 were developed. In 1951, spraying about 40 caged adults with 0.5 μCi P32 (in phosphoric acid) diluted to 2 cm3 with distilled water resulted in counts per minute of 1200 - 1600 after 24 h, 200 - 1600 after a week and 400 after a fortnight, when only one fly survived. In 1952, similar treatment of 50 flies with 0.25 μCi P32 in 2 cm3 resulted in averages of 248 cpm after one day and 75 after 72, when all but two flies were dead. The radioactivity was not removed by washing, and radioactive eggs were laid by some females, indicating that the solution had been absorbed, but as the length of life was reduced and all the flies in a group might not receive sufficient spray, the method was considered unsatisfactory. About 100 flies that were allowed to feed on a solution of 0.5 μCi P32 in 100 cm3 3% sucrose solution from a Wick of dental cotton which was soaked in the solution every day, showed on average of 340 cpm after a week in 1951. In 1952, when flies were provided with a solution of 0.75 - 1 μCi P32 in 100 cm3 5% sucrose solution daily for 13 d, the average cpm rose from 200 on the second day to 960 on the 12th and fell thereafter to 150 on the 42nd, when only one fly survived. Females developed significantly more radioactivity than males, and some laid radioactive eggs; larvae from the latter showed no radioactivity. As a significant count for a considerable period after feeding with radioactive material ceased, and as there was no apparent effect on survival or oviposition, this method is considered satisfactory. (RAE-45: 344, 1957)

* Flemion et al., 1962 - [33]

355


Very general survey of the subject. Mention is made of Pennes' method. No details are given. - So.

366

Fredericksen, C.F., Lilly, V. TAGGING WITH RADIATION

Wireworms of the genus Meloe activity about 0.07 μCi of Ca51 reactions to 4 different soi... were studied. The subsequent... ina... some... is... - So.

388

Fuller, R.A., Spilks, J. W. INVESTIGATIONS ON SOIL-

The author describe experiment (Brown) and cutworms [41] for observations on the biologically energy of its γ-radiation minimizes corrections for the isotope with a long half-life. Wireworms are described, which were carried out by means to with in a to a depth of different thickness. The e... soil-moisture cond... followed; both rates and the... toxic for wireworm larvae, - So.

399

Gillis 1958 - [771]

Godwin et al., 1951 - [907]

Gilliland, R., Kloft, W. MIT CALOTERMES FLAVICOLLIS - Flavicollis means of Calotermes flavicollis.

Experiments were made over to termites. The dry wood is resistant to environments investigations (the insects were... fifth-instar larvae and "Pre" larvae do not feed for 4 d, some are trying to feed at... effects of C. flavicollis on technique for these tests can gnaw through material. A proof material, if the pheromone releasing mechanisms for... testing for repellency, sur
Food and Agriculture Organization of the United Nations, Rome, European Commission on Agriculture.


Very general survey of European research programs engaged on so far, and to be envisaged for the future. Mention is made of Finnish studies with CuI on the wheat bugs Dollycotis baccarum and Lygus rugulipennis. No details are given. - Some introductory reading is listed for the whole field.

Friedelreich, C. F., Lilly, J. H. MEASURING WIREWORM REACTIONS TO SOIL INSECTICIDES BY TAGGING WITH RADIOACTIVE COBALT. J. econ. Ent. 44, 4 (1951) 489-492.

Wireworms of the genus Melanurus were tagged with Co58 by having a small piece of cobalt wire (initial activity about 0.97 mc) cemented to the dorsal surface of the caudal segment after which the wireworm reactions to 4 different soil insecticides (Aldrin, Dieldrin, heptachlor or Lindane - almost pure γ BHC) were studied. The subsequent vertical and horizontal positions were determined by a G-M counter. Movement was found to be greatest in untreated soil, with greatest reduction in soil treated with Aldrin or BHC. Dieldrin had the least effect. However, all wireworms that entered treated soil and stayed in it were dead or moribund after 4 d, so that all the insecticides were toxic to them, and all from the boxes containing some treated soil were dead within 2 weeks, even though they had not actually entered the treated areas; some fungistic effect is thus implied. The wireworms in untreated soil survived normally.


The authors describe experiments carried out in Canada, in which wireworms [Ctenoides aceris (western Brown)] and cutworms [Oxya ochrogaster (Gr.)] and Aegialia orthogonia (Morr.) were marked with Co58 for observations on their behaviour in the soil. This material was chosen because the comparatively high energy of its γ-radiation makes detection possible through several inches of soil, and its long half-life minimizes corrections for decay; the larvae studied were slow-moving and unlikely to be lost, so that an isotope with a long half-life could be used without much damage. The technique and its effects on the worms are described, including the distribution of radioactivity within them. A number of experiments were carried out by means of a probe which allowed the positions of radioactive larvae to be determined to within 1 in to a depth of 5 in. Curves are shown to give absorption of γ-rays from Co58 by soil of different thicknesses. The effect of temperature on wireworms was tested. Wireworms were also offered alternative soil moisture conditions. In another experiment, the path of several wireworms seeking food was followed: both rates and routes varied greatly. Insertion of Co58 on wire into the body cavity proved highly toxic for wireworm larvae, but gave only a small percentage of mortality in cutworms.

Gillies 1958 - [711]

Goldin et al. 1957 - [99]

Görsche, K., Kloft, W. ZUR LABORATORIUMSRÜTUFUNG VON TELTILN AUF TERTIÄRFESTIGKEIT MIT CALOTERMES FLAVICOLLIS FABR. (Laboratory testing of textile fabrics for termite resistance by means of Calotermes flavicollis Fabr.). Ent. exp. et appl. 2 (1960) 266-78.

Experiments were made over a period of two years on the resistance of various materials, especially textiles, to termites. The dry wood termite, Calotermes flavicollis Fabr., was used as a test animal, as this insect is resistant to environmental conditions and it readily attacks hard materials. Quantitative radio-biological investigations (the insects were rendered radioactive by feeding them ph32-labelled filter paper) showed that fifth-instar larvae and "Pseudergates", which both feed actively, are good test animals. After mortuing, larvae do not feed for 4 d. It is advisable therefore to use large batches (30 larvae in each) to ensure that some are trying to feed at any time. Experiments should last 21 d at least. The method used in testing the effects of C. flavicollis on textiles, and the way the insect is acclimatized, are described. A useful new technique for these tests consists of pulling the textile into the metal frame of a projector-slide. Termites can gnaw through materials otherwise resistant when they are covered by a thin perforated film of termite-proof material. If the perforations are of the same diameter as the termite's head they serve as innate releasing mechanisms for "food-tunnel gnawing". This method should only be used in special cases, e.g. testing for repellency, surface hardness, etc. (auth. summary)
360 Jacob, J, Siritin, J.L. LABELLING OF INSECT SPERMATOZOA BY ADENINE-8-14C. *Experien*cia 14, II (1958) 402-3.

A labelling technique for mature spermatozoa of *Prinus hirtellus* (Coleoptera) and of *Drosophila melanogaster* is described. About 0.01 cm³ of a solution of adenine-8-C¹⁴ (20 μg/cm³, 9.6 μc/mg) was injected into each larva of *P. hirtellus* using a microneedle. *Drosophila* larvae fed on dead yeast medium containing adenine-8-C¹⁴ (10μc/cm³ of medium). Autoradiographs of sections, squashes or smears of adult tested were made.

*Kartman et al 1958* - 406


Experiments are described in which hoppers and adults of *Schistocerca gregaria* were fed on materials containing P³². This method would make it possible to mark hoppers, for which external markings are of no use because they shed their skins frequently. However, it would be costly and difficult. Unless some automatic recording device can be found, it seems that the radioactive isotopes have no advantages for colour paints for labelling adult locusts. (8A 29: 27205, 1955)


Locusts (Locusta migratoria L. and Locusta pardalina Walk.) were labelled with P³² in the nymph and adult stages. P³² was rapidly absorbed in the organic or inorganic form. Autoradiography showed differences in localisation of radioactivity, depending on whether the P³² had been acquired before or after reaching the adult stage. The author concludes, however, that without the use of some automatic recording device, radioactive labelling of locusts has little advantage over colour paints since these can be recorded by unraviled workers.

*Klopf 1960* - 27

*Klopf and Ehrhardt 1959* - 41


About 1900 ticks (*Amblyomma americanum* L.) were made radioactive by subjection in a solution containing P³² as sodium diphosphate and having a specific activity of 19 μc/ml. The ticks (in lots of up to 200) were confined in a filter funnel by a disk of 36-mesh brass wire, with a 1/4-inch hole in the center through which they were inserted. The solution was poured into the funnel, allowed to stand for one minute and then drawn off. This procedure was carried out three times with the same solution. The ticks were then transferred to clean petri dishes. They were measured for uptake and retention of P³² with a millicand-well G-M tube attached to an autoscanner. They were held in place individually under the window and 1 inch from it in a rubber retaining ring with a lead-paper cover on a stainless steel planchet. The mean counts per minute for lots of about 25 individuals treated 14 days in solution containing no feeding agent were 210 for males and 397 for females. Addition of a feeding agent to the solution did not increase uptake or retention of P³² but substantially reduced survival of female ticks. The use of feeding agents is therefore not recommended. (RAE-B 45: 115, 1957)


Experimental bees may be isolated on a cordovan, or by radioactive methods. Radioactive isotope of P³². Natural nectar was therefore sprinkled on the frame, either by Geiger counter or by X-rays. (10, 75%) were radioactive. In population the increasing bees are discussed. Radioactive tagged individuals, and removes trees advantage, however, of being harmless and a convenient method.

* Liesner 1960* - 406

366 Montreuil, M. MARQUAGE PAR RADIOACTIVITÉ DU CHIEN. *SA DESCENDANCE PARTHÉNIQUE*.

L'auteur décrit une technique de radioisotopes d'aphes (Aphis leguminosae). Le nombre de marquage d'aphes (Aphis leguminosae) est exposé à un rayonnement à la température de 20 mecières. Les résultats obtenus démontrent que le marquage par radioisotopes d'aphes est possible et utile.

367 Quinn, S.P., Hartwell, W.V., MEDICAL IMPORTANCE, P³².

Radioactive cerium (Ce³⁸) with P³² and P³³. It has a short-lived 8-electron, easily detected and isolated. The irradiation of 10 μc/ml, mosquitoes (Aedes aegypti) were exposed to water containing less than 10 μc/ml, a time of 60 minutes. The data show that the radioactivity of Ce³⁸ is not detectable amount of the isotope of diamantine-like isotopic ratio. The results show only very slightly below those obtained with the equipment. A disadvantage of the method is that it is carried out in an area in which there has been an enthusiastic decay of the Ce³⁸.


369 Rings, R.W. COMPARATIVE STUDIES ON THE DISPERSEL OF PLUM CURCULIO. *Laboratory and Field Investigations of Tagging Agents for Control of Pests.* Laboratory and field investigations for tagging agents for control of pests. The agents were tested on peach foliage, the results showed that the best tagging agent was 10% of the oil mixture, and that the agent had a relatively long lasting effect. This method is under study because of the short life of the oil mixture.

370 Rings, R.W., Layne, G.W., J. Econ. Ent. 66, 3 (1943) 770.

A good account is given of the use of the oil mixture (immersion or direct indoor spraying) for tagging agents.
were used, Pb and Sr were quickly absorbed by the peach foliage, optimum concentrations being 100 μg/ml and 2 μg/ml respectively. 85Sr(Na2) was unsatisfactory and replaced by Sr3+Cl-. Pb is suitable for dispersal studies but not for determining infestation sites. Zn was found to be either extremely toxic to foliage or else not to activate the beetles sufficiently. Attempts to produce Pb1-labeled foliage proved unsuccessful, partly because of uneven distribution, Co was absorbed unevenly by the weevils. Whereas they did not retain sufficient activity for exact site determinations, overwintering in the orchards could be confirmed after 5-6 months.


Radiation effects from internal ingestion do not appear to have any appreciable effect, but if any are discussed.

376 Somoalainen, E., Turpenheimo, M. MEDIA CONFAVING CARBON.

The mutagenic action of C14-w on media containing C14-labeled sucrose medium had a 1, 0.1, or 0.01 generations reared on these media in the technique of Demerec (cf. Ca 1935) 1-mo-medium (total radiation 1- to 3-mo-medium (1000) t a significant effect.


X-chromosomes of Pb1-treated females. Treated larvae were reared in Pb1-contaminated soil. 388 tested chromosomes 42 had Pb1-content of the sex-linked gene. An increase in the same frequency of recessive sperm. A fly reared in medium, a calculated total radiation, were recorded. For equivalent a (auth.)


55 fed as larvae on medium containing no radioactive material and reared to adulthood. The Pb1 content was determined in the eggs and recorded as the ratio of the Pb1 content to the medium, when the sperm sample...
timum concentrations being 100 μg/ml
of 60CoCl₂. 68P is suitable for dispersal
as a bait. It is extremely toxic to foliage or
beetles. The beetles were not
the orchard could be confirmed

Att. Sth. agric. Wkrs 59 (1956) 130,
the movement of white grubs through
the myriads of each grub. Details of the
conditions of ground cover to
Ant predation proved annoying.

APHILLA, BIERR. WITH RADIOACTIVE

Mass emergence of imagos occurs in
the fields. The following spring they
are water and 68P-labelled phosphoric
acid containing 100 μg of 68P per ml
of 0.5 m away. Two hundred were tagged
in the ground, some distance below
the moths up until the first frost
and detection of the imagos the

CAPTUS BATI BROWN (COREIDAE),
IN THE INSECT. Bull. ent. Res. 40: 3

containing 64Cu or 68P at the rate of
a 0.1% solution (pH 3-5), with original
a little NaCl (pH 1-2) with the
of the tarsal exoskeleton became radioactive
was distributed chiefly in the meriste-
more uniform. Nymphs reared
in such nymphs given 500 cpml above
68P is more suitable than 68P.
Several
ation, with palms spaced roughly

TREATMENT OF MOSQUITO LARVAE AND
(1) 34-7.

acidi into both larvae and adult
manipulating devices. Abdes striatus (Meig.)
round after they had been allowed
a solution intraperitoneally 24 h
activity was found in the abdomen and
reared in water having an unknown

I - D Developmental and Genetic Effects Incurred
Through Labelling

375
Kaplan and Sliten 1960 - (220)
Pavan, C. EFFECT OF RADIATION ON PUFS OF POLYTHENE CHROMOSOMES OF PHYCHNOCEA,
ANGELAEA. p. 42-56 in "Radiation and Radiation in the Life Sciences, 2nd Inter-American Symposium

Radiation effects from internally applied tritium (by injecting 64Cu-labelled thymidine) or external x-irradiation
do not appear to have any appreciable effect on pup formation. Techniques and implications of the results
are discussed.

376
Bommelhausen, E., Turpeinen, G., Nisti, R. MUTATIONS IN DROSOPHILA MELANOGASTER GROWN ON

The mutagenic action of 64Cu was investigated by rearing D. melanogaster individuals from eggs to adults
on media containing 64Cu-labelled sugars prepared photometrically by Cauna indica leaves. The culture
media contained 1, 0.1, or 0 μc radioactive per culture bottle. The male offspring of the first and second
generations reared on these media were tested for the presence of the X-chromosome lethals by the Muller's-
technique of Dement (cf. CA. 42: 7458c). The number of mutations observed in flies reared on the
0.1-mo-medium (total radiation approximately 75 μr) was not significantly different from 0. For the
1-μc-medium (800 μr) a significant frequency of mutation (2.5 - 2.8%) was observed. (CA 50: 170211, 1956)

377
Amazon, T.J., Irwin, R.L.B., Spinks, J.W.T. 68P-INDUCED LETHAL MUTATIONS IN DROSOPHILA,

X-chromosomes of 68P-treated wild-type D. melanogaster were tested for recessive lethal mutations.
Treated larvae were reared in food medium containing initially 6.5, 32.5, 65.0 or 162.5 μg 68P/ml. Of
285 tested chromosomes 48 had recessive lethals. The frequency of mutation was roughly proportional to
68P content of the food. An initial concentration of 18.8 mg 68P in larval food is expected to produce about
the same frequency of recessive lethal mutations as is obtained with 1000 r of X-rays applied to mature
spem. A fly reared in a medium having an initial concentration of 32.5 mg per ml receives, prior to
mating, a calculated total dose of 0.85 gram roentgen. At this dosage 4.2% recessive lethals
were recorded. For equivalent amount of ionisation 68P is apparently 2.3 times as effective as X-rays.

378
Batesman, A.J. THE TIME FACTOR IN 68P-INDUCED MUTATIONS IN MALE DROSOPHILA. Heredity 9: 2

53 fed as larvae on medium containing 68P were mated daily to fresh batches of attached-X yellow flies. The
mutation rate in daily sperm samples was measured as the incidence of non-yellow daughters (hyperplaid for a
deleted-X). The 68P content varied greatly during the life of the fly, according to the rates of absorption
and excretion as well as radioactive decay. The variation in mutation rate between daily sperm samples
was related to the 68P content of the fly, pupa, or larva and to the presence or absence of active food
medium, when the sperm sampled was in its hypersensitive stage, 7-8 8 before maturity. (auth.)
of embryos from eggs oviposited and ingested, with doses above 2000 μCi correlated with the level of injury caused by the effect of radionuclide formation of the radionuclide (Ca). Groesch, D.S., Sullivan, R.L. \textit{EMITTING ISOTOPES FED TO RADIATION RES., 5, 3 (1956) 211.}

Precision weighing is used to determine the activity of the isotope. The entire weight of the isotope was determined by precision weighing. The radionuclide must be obtained with high precision. The radionuclide was then diluted with a critical period of time after ingestion. Groesch et al. 1957 - [330]

Hahn, P.F., Haas, V.H., Wesson, D. A. \textit{MOUSQUETES (AEDES AEGYPTI) AFFECTED BY A TOXIC Mixture of 250 Aedes aegypti Plasmodium galloinae and the mosquitoes were provided a diet} of 250 μCi, and the radioactivity of about 30 μCi of nonradioactive glucose solution. The radionuclide was dissected for determination of its distribution, and the data indicated that the radionuclide was not only produced in D. virilis but also chromosomal rearrangements. The tolerance to such irradiation is considered to be high. (NSA 14, 1960) [383]

Darwish et al. 1958 - [383]

Disanazie et al. 1957 - [346]

Gamblin et al. 1960 - [361]

Groesch and Sullivan 1954 - [132]

Groesch, D.S. \textit{LETALITY INDUCED BY FEEDING RADIONUCLIDE TO MALE HABROBRACON. Amer. Nat., 90 (1956) 200-2.}

Feeding of P32-labelled honey to male wasps (starved) and subsequent mating under the experimental conditions described gave rise to a sex ratio of nearly 1:1 instead of the typical 60-70% predominance of females. In females similar feeding can cause permanent cessation of egg production. Even when successful, radionucluss feeding experiments show considerable less effect when males rather than females are used. In order to corroborate evidence of dominant lethality, the cocoons holding unopened pupae were opened and the contents identified as female pupae. Nearly twice as many unopened females were obtained from treated females as from controls. Possible reasons for the relative ineffectiveness of P32 fed to males are reviewed in terms of recent studies. Groesch 1968 - [1137]


Unmated females of Habrobricon juglandis, wild type 33, starved for 5 d at 30°C and then fed a droplet of white-clover honey containing varying doses of P32 delivered to the side of the storage vial to prevent external irradiation, were permitted to oviposit on two pre-mang carcerellar wasps. Collected eggs were incubated in mineral oil (m/μl) at 30°C for 48 h to test viability. At doses of greater than 500 μCi/g egg production was halted in a few days, between 50 to 200 μCi/g initial egg production was reduced, followed by recovery; below 50 μCi/g no decrease in egg production was observed. With doses above 200 μCi/g the viability of Habrobricon juglandis, wild type 33, starved for 5 d at 30°C and then fed a droplet of white-clover honey containing varying doses of P32 delivered to the side of the storage vial to prevent external irradiation, were permitted to oviposit on two pre-mang carcerellar wasps. Collected eggs were incubated in mineral oil (m/μl) at 30°C for 48 h to test viability. At doses of greater than 500 μCi/g egg production was halted in a few days, between 50 to 200 μCi/g initial egg production was reduced, followed by recovery; below 50 μCi/g no decrease in egg production was observed. With doses above 200 μCi/g the viability of

96
of embryos from eggs oviposited within the first 2/3 of life were correlated with the level of radioactivity ingested. With doses above 200 μCi/g the viability of embryos from eggs produced during the 2/3 of life was correlated with the level of ingested radioactivity. None of the animals showed a decrease in longevity as a result of radiation exposure. (CA 46: 766a, 1952)


Precision weighing is used to determine the amount of radiotrace required to cause temporary and permanent sterility. The entire wasp, Habrobracon juglandis, is weighed before and after feeding an honey adulterated with radioisotope. As shown by lowered egg production and hatchability, the descending order of effectiveness of the ingested radioisotopes is the same as the ascending order of physical half-life: \(^{137}Cs\), \(^{60}Co\), \(^{32}P\), \(^{54}Mn\). Permanent sterility was obtained only after feedings of \(^{137}Cs\) and \(^{54}Mn\). Experimental results support the concept that effectiveness of a given isotope is correlated with the number of particles received by an organism within a critical period of time after ingestion, and with the energy of these emissions. (auth. D. S. G.)

Grosch et al., 1967 - [832]


A total of 250 Aedes aegypti mosquitoes were allowed to engorge on chicks which were infected with Plasmodium gallinaceum and that showed many gametocytes in their peripheral blood. Thereafter 150 of the mosquitoes were provided daily with 5% glucose solution containing radioactive sodium acid phosphate (with a total radioactivity of about 30 mc of \(^{137}Cs\)). The remaining mosquitoes served as controls and were provided with nonradioactive glucose solution. Nine days following the blood feeding, 10 mosquitoes from each group were dissected for determination of the presence of oocysts in the stomachs. All 10 of the irradiated specimens contained oocysts, as did 8 of the controls. Five days later, mosquitoes from the two groups were dissected and no sporozoites were found in the salivary glands of the irradiated specimens, but 11 out of 15 control specimens showed these forms. The lowest activity for any salivary gland in the specimens administered the \(^{137}Cs\) solution was 334 cpm, while the average was 2400 cpm: calculations suggest a very high equivalent routigen dosage was delivered to the salivary gland tissue, despite the apparent absence of any detectable effects. The author concludes that the radiation delivered by the ingested \(^{137}Cs\) was sufficient to arrest the development of the parasites during the oocyte stage. (NSA 4: 4426, 1960)

Hassett and Jenkins 1951 - [272]

Hoffman et al., 1951 - [355]


Males show a higher percentage of sex-linked lethals than females. Developmental stages are very sensitive to radiation and fail to survive treatments which would result in very low mutant induction in adults. \(^{32}P\) is distributed among the head, thorax, gut, gonad and abdominal sheath in the ratio of 20:50:10:10:10 regardless of the total activity of the fly for males labelled as adults. Radioautographs (spermatothecae, associated organs of inseminated females) showed radioactive sperm. At least 20% sex-linked lethal mutation rates have been induced in adult males of an inbred Canton-S stock by the M6 technique. Out of a total of some 1981 X's treated so far, 90 sex-linked recessive lethals and 11 viable mutations have been recovered. By changing the initial activity - feeding time relations an increasing the number of \(^{32}P\) atoms in the medium while keeping the number of \(^{32}P\) atoms constant it is possible to expose different groups of flies to an equal flux of high energy \( \beta \)-particles from the medium but to an entirely different internal radiation dose from the radioactive decay of \(^{32}P\) atoms incorporated into tissue.


King, R. C. CALCULATION OF RADIATION DOSES TO \(^{32}P\)-LABELED MALE DROSOPHILA MELANOGASTER. Nucleonics 10, 11 (1952) 88-9.

A method is described for calculating the geometrical factor necessary for determining the radiation dose absorbed by the gonad of the male. A very simple model of a male fruit fly is proposed, consisting of 3 spheres of water, corresponding in weight to the head, thorax, and abdomen. A homogeneous distribution of \(^{32}P\)
atoms is assumed. It is calculated that about 12.6% of the total energy dissipated by particles originating from internally decaying $^{32}$P is absorbed by the tissue of male *D. melanogaster*. Radiation contributed to the gonad by $^{32}$P-labelled tissue of the head and thorax is negligibly small when compared to that contributed by abdominal tissues.

See also BNI-1300, Brookhaven National Lab., Upton, N.Y. 11p.

**387**

King, R.C. THE MUTAGENIC EFFECTIVENESS OF RADIOACTIVE PHOSPHORUS IN *DROSOPHILA MELANOGASTER* (abstr.). *Genetics* 37 (1952) 595.

The mutagenic effectiveness of radiophosphorus in *D. melanogaster* has been studied using the Muller-5 method for recovering sex-linked recessive lethal mutations. Methods are described for varying the radiation dose from the radioactive medium and the dose from $^{32}$P within tissue with respect to each other. The radiation dose from the medium is determined by actual measurement, while the radiation dose to the male gonad from $^{32}$P in tissue is calculated. It is shown that radiosensitivities of internally located $^{32}$P atoms are mutagenically effective. However, in the case of male *Drosophila* fed upon $^{32}$P as adults there is no indication that internal $^{32}$P is more efficient mutagenically than external $^{32}$P. Among the genetic changes recovered following $^{32}$P treatment are sex-linked recessive lethal and viable mutations, inversions and dominant lethals. $^{32}$P treatment also increases somatic crossing over and produces potential chromosome breaks leading to the production of unilateral mosaicism. The importance of this work in the study of genetic effects attributable to the actual transmutation of $^{32}$P to $^{32}$S is discussed.


**388**


Exposure of developmental stages of *D. melanogaster* to media of activities above 5 mc/g results in the killing of embryos, larvae, and pupae, in the retardation of development, and in the production of sterile adults. Females are more resistant to $^{32}$P treatment than males. The external radiation from the medium is shown to be relatively unimportant in killing insects. (auth.)

**389**


Freshly hatched males were given $^{32}$P-labelled food. Methods are described for varying the radiation dose from the radioactive medium and from $^{32}$P in tissue with respect to each other. The former is determined by actual measurement, the latter by calculation from the dose to the gonad from $^{32}$P in tissue. Radiations from internally located $^{32}$P atoms are shown to be mutagenically effective. Calculations lead to an erroneously high value describing gonad absorption of energy liberated by decaying $^{32}$P in tissue. Only 2% of such energy is absorbed in the gonad; 1.6 x 10^7 disintegrations/individual will produce a 1% sex-linked lethal mutation frequency. Some sex-linked recessive lethal and sex-linked viable mutations, inversions and dominant lethals were among the genetic changes recovered following treatment with $^{32}$P. It also increased somatic crossing over. Potential chromosome breaks leading to unilateral mosaicism were also produced. The significance of this work in the study of genetic effects in the transmutation of $^{32}$P to $^{32}$S is examined.

See also BNI-1357, Brookhaven National Lab., Upton, N.Y. 36p.

**390**


The effect of various concentrations of $^{32}$P in the medium upon the development of *Drosophila* was studied. Flies reared from a medium containing 50 mc/g of $^{32}$P--DPA showed high embryonic, larval and pupal mortality, and there was a retardation in development depending on the concentrations involved. Forti-all adults appeared in cultures containing 5 mc/g or lower. Concentrations low enough to allow complete development may produce sterility. Females, probably as the result of their X-chromosomal diploidy are more resistant to treatment than males. Under the experimental conditions applied here radiation from the medium is relatively unimportant in producing lethality. Of the energy liberated by $^{32}$P particles from decaying $^{32}$P in tissue sufficient is absorbed by the fly to account for the lethal effects observed.

**391**


*Drosophila* homogeneously on homogeneously labeled 3 mc $^{32}$P/g wet weight and in abnormally rich in phosphorus rises above 0.4%. A study of the highest $^{32}$P concentration of a larva was made to bradyogenesis. A homogeneously labeled Drosophila condition (1.24 mc/g/1 x 10^9 Drosophila with respect to each) and sex ratio of the mating is presented relating this to

Kogure, M., Nakajima, M. WITH MULBERRY LEAVES.

Kogure and Nakajima 1958

**392**

Natt, J. TRANSLLOCATION MELANOGASTER BY INSEG. Congress on Genetics, Mont.

The findings of Oftedal and mutation rate for sex-linked mutations might be due to the fact that the acute dose of radiation to sterile lethals has been determined. The genetic implications of this are not sex-linked as these be induced by radiations.


In previous communications *Drosophila* sparsomagensis, in the times of the total dose, half of the total dose fraction has been estimated to feeding 3-day old males with a test and then mating them for a few hours for testing. The percentage of the total dose obtained with acute dose during the first 24 h after ingestion of 1000 cpm in the fly as measured contained in the fly give a higher energy, approximately 3-4 different techniques.

(Anonymous of paper presented at 1956)

Oftedal, P. THE PREDCICTION 2nd UN International Conference Biological decay curves of $^{32}$P mutations after 1000 x-rays efficiency factors are given, the curve. It is not possible, from $^{32}$P ingestion could be explained were caused by the transmutation discussed.
Drosophila homogeneously labelled with $^{32}P$ have been produced by rearing flies for their entire life cycle on homogeneously labelled yeast growing on a solid $^{32}P$-labelled synthetic medium. Drosophila adults contain 3 mg $/g$ wet weight and maintain their phosphorus content at this level, even when forced to feed on media abnormally rich in phosphorus. Defense to adults occurs when the overall phosphorus content of all tissues rises above 0.4%. A study of the variation of $P$ content during development showed the egg to contain the highest $P$ concentration of any stage. The relation between total $P$ and wet weight for larval and adult larvae was found to be hyperbolic; for adult larvae, tachyhydric. The daily radiation dose to homogeneously labelled Drosophila developing on labelled medium was calculated. Under the experimental conditions ($1.24 \times 10^{-4} \text{rads} / \text{hr}$) at $T = 30^\circ$, no detectable difference was noted between labelled and control Drosophila with respect to egg hatchability, eclosion, time required for development from egg to adult, and sex ratio of the testing adults. Fecundity and fertility of $F_1$-labelled females was lowered, and evidence is presented relating this to transmutation of internal $P$ to $^{32}P$ rather than to ionization.


Kogure and Nakajima 1958 - (1147)


The findings of Ofredal and Monsign that incorporation of $^{32}P$ in sperm followed the same curve as the mutation rate for sex-linked recessive lethals in drosophila broods suggested the possibility that some of the mutations might be due to the distintegration of $^{32}P$ incorporated in the genetic material. In an attempt to elucidate this question the day-to-day mutation curve for II-III translocations was determined. After an acute dose of radiation to newly mated males, the daily sensitivity pattern for translocations and recessive lethals has been determined. If, after ingestion of $^{32}P$, an appreciable number of mutations is due to distintegration in the genetic material, and these distintegration are able to produce breaks leading to translocations as well as to sex-linked lethals, translocations should be found among the progeny of days 9 and later as there could be induced by distintegration in pronematoic sperm. No such translocations have been found.

Monsign, J., Ofredal, P. THE MUTAGENIC EFFICIENCY OF $^{32}P$ CONTAINED IN DROSOPHILA MELANOGASTER MALES. Radiation Res. 9 (1958) 156.

In previous communications concerning the incorporation and mutagenicity of radiophosphorus during Drosophila spermatogenesis, the authors have emphasized the difficulty of calculating the fraction absorbed in the testes. In the present paper this fraction has been estimated genetically. The genetic experiments have been made on mature sperm only, feeding 5-day old males which have not previously been mated, storing them for an additional 24 h, and then mating them for a few hours only to as to limit the variation in exposure time of the sperm utilized for testing. The recessive sex-linked lethal mutation rate in these sperm is then compared with mutation rates obtained with acute doses of X-rays. Taking into consideration the biological decay of $^{32}P$ in the fly during the first 24 h after ingestion, the result is found to be equivalent to between 1 and 2 $\times$ per hour per 1000 cpm in the fly as measured by our technique. Calculations based on the total amount of radioactivity contained in the fly give a total dose of some 50 rads/1000 cpm. Thus only a very small amount of the energy, approximately 0.5%, is absorbed in the testes. This agrees with King's (1950) results obtained by a different technique.


Biological decay curves of $^{32}P$ and $^{42}K$ in Drosophila males are shown, and recessive sex-linked lethal mutations after 1000 r X-rays, and mutation curves after $^{32}P$ feeding, together with theoretical curves, efficiency factors are given. A mutation curve is also shown for $^{32}P$ citrate injection, with theoretical curves. It is not possible, from the curves, to obtain insight into whether all the mutations observed after $^{32}P$ ingestion could be explained on the basis of radiation effects of $^{32}P$ in the fly or whether some mutations were caused by the transmutation of the $^{32}P$ incorporated into the sperm. The significance of the results is discussed.
Gamø et al. 1968 - [264]
Gamø et al. 1960 - [265]
Grosch et al. 1966 - [883]
Cytological studies with Trachea and spontaneous chromosome breaks in chromosome stability. The aneuploidy at which the cells pass, judgland, have shown that the apparently firmly bound in the incorporation of isotopes in the chromosome structure are dis...
MUTAGENESIS DURING SPERMATOGENESIS. The time as the genetic effect of the results are tabulated, and mutations in incorporation and mutation might be transmutation of $P^{32}$ atoms usual relationship, and (2) mutations and the whole correlation reflects the significance of $P^{32}$ IN DROSOPHILA SPERM.

401 Grosch, D.S., LaChance, L.E. FATE OF RADIOACTIVE P IN HABROBRACON FEMALES. Science 122 (1956) 141-2.

The tissue distribution of Sr$^{89}$ was studied in virgin females (wild stock 3R of H. juglandis, following feeding with Sr$^{89}$-labelled citrate in honey (277 $\mu$C/g of mixture), and maintained at 30°C. Eggs laid within the first days of feeding only showed some slight radioactivity. The radioactivity was mainly concentrated in the abdomen. Half the Sr absorbed is eliminated within a day. Irreversible sterility was produced in Habrobracon females.

Radiotracer techniques applied to ecology and dispersal studies are reviewed. In experiments on the radioactivity of Plasmodium gallinaceum, however, it was observed that ingestion of $^{32}$P by Aedes aegypti (L.) during the period of extrinsic incubation caused the development of the parasite to be arrested in the oocyst stage. The results are cited of unpublished experiments by the author and his associates in which bacteria labelled with $^{32}$P were used to study the persistence and multiplication of Escherichia coli in Musca domestica L., when ingested with food. The difficulty was to ensure that the tracer was chemically bound. Thus in one experiment in which the time and amount of regurgitation and excretion of the bacteria by the flies was checked quantitatively by plating bacteria and determining radioactivity, correlation between radioactivity and bacterial counts was good during the first few days of the test, subsequent accumulation of $^{32}$P in the flies implied that the bacteria were probably not tagged molecularly. Radionuclides for insecticides have proved very valuable for studying the site of entry or physiological action, and have also facilitated distribution studies on a treated surface. They have shown promise in assessments of the dissemination of sprays applied from aircraft.

* Jenkins 1956 - [73]
* Bruce-Chwatt 1956 - [109]


Culex fatigans larvae reared in baths containing varying concentrations of $^{32}$P as the orthophosphate developed into radioactive adults, the females having an activity 3 times greater than that of the males. Only adult females reared in a medium containing 0.1 $\mu$Ci/cm$^3$ took a blood meal, and they were fed on patients having a high count of filarial larvae of Wuchereria bancrofti. The activity of the microfilarial larvae isolated from the dissected mosquitoes was constant at about 120 $\beta$-counts/min. The successful tagging of filarial larvae will aid in studying their further development in the definitive host. (CA 61:1256g, 1957)

* Dissanaike et al. 1957 - [346]
* Dissanaike et al. 1957 - [208]
* Hartwell et al. 1958 - [71]
* Jackson and Maier 1955 - [68]
* Knapp et al. 1956 - [363]


Plasmodium gallinaceum was selected for tests because of the ready availability of gametocytes, the occurrence of cryptosporids at the site of inoculation, and the ease of rearing and maintaining the insect host, Aedes aegypti. An account is given of the methods used to produce radioactive oocysts of P. gallinaceum. Both $^{32}$P and $^{85}$S were used. Feeding the radioisotope to mosquitoes that had already become infected with malaria finally proved most appropriate as technique. Autoradiographs demonstrated early pre-erythrocytic forms of the malarial parasite.

I-E-2 ANIMAL

* Dissanaike et al. 1957 - [208]
* Hahn et al. 1960 - [384]


In the course of this review article data is presented on the direct observations of flea transfer between host species. Fleas and other arthropods were labelled with Ce$^{148}$. Fleas were bated for less than 5 min in aqueous solutions of Ce$^{148}$-Pr$^{148}$ containing 10 $\mu$C/ml. Tagging was accomplished by a stable combination of Ce with exoskeleton. Work is described on Malarzana telchilmium. Fleas were radioactive fleas were also reared under certain conditions, Fleas in all trials, tagged fleas showed no transmission after 56 days, 3.6 to 5.1 x 10$^{-6}$ conceals will also transfer to rats.

Bjerling, K., Liljell, D., O. PHOSPHORUS. Acta agric.

Preliminary experiments (labelled became radioactive when live 0.36 mc $^{32}$P). The radioactivity of techniques are given. Aphis radioactive plants. The radioactivity experiments which were carried on of aphis (M. persicae), $^{32}$P as sodium orthophosphate of the same centre could be studied, the distances covered, the effort points of view, including the (An abridged report was read published in the proceedings of)

* Cornwall 1956 - [104]
* Cornwall 1956 - [105]
* Day and McKinnon 1951 - [109]
* Day and Irishkiewicz 1955 - [363]
* Day and Irishkiewicz 1964 - [363]
* Klop and Kunkel 1960 - [286]

408 Liesering, R. BEITRAG ZUR KIEZILICHE KOCH (TETRANYCTIDAE) MECHANISM OF ACTION OF TETRANYCTIDAE IN ORDER TO SETTLE THE QUESTION OF WHICH BUT胸部 were labelled with $^{32}$P. This was activity from 1-2 mc/ml (P$^{32}$). A further 2 d were required before its saliva. Intermediate passive contamination of the insect and autoradiography that this result is of great importance is transmitted by insects and...
exoskeleton. Work is described on 2 rodents, Micromus californicus and Rattus norvegicus, and tagged fleas, Malaceus talhini. Fleas were found to transfer between individual Micromus. The data are tabulated. Radioactive fleas were also recovered from vole nests; radioactive fleas confirmed some ingestion of fleas. Tests with domestic rats showed that the fleas would transfer readily from the field vole to domestic rats under certain conditions. Fleas were combed from rats and also obtained from rat nests. Data are tabulated. In all trials, tagged fleas showed an initial average count of 0.2 to 8.5 x 10^5 counts/flea/min and, after 6-8 days, 5.6 to 5.7 x 10^5 counts/flea/min. Undoubtedly, other important wild rodents flea vectors of plague will also transfer to rats.

I-E-3 PLANT


Preliminary experiments (laboratory) showed that aphids (Myzus persicae Sulz. and Aphis fabae Scop.) became radioactive when living on broad bean plants watered with labelled sodium orthophosphate (0.06 - 0.35 mc P^31). The radioactivity of the aphids could easily be demonstrated autoradiographically. Details of techniques are given. Aphids retained their radioactivity for at least 2-3 weeks after removal to non-radioactive plants. The radioactivity was "inherited" by the offspring for at least 2 generations. The main experiments, which were carried out on sugar beets in the field, were arranged in such a way that the distribution of aphids (M. persicae and A. fabae) from a radioactive centre (plants watered with 0.4 - 1,6 mc P^31 as sodium orthophosphate) to the surrounding plants in the plot and the spread of yellow virus from the same centre could be studied. The conclusions drawn from the movements of the aphids, their average speed, the distances covered, the effectiveness of the aphids as virus vectors, etc., are discussed from different points of view, including the limitations of the method in its present form.

(An abridged report was read by D.L. at the Potato Virus Conf, in Wageningen, 13-16 Aug, 1951, and is published in the proceedings of the conference)

* Cornell 1956 - [104]
* Cornell 1958 - [105]
* Day and McKimmon 1951 - [32]
* Day and Irzykiewicz 1953 - [23]
* Day and Irzykiewicz 1954 - [320]
* Klofth and Kunkel 1960 - [28]


In order to settle the question of whether the spider mite injects material into the plant during suckling, mites were labelled with P^31. This was done via the host plant (young bean leaves, placed in solutions of a specific activity from 1-2 mc/ml). These were left in the solution for 3 d and then populated with spider mites. A further 2 d were required before the spider mite acquired a sufficiently high activity to be measurable in its saliva. Intermediate passages were introduced in order to avoid faulty deductions from possible radioactive contamination of the mandibles (cf. Klofth’s methods for aphids). It was clearly established by measurement and autoradiography that Tetranychus urticae releases substances to the plant tissue during suckling. This result is of great importance phytopathologically, particularly for the mechanism by which plant diseases are transmitted by insects and spider mites.
Худаков, Г.Д. МЕТОД НЕЧЕСНИЯ НАСЕКОМЫХ ПОСРЕДСТВОМ ДАЧИ ИМ РАДИОАКТИВНЫХ ИЗОТОПОВ С КОРМОМ. Вестник Моск. Объединения Институтов Природы, Отдел экологии, 54, 3 (1959) 35-46.

1. Для целей маркировки насекомых посредством дачи им радиоизотопов с кормом пригодны те радиоактивные изотопы, которые обладают бета-излучением со средней энергией выше энергетического уровня бета-спектров порядка 0.6 МэВ и выше, а также имеющих период полураспада не меньше недели. 2. При увеличении концентрации радиоизотопа в корме пропорционально увеличивается и радиоактивность насекомых, питавшихся им.

3. Для проведения опытов с чечевицами насекомыми в течение 10-20 дней можно их метить посредством дачи им корма, содержащего радиоизотопы в концентрации 1-3 мккн на 1 мл. Для проведения более длительных опытов концентрации изотопа в корме необходимо соответственно увеличивать.

A study was made to determine the best method of labelling insects (Musca domestica and Blattella germanica) using radioactive food. Flies and roaches were used in the study which compared Sr, Ca, Fe, Zn, Sr, Y, Ca, Ba, and La in various food preparations. It was found that a 24-h exposure was required for 100% tagging, the best results being obtained with Sr in a mixture of 3 parts milk and 1 part 10% sugar water. A direct relation was found between the 5th concentration in food and the radioactivity of the flies, and the females were twice as radioactive as males, being twice as heavy. The effects of elimination, isotope decay, and energy of the emitted ray were considered. Radiosotopes with a beta emission above 0.8 MeV and a half life not less than 1 week are suitable. The food for studies running 10 to 20 d should contain 1 to 3 μ. (NSA 14: 12548, 1960)

*) Post-script to reference 337, cited on p. 86.

409 Dahm, P.A. RADIOACTIVE ISOTOPES AS MARKERS. (9) 136-7, 139, 161; (19) 148-9

410 Haller, H.L. RADIOACTIVE ISOTOPES IN AGRICULTURE. Lab., 454-546. (Survey article. The principles discussed, A survey of the way individual research being given) Darm 1953 - [806]

411 Hinton 1954 - [6]

412 Know, J., Tahir, L. RÁDIONAMÉTRICKÉ INSEKTICIDY a their toxicology of insects. (1959) 447-56. (In Slovak)

413 Metzalf, R.L. RADIOISOTOPES IN P. 237-252 in "Radioisotopes and
HREM RADIOACTIVE ISOTOPES WITH
Musca domestica and Mattella germanica
in compared P32, Ca45, Fe57, Zn65,
- found that a 24-h exposure was
- a mixture of 5 parts milk and 1 part
- in food and the radioactivity of the
- the effects of elimination,
- isotopes with a beta emission above
- for studies running 10 to 20 d should

II INSECTICIDES

II-A Survey Articles

Dahm, P. A. RADIOACTIVE TRACERS IN INSECTICIDE RESEARCH. Soap, N. Y. 29 (1953) (9) 136-7, 139, 181; (10) 148-9, 151, 153, 163, 165; (11) 141, 143, 144, 147, 165; (12) 167-8, 178.
Review Article. The principles of applying radioisotopes generally and in this field, in particular, are discussed. A survey of the way in which radioisotopes have already been applied is given, references to individual research being given.

* Dahm 1953 - [805]
* Dahm 1957 - [806]

Review article. Applications of radioisotopes to chlorinated hydrocarbon, organic phosphates, and systemic insecticides are reviewed, followed by a discussion on penetrating radiations. Radioisotopes have been applied for tagging insects used in flight, migration and dispersal studies.

* Hinton 1954 - [8]
* Jenkins 1954 - [403]


Except for the very end and where some research in Leninograd is described, the paper is a review article of foreign publications. Experiments (USSR) are described on the decomposition products and isomers of 85Rb-labelled Parathion, identified by a paper-chromatographic technique. Fatty solutions of Parathion were shown to possess greater penetrating powers than water emulsions. This was also true of cold aerosols relative to "water" sprays. Autoradiographically, the insecticide could be proved to have greater spread when applied as a fatty solution. A radiometric separation method (Gad) was employed for testing the stability of fatty solutions of Parathion. No hydrolysis was found after they had been subjected to 110°C for 48 h. The importance of being able to measure the penetrating ability of aerosols is stressed. Further useful applications of radioisotopes to related problems are discussed.

* Lindquist 1957 - [9]
* McCormick 1958 (Bibliography) - [797]


A review article, illustrated by specific examples. Auxiliary techniques valuable with radioisotope insecticides are discussed; paper chromatography, autoradiography, partition coefficients, and radioautography. Further sections are devoted to tracer work on the chemistry of insecticides, plant systemic insecticides (absorption, translocation, and metabolism), insect resistance to insecticides and the study of the mechanisms of action of insecticides by the labelled metabolic pool technique of Winteringham. An appendix gives a source list for descriptions of syntheses of most of the labelled insecticides reported up to 1969.


Review article. The respective efficacy and application of selective insecticides are discussed, also the usefulness of radioisotopes in investigations on translocation, decomposition, etc.


A general article, dealing with radioisotope tracers in plant nutrition and insecticide research.


Review article. Investigations into insecticide biochemistry are surveyed, concerned with such problems as insecticide absorption, distribution, their decomposition or metabolic products and residues, etc. The applications of isotopes (e.g. a radioactive B analogue of DDT was used) and labelled insecticides, and their scope in such studies, also in combination with other techniques (paper chromatography, autoradiography, etc.) is discussed.

II - B Fumigants


The impact of the combined application of radioactive tracers and micro-fractionation techniques such as chromatography in bringing new fields of biochemical research within the range of quantitative analysis are discussed. Successful application involves first the introduction of suitable radioactive tracers into the system to be studied followed by adequate techniques of fractionation and identification. Methods of using labeled reagents, radioactivation, and the labelled pool technique for fulfilling the first condition are described. Methods for characterizing and identifying labeled compounds separated on paper chromatograms in amounts below the limits of chemical detection are also discussed. (From auth.)


Разработана методика получения меченого цианкислого калия, которая базируется на следующих основных операциях: 1) проведение реакции изотопного обмена КС14O2 + Н2СO3 при 800° в течение 3-4 часов. 2) Разделение смеси КС14O3-Н2СО3 путем экстракции КС14O3 меченным аммиаком в циркуляционном экстракторе. При обмене эквимолекулярных количеств ИКН и КС14O3 получено цианкислый калия с химическим выходом не ниже 90%, с содержанием основного вещества 99-100%. При применении КС14O3 в высокой удельной активности (80-70 мккв/мл) удельная активность ИКН получается выше 80 мккв/мл. Указанный синтез, обсужденный изотопом С14, рекомендуется после экстракции аммиаком без заметных потерь.


The authors obtained cyanide in reaction XCN2-H + BaC12 extracting the KCN with large quantities of EC2 and BaCO3, basic substance content of 95% of specific activity of over 80% as the scavengers after the amoniation.


The metabolism of cyanide in a gaseous low-molecular-weight product (triphosphatidyl micro- or macro-scale) and may be obtainable directly.

422 Bridges 1955 - (765)

423 Bridges 1958 - (766)

424 Cox, I.D., Warne, R.J. ETHYLENE OXIDE AND ETHYLENE DIOXIDE. Analyst. 88-99% (CH2)2O, reduction to ethanol (based on BaCO3). 1960.


The authors obtained cyanamide-labelled potassium by the following method: (1) The isotope exchange reaction KC14H3N + HCO3- is produced at 80°C in 2 h. (2) The mixture KCN + BaCO3 is separated by extracting the KCN with liquid ammonia in a circulating extractor. By exchanging the equimolecular quantities of KCN and BaCO3, potassium cyanide is obtained with a chemical yield of more than 90% and a basic-substance content of 96-97%. By using BaCO3 with a high specific activity (60-70 μC/mg), a KCN specific activity of over 60 mcg may be obtained. The potassium carbonate depleted of isotopically C14 regenerates after the ammonia extraction with appreciable loss.


The method of preparation described offers several worthwhile advantages: (a) in one convenient reaction, a gaseous low-molecular-weight starting material (C8H8O2; mol. wt. 88) leads to a solid high-molecular-weight product (trisphenylacetic acid-1-C14; mol. wt. 288, melting point 267°C); (b) it is equally adaptable to a micro- or macro-scale; and, (c) other useful single carbonate compounds such as formate, methylene, etc., may be obtained directly (in the course of exploration).


The uptake of hydrogen cyanide by this species increased linearly during fumigation even after absorption of a lethal dose. Respiratory inhibition did not appear to be the direct cause of death by this poison. The fate of C14-labelled hydrogen cyanide within the insect was studied.

BRIDGES 1956 - [765]

BRIDGES 1956 - [766]


A synthesis of ethylene oxide-1, 2-C14 is described. The compound is of interest as a fumigant. Details are given of apparatus and methods for the preparation from BaC14O3 of C14H4 through barium carbide (in 7% isotopic yield), C14H4 (quantitative yield) and C14CH2CH2OH (92% recovery of isotopes); KOH gives 85-95% (CH3)2CO reduction with LLIH4 gives 98% α, β labelled ECH (over-all isotopic recovery of 76% based on BaC14O3).


Men(C2H5O2CH2)4Br has been labelled in the Me group with C14 for a study of the mechanism of the cell damage caused by 1. C2H5O2CH2Br (0.5-10 mmol) is converted in a specially designed apparatus by means of 5 cc of a mixture of 8 HCl concentrated H2SO4 and 23 0.2%, 49% HBr into 94-95% C14H4Br (II). It is allowed to react in a special apparatus with NH (CH3)2CH2OH (III) in abolute ECH, and the mixture, containing C14H4N-C2H5OCH2CH2OH and III, treated in C14H4 saturated with HCl in the calculated amount of SOCl2, giving 92% (based on the CH2OH used) C14H4N-C2H5OCH2CH2HCl (IV), with an activity corresponding to 22 μc/mg (HCl, 14H, m. 82-4°C), each of which II and III is 1:1, 20-30% (C14H4O2CH2CH2Br, m. 217-18°C) is obtained. (CA 44:41416c, 1950).


Dried prunes fumigated with ethylene oxide-C14 react with the fumigant to give non-volatile and relatively non-toxic alkylation products. Over 50% of the total radioactivity is combined in insoluble hydroxyethyl cellulose in the prune skin, 30% as hydroxyethylated sugars in the pulp, and 5% as glycals.
The author reviews the potential for the DDT resistance in several insects to be characterized as morphological or biochemical. Numerous studies from which this review is drawn are directly concerned with the study of DDT resistance in insects. The review highlights the complexity of the resistant mechanism and the factors associated with it.


An excellent review article, emphasizing the key biochemical mechanisms involved in DDT resistance, is provided. The article discusses the enzymes involved in the degradation of DDT and the metabolism of DDT in resistant strains.


The author describes a relatively simple and inexpensive procedure for obtaining a high yield of HCN with a specific activity essentially unchanged from that of K4 C14O4 used as starting material.

* McCollister et al., 1951 - [744]

* Perlowitz-Szumlevics, 1952 - [465]


Experimental details are presented on the preparation of HCN from BACO-C14O4 by reduction with K metal in the presence of NH3. The procedure used was essentially that of Casner and Kistakowsky (*J. Biol. Chem.* 137, 547 (1941)), as modified by Lofstedt (*Bioscience* 3 (3) 54 (1947)) except that dilute H2SO4 was used to generate the HCN. No difficulties were encountered, and yields of 80 to 90% were obtained. (NSR 5; 4460, 1951).


When CS2 containing C14 was administered intraperitoneally, subcutaneously, intracardially, or by inhalation to guinea pigs and mice, the distribution was general throughout the body tissues, with a higher concentration of C14 in the liver than other tissues. The nonmetabolized CS2 was excreted rapidly, but the tissues retained a large proportion of the retained C14 in the urine, largely as inorganic sulfates. (CA 44:6131c, 1959).


Ethylene oxide-1,2-C14 was isolated in 90% yield from the reaction of ethylene-1,2-C14 with phenylbuthyl acid in tetrahydrofuran solvent in the presence of iodine catalyst. A procedure was developed for the determination of ethylene oxide in tetrahydrofuran solution. (auth.)

* Winteringham and Hellyer 1954 - [729]

* Winteringham 1955 - [787]

* Winteringham 1956 - [760]

* Winteringham 1957 - [761]

* Winteringham et al., 1968 - [730]

**II - C. Halogenated Hydrocarbons**

Survey Articles

The author reviews the protective mechanisms concerned with DDT-resistance in *M. domestica*, which may be characterized as morphologic, physiologic and behavioristic. They are discussed in some detail. Numerous studies from which data are drawn have used radioisotopes. Among the factors reported, some are directly concerned with protecting the insect from the lethal action of DDT. Others supplement a protective mechanism already present. Still other, i.e., certain structural differences, etc., are incidentally associated with resistant strains but offer no protection to the fly ("resistance-marker"). The complex nature of DDT-resistance makes it difficult to characterize this phenomenon in terms of a single common factor. It is likely that each strain possesses a combination of attributes for resistance which are different from those found in other strains.


An excellent review article, discussing detoxication mechanisms, which may bring about (a) conversion of insecticide to nontoxic metabolites which are either excreted or retained within the tissues; (b) excretion in the unchanged form; or (c) storage in non-sensitive tissues of toxic metabolites or of the unchanged chemical. Work with radioisotopes is cited freely. Reference is also made to unpublished work by Perry (1957) on the metabolism of C14-labelled Lindane in houseflies. Topical application (4 µg/resistant fly) led to rapid toxicant metabolism. After 34 h 60% of the total radioactivity was in the excreta. Partition of the C14-labelled compounds in excreta between water and cyclohexane showed 44% to be water-soluble. The amount of C14 in the fly also indicated a non-toxic, dechlorinated product.


A reference book. The various compounds are listed with their formulae, procedures for their preparation, notes, references and other preparations. To quote just the example of DDT, the B14-analogue is discussed on pages 1157, 1158, the I138-analogue on p. 1229, DDT labelled at C14 on p. 888, and at C13 on p. 892.


A review article. It includes a discussion of biochemical, physiological effects, the metabolic fate and possible mode of toxic action of MeBr, CH3Br, CH2Br2, CH2Cl2, dichlorobenzene, DDT and its analogues, hexachlorocyclohexane isomers, Aldrin, Dieldrin, and Chlordane. Amongst the 353 references are numerous references to work utilizing radioisotopes although these are not mentioned specifically in the text.

434 Chang, C. C., Kearns, C. W. STUDY OF DIELDRIN METABOLISM IN HOUSE FLIES. Bull. ent. Soc. Amer. 5, 3 (1960) 118, abstr. 77.

Tagged Dieldrin was used in a metabolism study in susceptible and resistant houseflies. Paper chromatographic separation of the benzene-extracted dose demonstrated only one radioactive spot with identical Rf value of reference Dieldrin in three solvents systems. A constant specific activity was shown for these successive crystallizations.


The insecticides 1, 2, 3, 4, 10-hexachloro-1, 4, 4a, 5, 8a-hexahydro-1, 4-endo-exo-6, 8-dimethanophthalene (Aldrin) and 1, 2, 3, 4, 10-hexachloro-6, 7-epoxy-1, 4, 4a, 5, 8, 9, 10-endo-endo-exo-6, 8-dimethanophthalene (Dieldrin) were prepared labelled with carbon-14. They were synthesized by labelling hexachlorocyclohexadiene and subsequent reaction with 3, 5-norbornadiene. Starting with
BaCl\textsubscript{2}O\textsubscript{4}, a 20% yield of Aldrin (melting point 102.5°C) and a 22% yield of Dieldrin (melting point 181°C) were obtained. The specific activities were 3.6 and 3.5 ± 0.1 nC per gram for Aldrin and Dieldrin, respectively. (auth)


The absorption and metabolism of C\textsuperscript{14}-labelled Aldrin by susceptible and Dieldrin-resistant larvae of Anopheles gambiae have been compared. Both strains absorbed about one quarter of the Aldrin initially added to the water (5 ppm) after 4 hr at 25°C but this was largely recovered by rinsing the cuticles in acetone and relatively little had penetrated the internal tissues of either strain. There were some minor but small differences in Aldrin to Dieldrin in the tissues of both strains. The data suggest that resistance of the larvae is not due to lack of cuticular penetration or detoxification in the tissues as a whole.


The sulphur analogue of Dieldrin (S\textsuperscript{35}-labelled) was shown to be partly metabolized by resistant and susceptible houseflies. The results were determined as S\textsuperscript{35}-radioactivity, corrected for decay, self-absorption, etc., and expressed as a percentage of the dose applied. Unchanged insecticide and metabolites were determined by radio-paper-chromatographic techniques. The rate of accumulation of S\textsuperscript{35}-metabolites in the abdomen of adult M. domestica is illustrated. A table gives details of the fate of the S\textsuperscript{35} analogue of Dieldrin three hours after topical application to Dieldrin-resistant and susceptible adult houseflies, at a dose of 2 mg per insect. A bromine analogue of Dieldrin (Br\textsuperscript{14}-labelled) was shown to be excreted unchanged in equal proportion by both resistant and susceptible houseflies. Small amounts of water-soluble metabolites were also produced.

BHC and Isomers


Benzene hexachloride was mixed with thion and its distribution studied by analysis of its radioactivity. This gives depth of penetration as well and is useful in explaining discrepancies shown by biological tests.


Experiments on the absorption and metabolism of BHC isomers in houseflies (Musca domestica L.) are described for a strain normally susceptible and a strain resistant to γ BHC. The flies were exposed to vapours of the isomers at 25°C (77°F), the isomers being labelled with Cl\textsuperscript{14} or C\textsuperscript{14}. Radioactive material was recovered from the treated flies by extraction with carbon tetrachloride and with water. The ultimate production of 11 water-soluble compounds from both α and γ BHC was deduced from chromatographic data, and is discussed. The part played by metabolism in making an insect resistant to poisoning is discussed in terms of the effect of the product of concentration and time, and it is concluded that detoxication by metabolism is essential for the complete recovery of an insect following absorption of insecticide. Figures are given showing the extent to which α and γ BHC were metabolized to water-soluble material in susceptible insects of several species, including mosquitoes and cockroaches. It is evident from these that the susceptible strain of the housefly is in a class by itself in its ability to eliminate γ BHC as water-soluble products. It is thought that the existence in normal houseflies of a metabolic way of dealing with BHC predisposes the species to the acquisition of resistance. (from RAE-B 46: 52, 1958)


The gamma-benzene hexachloride was labelled with Cl\textsuperscript{14}. Normal flies (Hawthorne stock of Musca domestica) were used, with another strain originating in Uruguay, having a very high resistance. Results of the particular techniques used were a resistance to penetration of the insecticide to benzene hexachloride.
the particular techniques used might be taken to indicate that (1) the resistance by houseflies is not due to resistance to penetration of the insecticide; and (2) a detoxification mechanism is unlikely in flies resistant to benzene hexachloride since these carry over in their tissues from the larval stage enough insecticide to kill normal flies in a few minutes.


The fate of $\gamma$-benzene hexachloride in both normal and benzene hexachloride-resistant houseflies ($Musca domestica$) has been studied by radiochemical methods by means of C-14 labelled $\gamma$-benzene hexachloride. After exposure to the insecticide the resistant flies showed less radioactivity in carbon tetrachloride extracts than did the normal flies, but paper chromatography of these extracts showed the radioactive compound present to be $\gamma$ benzene hexachloride. A proportion of the absorbed benzene hexachloride in both kinds of flies is converted into water-soluble products which are not extracted by carbon tetrachloride, and the amount of this product is greater for resistant flies, being approximately 50% of the total benzene hexachloride absorbed during 6 hours' exposure of the insects to the insecticide. (auth.)


The absorption and metabolism of BHC was examined in two laboratory strains of Anopheles gambiae Giles, of which one (G) was 26 times as resistant to BHC as the other. Deposition of the $\alpha$ or $\gamma$ isomer of BHC labelled with C-14 were made from carbon tetrachloride solution in flasks, and weighed batches of mosquitoes (50-100 of mixed sex) were exposed in the stopped flasks at 25$^\circ$C (77$^\circ$F) for 24 h with pieces of untreated filter paper for them to rest on. The radioactive material was then recovered and estimated as fractions soluble in CCl_4 and in water. The $\alpha$ isomer was included as it is known that $\gamma$-resistant flies ($Musca domestica$) can metabolize it as easily as the $\gamma$ isomer, and it allows of longer survival of the $S$ strain. The (tabulated) results show that the $S$ strain absorbs as much BHC as the $G$ strain and converts a smaller proportion (about 6% as compared with 11% in the case of the $\gamma$ isomer) to water-soluble products. The radioactivity in the CCl_4 extracts revealed almost entirely unabsorbed BHC. As the $S$ strain was knocked down by BHC after some 30 min and the $G$ strain only after about 3 h, a further experiment was carried out in which the mosquitoes were exposed to BHC for 1 h and then kept for 24 h at 25$^\circ$C in a clean flask. The pattern of absorption and metabolism was very similar to that shown with the longer exposure. Thus, insecticide resistance can occur in a strain of insects that is no more able to metabolize the poison than is a susceptible strain. A. gambiae can convert only 11% or less of absorbed BHC to excretable products, whereas houseflies of a resistant strain under similar conditions can convert more than 50%.


Studies were made of the pick-up and metabolism of BHC isomers by normal and resistant houseflies, employing the compound labelled with C-14. The $\alpha$, $\beta$, $\gamma$, and $\delta$-isomers were all metabolized, conversion to water-soluble metabolites being in the order $\alpha$- and $\gamma$- > $\beta$- and $\delta$- isomers. Resistant flies showed a more rapid metabolism of the insecticide than did normal flies. They also absorbed less, with the result that their content of the $\gamma$ isomer was about that of normal flies after 15 min exposure to the insecticide vapour. (CA 50: 133555, 1956)


A detailed study of the minor constituents of the carbon tetrachloride extracts of flies treated with C-14 labelled $\gamma$-BHC has established the presence of pentachlorophenol, trichlorobenzene and acidic substances. Under various conditions of exposure and different dosages these compounds occur only in small amount (5% or less of the absorbed dose of $\gamma$-BHC). Pentachlorophenol was never found in quantities greater than 5% of the $\gamma$-BHC absorbed and it is concluded that if this compound is an intermediate in the metabolism of BHC by resistant houseflies, it has, in the $\gamma$-BHC-resistant Uruguay strain, only a very transient existence. One result of the discovery of these minor constituents in carbon tetrachloride extracts is to show that the resistant strain enjoys a greater advantage over the susceptible in rate of detoxication of $\gamma$-BHC than had previously been supposed. (from auth.)

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As \( \gamma \)-BHC is being increasingly used for the control of insects and mites that infest stored foodstuffs and is persistent enough to leave a residue, especially in fatty materials, the fate of the residues in certain products was investigated. The results are given in these two parts of a series. BHC labelled with\( ^{14} \)C was used to study the rate of loss of the insecticide from whole wheat and its distribution between the flour and bran fractions after milling. Loss from exposed wheat was rapid, but when it was stored in closed containers no loss was detected. After milling the wheat, 40-50% of the initial residue was still present in the "fine" flour fraction, while the residue in the bran was increased between 2- and 4-fold. Loss of the insecticide from Cheddar and Stilton cheeses was slow, about 40% of the weight applied remaining after 46 weeks. Penetration of the insecticide into both types of cheese was slow, although appreciably more rapid in the Stilton cheese. Extensive applications caused a build-up of the insecticide in the outer few millimeters of the cheeses, but had little effect on the amount penetrant more deeply. The toxicological significance of such residues is discussed. \( ^{14} \)C-labelled \( \gamma \)-BHC was used to study the effect of heating at baking temperatures on the insecticide when present in wheat starch, gluten and milled wheat. The amount of \( ^{14} \)C-activity retained by the starch and gluten after heating for 1 h at 180°C (350°F) depends on the initial moisture content of the materials. With wheat starch, 6.4 and 17.9%, little difference in the amount of \( ^{14} \)C-activity retained was observed, but when mixed into a dough with water prior to baking, a greater proportion of the initial \( ^{14} \)C-activity was retained. The residue remaining after heating was "locked up" in desiccated starch granules and could not be extracted with acetone until the heated material was treated with water. The residue in the heated starch consisted mainly of unchanged BHC, but that in the flour was shown to be mainly a mixture of \( \alpha \), \( \delta \)- and monoclorobenzene. The toxicological significance of these breakdown products in bread is discussed. (4AF-1:27: 223, 1959)


A Dieldrin-resistant (R-strain) and susceptible strain of Musca domestica were used. A simultaneous high resistance to \( \gamma \)-BHC was encountered. Studies of the resistance mechanism were made using \( ^{14} \)C-labelled \( \alpha \), \( \gamma \) and \( \delta \)-isomers of BHC. Details of the methods and their applications are given. Results suggest that monoclorobenchlorination is the first step in any major pathway for the metabolism of \( \gamma \)-BHC by houseflies. Detection of \( \gamma \)-PCCH together with other chlorinated benzenes may mean that an alternate pathway by dehydrochlorination is possible, though of secondary importance.

Craig et al, 1953 - [778]
Craig 1956 - [779]
Craig 1960 - [780]
ELIAS, H., LIESER, K.H., KOHLHOFER, H.W. RADIOCHEMISCHE UNTERSUCHUNG DER ISOMERISIERUNG DES 1,2,3,4,5,6-HEXACHLOROCYCLOHEXANES (Radiochemical Investigation into the Isomerisation of 1,2,3,4,5,6-hexachlorocyclohexane). Chem. Rev. 53, 9 (1950) 2126-37 (in German).

With the use of C14-labelled γ- and α-HCH (i.e., 1,2,3,4,5,6-hexachlorocyclohexane) it was possible to follow quantitatively the isomerisation of γ-HCH and α-HCH in the homogeneous system HCH/AlCl3/1,1,2,2-tetrachloroethane as a function of time in the temperature range from 100-130°C. Calculations based on experimental data showed that isomerisation may be considered as equilibrium reactions of the type γ-HCH ↔ 6-HCH ↔ α-HCH. In the region 100-130°C the equilibrium is very markedly displaced towards α-HCH. Velocity constants and activation energies of intermediate stages were determined, assuming second order bimolecular reactions. (Tr. Kuhn. Med.)


A method of preparing C14-labelled γ-HCH 1,2,3,4,5,6-hexachlorocyclohexane, is described. It was used as a laboratory check on other analytical procedures.


For the y isomers of benzene hexachloride obtained by the present AOAC method (AOAC Methods of Analysis, 7th ed., 1950, p. 163 (CA 45, 29246)) was similar to those obtained by the modified procedure reported previously. Therefore no change in the present procedure is recommended. The results by this and Tyrone radiocarbon isotope dilution method (Craig et al., CA 48, 29074) showed excellent agreement with those found by the infrared method. (CA 49: 98588g, 1958)


As a result of a collaborative study, the present official partition chromatographic method for the determination of γ-benzene hexachloride (γ-HCH) was revised (details given). The following average values were obtained on a 6% dust (5.6% by infrared analysis): present method, 5.70; revised 5.38; on a 13% dust (13.1% by infrared and 13.9% by radiotopoe dilution analysis): present 13.07; revised 12.90. (CA 50: 9661c, 1958)


The Craig et al., radiocarbon-isotope dilution method for the determination of the γ-isomer content of technical BHC (1) was applied by collaboration to 5 samples of technical 1 containing 13 and 19% of γ-HCH, a 39% concentrate of γ-1, and γ-1-reinforced samples prepared by adding known amounts of pure γ-HCH to technical grade 1 of previously established γ-HCH content. Statistical analysis of all samples except the concentrate revealed an over-all relative precision of ±4.4% at the 95% confidence level. The accuracy and precision of the method is considered excellent. It was difficult to obtain representative samples of the concentrate. (CA 51: 13304b, 1957)


A C14-isotope dilution method for determining the Lindane content in crude BHC is described.

PEARCE, G., KRAUSE, S. CHLORINE EXCHANGE BETWEEN ALUMINUM CHLORIDE AND γ-1,2,3,4,5,6-HEXACHLOROCYCLOHEXANE. J. Amer. chem. Soc. 79 (1957) 271-3.

Chlorinated hydrocarbon insecticides labelled with C14 represent a most effective tool in studies of the fate and toxicology of this class of compounds in resistant strains of arthropods as well as in higher animals. The use of exchange reactions appeared to offer a simpler way of preparing C14-labelled compounds than their complete synthesis. Chlorine exchanges readily between aluminium chloride and γ-1,2,3,4,5,6-hexachlorocyclohexane (γ-HCH) at temperatures above 100°C with some decomposition of isomerisation, primarily to α-HCC and 6-HCC. Mechanisms for both exchange and isomerisation are proposed.

A knowledge of the solubility of DD'T in water was required to study the effect of dissolved and undissolved toxican on bionasa with mosquito larvae. The DD'T was analyzed radiometrically, undissolved particles (~41 Å) were removed by an average ultracentrifugal force of 84150 g. The solubility of DD'T in water was found to be 1.2 parts per 10\textsuperscript{6} or less at 25°C. Date on sizes of undissolved DD'T particles and on recovery of DD'T after ultracentrifugation at 1 g are presented.


A method is described very brief adaptation of PP's technique was found to be 10%. The is still specific activity of 1.40 x 10\textsuperscript{7}.

Burk, J.S., Chang, S.C., CH. AMERICAN COCKROACHES.

2-C\textsuperscript{14}-labelled DD'T was synthesized. Among 29 moths, each injected after 48 h in a respiration channel led the authors to speculate that the injected compound compost into formation of a conjugate might.

Fields, M., Gibbs, J., Walla, 

-4'-C\textsuperscript{14}-ETHANE. Science.

The authors undertook the syn.

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Gjollin, C.M., Hidigast, A. NON RESISTANT MOSQUITO.

The amounts of C\textsuperscript{14}-labelled DD'T commercial type window/ and A. stric. absorbed from 0.0070 to 0.00362 mortality ranged from 21-97. Larvae tested in acetone suspension mortality was lower at 95%. The reaction to treatment of the non-resistant larvae treated with larvae of xenus and strains amount of the DD'T to non-tox also briefly reported in Apic.

Hagley, E.A., Morrison, F. COMBINATION WITH DD'T.

Montreal 17-20 Aug. 1966', 

The toxicity of DDT in aqueous-acetone suspensions to mosquito larvae is affected by the volume of suspension and the type of the test container. To learn whether the differences are due to settling, settling rates for different concentrations of DDT suspensions were determined. Settling does take place at the 1 ppm level but not at 0.01 ppm, a concentration approximating that normally used in mosquito larvicide tests. In further studies of such suspensions, a high proportion of the DDT was found deposited on the inner walls of glass, aluminum, or paper container when the liquid phase was withdrawn within minutes after preparation of the suspensions. The concentration of the DDT in suspension was thereby reduced. Another surprising finding was that more than 90% of the DDT from 0.001 ppm suspensions was lost by volatilization with the liquid phase during 24 hours. This volatilization plus the deposition on the walls of the container account for the loss of DDT from larvicide test suspensions. A physicochemical explanation for these findings is presented. C14-labelled DDT was used, (auth.)


A method is described very briefly to meet the need for uniquely labelled DDT; it represents a microscale adaptation of Fry's technique (J. Amer. chem. Soc. 72 (1950) 3290). The overall yield for this procedure was found to be 10%. The isolated product DDT gave a melting point 104-104.5°C (lit. 106-108.5°C), with a specific activity of 1.49 x 106 cpm/mM.


2-C14-labelled DDT was synthesized with a specific activity of 1.5 mc/mM, and injected into cockroaches. Among 29 roaches, each Injected with 3 ml of ethanol containing 20 mc of radioactive DDT, 22 survived after 48 h in a respiratory chamber at 30°C. Various fractions were tested for radioactivity. The findings led the authors to speculate that the water-soluble radioactive principle in this case is probably a conjugated compound composed of a DDT derivative and another, possibly carbohydrate, fragment. This formation of a conjugate might be related to the detoxification mechanism of DDT in roaches.


The authors undertook the synthesis of DDT labelled with C14 in the benzene ring. Both benzene-1-C14 and aniline-1-C14 are readily available; the preparation of tagged chlorobenzene by direct chlorination of benzene was investigated, as well as by the Sandmeyer reaction with aniline. Experimental conditions and results are described. A sample of 1,1,1-trichloro-2,2-bis(4-chlorophenyl)-4'-C14-ethane from chlorobenzene-1-C14 under the condition described in the paper had a specific activity of approximately 54 mc./mM.


The amounts of C14-labelled DDT absorbed by mosquito larvae and pupae were determined with a commercial type windless gas-flow counter attached to a scale. Fourth-instar larvae of Aedes vexans and A. stygicus absorbed from 0.003 to 0.005 with DDT in 54 h when subjected to keroseen films and from 0.0017 to 0.0034 with treated with acetone suspensions of radioactive DDT. The mortalities ranged from 21-97%. Dead larvae absorbed about two-thirds as much DDT as did live larvae. Larvae tested in acetone suspensions of DDT absorbed nearly twice as much DDT at 90°C as at 70°C and the mortality was lower at 90°C. Further details are given of the absorption of pupae of these species, and of the reaction to treatment of the resistant Aedes nigromarginal larvae which absorbed six times as much DDT as non-resistant larvae treated with 0.02 ppm. Bioassay of the extracts of these larvae with second-instar larvae of xenox and stuttgart indicated that both resistant and non-resistant larvae had degraded a large amount of the DDT to non-toxic substances, (from auth, summary) (The salient features of this article were also briefly reported in Agrie, Chemie, 5,8 (1952) 70 under "Radio-DDT studies")


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Four methylene dioxyphenyl compounds, 1,1 bis (p-chlorophenyl) chloromethane (DCC), 1,1 bis (p-chlorophenyl) ethanol (OMC), and 1,1 bis (p-chlorophenyl) ethylcarbinol (EC) were tested for synergistic action when applied topically to adult house flies of two strains. The (p-chlorophenyl) compounds were all effective in increasing the lethal action of DDT. The other chemicals showed no synergism. The fly strain did not affect the results. Increasing the proportion of synergist from 1:1 to 1:10 increased the effect. Studies using C14-labelled DDT revealed no increase in DDT penetration due to the synergist. When either DDT or synergist was applied in advance of the other, or when applications were made to different loci on the body, the synergistic effect was the same, but mixtures applied directly to the brain tissue were little more effective than DDT alone. When the synergist was applied to the proboscis, and DDT to the thorax after the cervical region had been tightly ligated, the effect of the ligature in reducing mortality was still evident but was not so marked as with DDT alone applied to the thorax. (auth.)

468 Hallepanavar, N. I., Kurkcamp, L. K., Patel, N. G. DENSITY OF GRANARY WEEVILS IN RELATION TO INSECTICIDAL EFFECTIVENESS. Bull. ent. Soc. Amer. 5 (1960) 152, abstr. 44.

469 Strophus granarius (L.) mortality in wheat treated with DDT was greater when smaller numbers of weevils were present. C14-labelled DDT was used to determine pickup. Several possible causes of the differences in mortality were investigated.


Knockdown tests with non-resistant females showed that the total exposure time needed to effect knockdown also increased as the interval between exposures was lengthened. In a series of tests with radioactive DDT (containing C14), resistant flies exposed intermittently for a total of 7 h to 5 mg per ft2 had a mortality of 16%, whereas resistant flies exposed continuously for the same time had a mortality of 45%, although the radioactivities of the two lots (and therefore the amounts of DDT absorbed by them) did not differ significantly.


The author emphasizes the importance of timing the analyses in absorption studies with DDT. A 3-day delay in the analysis of flies succumbing within 24 h after treatment increased the amount of DDT absorbed as much as 46%, and a one-day delay 69%. About the same increase was obtained for flies that survived the DDT treatment for five days, indicating that absorption of DDT proceeded at about the same rate in dead as in living flies. Treated flies radioassayed after a lapse of more than a year showed a large increase in the amount of DDT penetrating the integument.


The metabolism of DDT in 30 spp. of insects fell into 3 types: (a) absorbed DDT remained unchanged, and could be recovered by solvent, (b) much of the DDT was converted to dichlorodiethyl DDT (DDE), and (c) the products of metabolism of DDT did not respond to the Schecter-Haller (SH) test (cf. Schecter et al., CA 46, 1535b) and hence were not DDT nor (p-chlorophenyl)acetic acid (DDA). The recovery of DDT from survivors of LD50 doses in 6 spp. were, as follows: Bombus mori, DDT 98, DDE 12, and non-SH 99%; Nymphalis antiopa, DDT 96, DDE 3, and non-SH 99%; Malacosoma atherum, DDT 16, DDE 86, and non-SH 10%; Musca domestica, DDT 6, DDE 60, and non-SH 34%; Phila inter- punctella, DDT 18, DDE 26, and non-SH 59%; and Cnemidocorus cornutus, DDT 4, DDE none, and non-SH 99%. The large milkweed bug (Oncopeltus fasciatus), the resistant housefly (Musca domestica), and the cockroach (Periplaneta americana) illustrated the 3 types of metabolism. Results of studies of these 3 spp. of insects with DDT tagged with C14 were given. There was a definite sequence of metabolites in the 3 insect spp. The paper chromatogram strips were scanned by a gas-flow scanner of novel design. The C14 on the strips could be measured if the counts were 100/mg, or more. The apparatus was described.

(CA 53; 22544h, 1960)


Radioactive C14-DDT was placed in storage periods of one and two months and recovered from each soil extract by means of paper chromatography. (D) Decomposition of C14-DDT and degradation products of C14-DDT in soil. C14-DDT is not persistent in soil. (See also AS 31-53)


(Brief note). DDT has been reported as not decomposing in soils. A detailed description is given. Washington D. C.


Experimental techniques are applied to adult houseflies, and accumulation at the site of the body is directly related to a reduced rate of dead flies within the head of the adult estimates of the difference in the weather. The nearer it is to the observed median lethal susceptibility of individuals in the sensitivity of the photoresistant method.


DDT was applied to the third housefly, Musca domestica, 30 min. under light, 30 min. under dark, and 30 min. without light. The percentage of the total radioactivity in the flies after 30 minutes, applied dose produced the fraction of radioactivity absorbed. DDT absorption did influence the location of the insects.

Lichtenstein, E. R., Schulz, C. INSECTICIDES FOR AERIAL APPLICATIONS. The increased use of chlorinated hydrocarbon insecticides, particularly DDT, has greatly decreased the number of insects reaching the ground with DDT and using a soil of minimum existence within a green container such as that used in C14-labeled experiments. On the basis of extraction of one aluminous foil-covered pea plant grown in sand treated with the usual DDT was found.
Radioactive p,p'-DDT was incorporated in 18 representative soils at a normal rate of application. After storage periods of one and 6 months the soils were extracted with acetone and the amount of a radioactivity recovered from each soil tissue measured. Identification of the degradation products of DDT was made on soil extract by means of paper partition chromatography. The following conclusions were reached: (1) Decomposition of p,p'-DDT is generally greater in soils with a pH higher than 7.0; (2) the principal degradation products of p,p'-DDT found in 16 of the 18 soils was p,p'-DEE; (3) the phytotoxic derivative, p,p'-DPA, is not persistent in any of the soils studied in this work. (auth. summary)

Jensen et al. 1957 - [738]

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Brief note. DDT has been labelled in various ways, particularly by means of C\(^{14}\). The authors briefly discuss a technique for preparing 2,2'-bis(p-iodophenyl)-1,1,1-trichloroethane, the \(1^{31}\) analogue of DDT. A detailed description is given in Document 3488, American Documentation Institute, 1719 N Street, N.W., Washington 6, D.C.

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Experimental techniques are described, and the results tabulated and discussed. When DDT is topically applied to adult houseflies, the locus of application greatly influences the rate of penetration, distribution and accumulation at the site of action. The DDT is distributed by way of the haemolymph, but not accumulated in it. Other tissues and organs, particularly the integument, absorb the DDT or its metabolites from the haemolymph. The rate at which DDT enters the haemolymph and is distributed to the various parts of the body is directly related to the area of contact. Distribution from the point of application continues at a reduced rate in dead flies. The site of action appears to be some organ or product in or produced within the head of the adult fly. Median lethal doses calculated from the topical application of DDT and estimates of the difference in susceptibility between fly strains are both influenced by the locus of application. The nearer it is to the site of action (in the case of the housefly the inside of the head), the lower the observed median lethal dose and the less the observed differential in strain susceptibility. The greater susceptibility of individuals treated near or on the site of toxic action offers a method of increasing the sensitivity of bioassay methods. (from RAE-B 49: 192, 1950)

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DDT was applied to the tibia-femoral joint of the metathoracic leg or to the labella of males of the housefly, Musca domestica L., by Fisher's method at 2 \(\mu\)g per fly. Amputations of the treated leg after 30 minutes considerably reduced mortality, but amputation of the leg after 4 or 5 hours of labella after 30 mins had no effect. When flies were similarly treated with radioactive DDT and later sectioned, the percentage of the total radioactivity that were in several treated appendages were 1.1% in legs and 80 or 93% in labella after 30 minutes, and 80% in legs after 4 hours. Thus, absorption and distribution of 10-20% of the applied dose produced the full lethal effect, and the site of application did not influence the rate of absorption but did influence effectiveness. (RAE-B 42: 138, 1954)

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The increased use of chlorinated hydrocarbon insecticides in soil has often raised the question of whether or not these insecticides might translocate into the aerial parts of plants from the soil in spite of their extremely low solubility in water. This was tested by resorting to very high concentrations of insecticide and using a soil of minimum sorptivity and complexity. Plants were also grown in insecticide-free sand within a glass containers surrounded by insecticide-treated sand. Linkase, Aldrin, Dieldrin and heptachlor as well as C\(^{14}\)-labelled p,p'-DDT was used. Because a relatively small amount of DDT was available only one aluminium foil-covered pot containing DDT-treated quartz sand (90 mm) was planted with peas. Pea plants grown in sand treated with C\(^{14}\)-labelled DDT did not show any translocation of this insecticide. The basis of extraction of plant material and radioactivity, less than 0.01 ppm of C\(^{14}\) derived from DDT was found.

The absorption, metabolism and excretion of C\(^4\)-ring-labelled p,p'-DDT in adult females of the Madeira cockroach (Periplaneta americana (F.)) and fifth-instar larvae of the European corn borer (Pyrausta nubilalis (L.)) were studied. The cockroach absorbed DDT rather slowly (about 50% in 50 days) and excreted 95% of the total applied radioactivity over a period of 36 days. Separation of the radioactive compounds excreted in faeces by DDT-treated cockroaches was accomplished by paper chromatography. The presence of DDT, DDE (2,2-bis (p-chlorophenyl)-1,1-dichloroethylene) and three unidentified metabolites was demonstrated. DDT was the predominant radioactive compound excreted in the first 36 hours after treatment, after which a metabolite with an R\(_f\) value of about 0.85 was the major radioactive compound excreted. Metabolic pathways for the DDT in the cockroach are proposed. Fifth-instar larvae of P. nubilalis, have some tolerance of DDT and can convert significant amounts of absorbed DDT to DDE. No evidence of DDT metabolites other than DDE was found. Both colorimetric and radiometric analyses were used in the study of P. nubilalis. (from author, summary)


The distribution of C\(^4\)-labelled DDT in various internal organs and external parts of resistant houseflies, Musca domestica L., was studied. Flies topically treated with 8 to 11, 25mg of DDT each showed from 66-94% of the total absorbed in the internal organs and the remainder distributed throughout the cuticle. Flies exposed to a residual deposit of the DDT showed a similar distribution of the toxicants, but only 36 to 50% as much as in the topically treated flies. The prevention of ingestion of the DDT by removal of the proboscis did not appreciably alter the percentage recovery in the different parts. In another series of tests it was found that 19% of the total DDT absorbed was present in the body fluids. The intestinal tract, thoracic ganglion, reproductive system, and thoracic muscles of all flies examined showed some radioactivity. (author, summary)


Penetration of an insecticide through the cuticle of resistant Musca domestica was studied by applying 15 mg of C\(^4\)-labelled DDT. After 24 hr, both the dead and surviving flies were washed in acetone to remove exterior DDT, and then macerated and the DDT or metabolites extracted with acetone. The quantities of DDT recovered in the wash and extract were determined by radioactivity measurements and calculating the equivalent weights and percentages. From the flies surviving the topical treatment 76% of the DDT applied was recovered and 82% of the recovered DDT was in the wash. Of the flies given a topical treatment an average of 2.1 and 2.3 mg of DDT or toxic metabolites was recovered, respectively, from surviving and dead flies. Approx. 1/10 less DDT or metabolites was recovered from the flies exposed to a residue. Bioassays of the fly extracts with mosquito showed that 60% of the total DDT absorbed by topically treated surviving flies was nontoxic and therefore metabolized. The 57% that was toxic was probably DDD, since neither of the metabolic products, 2,2-bis (p-chlorophenyl) acetic acid or 2,2-bis (p-chlorophenyl)-1,1-dichloroethylene, killed mosquito larvae.


The author described a method for synthesizing tertiary-C\(^4\)-labelled DDT, 2,2-bis (p-chlorophenyl)-1,1-trichloroethane-2-C\(^4\). The various steps in synthesis are discussed. Me\(^2\)C\(^6\)H\(_4\)ClNa from labelled Ba\(^2\)Cl\(_2\) was heated with Me\(^2\)C\(^6\)H\(_4\)SO\(_2\)Cl at 30 min at 180-200°C to give (Me\(^2\)C\(^6\)H\(_4\)Cl)\(_2\). The labelled (Me\(^2\)C\(^6\)H\(_4\)Cl)\(_2\) gave Me\(^2\)C\(^6\)H\(_4\)Cl\(_2\)OCl by a Friedel-Crafts reaction. Direct chlorination yielded Me\(^2\)C\(^6\)H\(_4\)Cl\(_2\)OCl(ΟCH\(_3\))Cl. This product was condensated with HC\(_2\)O to give (Me\(^2\)C\(^6\)H\(_4\)Cl\(_2\)OCl(ΟCH\(_3\))Cl). The DDT contained 4.76% of the original C\(^4\).


A rapid method of assessment of loss of insecticidal activity of DDT and related compounds from mud surfaces has now been evolved, based on loss of radioactivity from surfaces doused with C\(^4\)-labelled DDT. The C\(^4\)-labelled compound migrates to only slightly beneath the surface, and the weak beta-rays are shielded so that loss of insecticide from samples of mud were made into by dissolving 990 mg of 0.4% DDT into a fine powder. By taking samples of 1 x 1 x 1 cm from a depth of 1.25 cm diam in a depth of 1.25 cm diam was obtained immediately after the experiment, and the DDT was measured at 5 mm. Morrison, F. O., LeBow, H. J. AGRIC. SCI., 34, 3 (1956) 316-8.

DDT (2 g per kg) was applied to Musca domestica L. that had eggs on, and the mortality of the eggs was recorded. The mortality percentages were 34 for flies not treated with DDE. Flies were separated 24 hours a recovered and the percentages were 70 (84) after treatment on the second day. The hemblymph of flies treated during the first 5 minutes were used from these results that DDT is a critical region for its lethal action.


A method has been developed for determining the presence of carbon-14-labelled DDT in food naturally.

Pearce, G. W., Jensen, J. A. (1953) 756-68.

The synthesis of DDT labelled with carbon-14 was used to determine the effects of adding acetone containing 26 mg of carbon-14 labelled alcohol. Two crystallisations were made of the melting point of 107-107.5°C.

Perry, A. S., Jensen, J. A., Perry, D. DDT AND ITS METABOLITES IN WATER. Studies on degradation products of DDT. C\(^4\)-labelled in the termites. Both DDT and DDE were found with increasing time intervals. The soluble portion of the extract was chromatographed on the experimental alcohol. No strain of acetone, small but consistent, was recovered from material from extract. Perry, A. S., Buckner, A. J. B. Body Louse Pediculosis Human. C\(^4\)-labelled DDT was incorporated into the body. The DDT-resistant shows to be metabolite DDT to a level of 2% DDT in the Schenker-Haller method. The DDT to be in a conjugated form, possibly DDT.
so that loss of insecticide from the surface may be followed by measuring loss in radioactivity. Different samples of mud were made into blocks under various conditions of humidity, and a homogeneous mixture prepared by dissolving 300 mg. pure p,p'-DDT and 9.8 mg. radioactive p,p'-DDT (specific activity 0.48 mc/g.) in carbon tetrachloride, evaporating the solvent, drying the residue over silica gel and grinding it to a fine powder. Each block was then dusted with the powder, with about 1 mg. DDT particles ranging from 1-25 μ in diameter, deposited from a stream of nitrogen. An average count of 4220/min. was obtained immediately after dusting. The subsequent rate of loss of radioactivity of the block in a dry atmosphere was tested, and the percentage of DDT in different layers determined. No DDT was found at a depth below 1.6 mm.


DDT (6 μg. per fly) was applied to the labela or to the tibio-femoral membrane of one leg of males of Musca domestica L. that had emerged four days before. Treatment of the labela gave 89% kill in 24 hours, and treatment of the leg gave 68%. When the cervical region of each fly was ligated with cotton thread, the mortality percentages were 31% and only 31% for flies treated on the labela and leg, respectively, and 14% for flies not treated with DDT. When DDT labelled with C14 was used, and the heads and bodies of the flies were separated 24 hours after treatment and tested for radioactivity, all the radioactivity applied was recovered and the percentages of it recovered from the heads of non-ligated and (in branches) ligated flies were 70 (89) after treatment on the labela and 6 (less than 1) after treatment on the leg. Radioactivity in the hemolymph of flies treated on the leg could be detected 30 seconds after treatment, rose fairly rapidly during the first 5 minutes and then remained at a more or less constant level for 24 hours. It is concluded from these results that DDT is translocated in the hemolymph of the fly, and that the head is probably a critical region for its lethal action. (RAE-448; 180, 1955)


A method has been developed for the synthesis of radioactive dichlorophenyl trichloroethane (DDT) of good yield, in which the tertiary carbon is labelled. (For details, see abstract under "Preparation of carbon-14-labelled DDT" in J. agric. Food Chem. 1, 12 (1953) 776.)


The synthesis of DDT labelled with C14 in the tertiary position was carried out in the following steps: barium carbonate to ethyl acetate to ethyl alcohol to chloral to DDT. Starting with 50 mmoles of barium carbonate containing 20 mc of activity, 16 g of crude DDT were obtained (40% yield based on ethyl alcohol). Two crystallizations from ethyl alcohol yielded 6.11 g of p,p'-DDT (17% yield) having a melting point of 107-107.5°C. The specific activity was approximately 0.5 mc/g. (auth.)


Studies on degradation products of DDT in seven DDT-resistant strains of houseflies, using radioactive DDT (C14-labelled in the tertiary position), showed that the only significant product of DDT metabolism was DDE. Both DDT and DDE were found in the ether-soluble portion of the excrata, the DDE-DDT ratio increasing with increasing time intervals. Very small amounts of a radioactive product were found in the water-soluble portion of the excrata. Losses of DDT were not consistent and are thought to be within the range of experimental error. No strain specificity was evident. In flies held 10 days after application of the insecticide, small but consistent losses of DDT were experienced, which might be attributed to incomplete recovery of material from excrata. (auth.)


C14-labelled DDT was incorporated into human blood. This was fed to adult lice through chelicerae membranes. The DDT-resistant (Korean strain) lice but not the susceptible ones (Oklahoma strain) could be shown to metabolize DDT to a water-soluble derivative giving a positive test when analysed by the Schechter-Haller method. The metabolite was not ether-extractable following acid hydrolysis but appeared to be in a conjugated form, possibly with a protein fraction.

Radioactive DDT and DDE, located on American cockroaches, are rapidly absorbed and widely distributed internally. As much as 70% of the DDT applied is excreted as metabolites in the faeces over a 24-h period. About 80% of the radioactivity in the faeces is due to metabolites containing the diphenyl-2-carbon moiety of DDT; less than 10% is due to DDT, DDE or DDA. Less than 1% of DDT applied or injected is excreted as C14O2. The syrgentl "piperonyl cyclomone" used with DDT, inhibits absorption of DDT as excretion of metabolites. (auth.)


Resistant houseflies, Musca domestica L., treated individually with measured drops of radioactive DDT absorbed 64% more of the toxicant with a lower mortality when held during a 24-h period at 90°F than when held at 70°F. Absorption of the DDT began within the first hour after treatment and gradually increased over several hours. Approximately the same amount of DDT was absorbed irrespective of whether the fly was immobile with carbon dioxide or was active. The excretion of treated flies showed some radioactivity. Approximately 12% of the total absorbed was accounted for in the excrement over a 7-h period. No radioactivity could be demonstrated in the carbon dioxide collected from DDT-treated flies. (auth. summary)


Radioactive DDT was used, labelled at the tertiary carbon with C14 (cf. Pearce & Jensen, 1959). Of the intestinally absorbed, radioactive DDT administered orally to rats with their thoracic lymph ducts cannulated, 47-65% was recovered in the chyle. Furthermore, 14-46% of the absorbed DDT-derived materials found in the chyle were dehydrohalogenated into a neutral material (DDC).


Fourth-instar larvae were used in the tests. The insecticides used were Dieldrin, Lindane, Dicofol, Malathion, and radioactive DDT (p,p'-DDT-4-C14) with an activity of 2.1 µc/mg. The mortality of mosquito larvae increased as the volume of acetone-water suspensions or solutions of Dieldrin, Lindane, Malathion, and DDT was increased from 100 to 1000 ml. The increase was greatest and more consistent with DDT than with the other larvicides and with larvae of Anopheles quadrimaculatus Say and Aedes taeniorhynchus (Wied.) than with Aedes aegypti (L.). No increase in mortality was caused with Parathion. When the diameter of the test containers was increased from 3 to 6 inches but the concentration and volume of the suspensions or solutions were constant, mortality of quadrimaculatus decreased when Dieldrin, Lindane, and DDT were used, but not with Malathion or Parathion. No difference in mortality was observed with the other two species of larvae. (from auth.)


The availability of C14-labelled DDT and of radiometric methods permitted quantitative studies on the toxicological aspects of DDT poisoning in mosquito larvae. In tests by radiometric methods the amount of DDT picked up and its relation to the mortality of fourth-instar larvae of Anopheles quadrimaculatus Say, Aedes taeniorhynchus (Wied.), and Aedes aegypti (L.) varied with the exposure time and the concentration. Larvae did not exceed DDT except when exposed to concentrations above the minimum LC-100. The toxic action of DDT on quadrimaculatus larvae differed from that on aegypti. Resistance to DDT in a strain of taeniorhynchus was not related to the uptake or the excretion. Live quadrimaculatus larvae absorbed three times as much DDT as dead larvae; however, in a 24-h test period the surviving larvae had about the same dose as the non-survivors.

(A useful abstract was published in Bull. ent. Soc. Amer. 4 3 (1959) 103, abstr. 285)


The concentration of DDT in a volume of the suspension and the volume of DDT by codistillation and/or that of mosquito mortality response was that of Aedes aegypti (L.) did not differ from that of Aedes aegypti (L.) mortality response. Biological mortality response is not sufficient quantities of insecticides in test conditions. (auth.)


Since the insecticidal properties of DDT are fundamental differences in the susceptible and resistant strains. Preliminary penetration studies resistance was not associated with toxicity. Mortality was only observed in DDT-resistant strains. The Mortality appears to be insufficient action, but it is this factor in which the DDD/"DDT and DDE" were not observed.


The author used a bromine (flu) houseflies (from Italy and South Africa) used for studying the metabolism of the dose absorbed was sufficient to overcome the susceptible strain did, however, show a higher tendency. At least the strain in which survival appears to be the enhanced metabolism was observed.

Winteringham et al. 1982 - [172]


The F2-labelled pool of residues were given the principal and assayed as explained elsewhere. The DDT-poisoned houseflies were given aqueous glucose. A significant difference was observed between the untreated and the experimental groups. The failure in ATP and insulin reserves or to the hypermetabolism of the granulation there was a failure in the level of anaesthesia.

The concentration of DDT in suspensions was shown to be less than the theoretical, and to vary with the volume of the suspension and the size of the container. This variation resulted from differences in the loss of DDT by codistillation and/or by association with the water interface, which explained the resulting differences in mosquito mortality. The mortality of Anopheles quadrimaculatus Say was influenced more than that of Aedes aegypti (L.), owing to a difference in the behaviour of the larvae and the desiccation-mortality response. Biological data obtained with Parathion, Malathion, Lindane, and Dieldrin indicate that insufficient quantities of these insecticides are lost from the containers to alter mortality under normal test conditions. (auth.)

* C14-labelled DDT was used throughout.

6 Winteringham et al. 1960 - (492)


Since the insecticidal properties of DB135 DT are similar to normal DDT and there is no reason to expect any fundamental differences in their metabolism, the penetration and metabolism of (Br135)2H2OC12CCl4 by susceptible and resistant strains of the housefly Musca domestica were studied by labelling it with Br135.

Preliminary penetration studies indicated that DDT-resistant flies were also resistant to DB135 DT but their resistance was not associated with decreased absorption of the applied insecticide. Metabolism of DB135 DT was only observed in DDT-resistant flies. Results suggest that the metabolism is enzymatic in nature.

Metabolism appears to be sufficiently rapid to account for the suspected resistance of the flies used in these experiments. Alternatively, only a small fraction of the applied insecticide is involved in the site of action, but it is this fraction which is metabolized. To check whether the presence of "DB135 DE" metabolites might account for the observed resistance, experiments were performed in which mixtures of DB135 DT and DB135 DE were injected into or applied to susceptible flies. No evidence of protection was observed.


The author used a bromine (Br135) analogue of DDT for treating two resistant and two susceptible strains of houseflies (from Italy and Sadifizia, and from Italy and England respectively). Both adults and larvae were used for studying the metabolism of DB135 DT. Both strains were able to metabolize the compound provided the dose absorbed was sufficiently low; the resistant strains degraded the insecticide more rapidly than the susceptible strains did, however. Only the intact, living flies were capable of metabolically degrading the absorbed insecticide. At least two kinds of DDT-resistance were observed, one represented by the Italian strain in which survival appeared to depend upon a mechanism such as enzymatic dehydrohalogenation and the enhanced metabolism was a consequence rather than a cause of survival.

9 Winteringham et al. 1962 - (786)

Winteringham et al. 1962 - (787)


The P32-labelled-pool technique was used for studying the effects of DDT and Dieldrin. Experimental details are given. The principal soluble phosphorus compounds were uniformly labelled in vivo, extracted and assayed as explained elsewhere (Winteringham, 1960). A significant breakdown of thoracic ADT in DDT-poisoned houseflies was noted at the late prothorax stage. This fall could be reversed by injecting aqueous glucon. A significant breakdown in insects spared the hypermotor activity by cyclopropane anaesthesia, cyclopropane also failed to prevent the enhanced deactivation associated with DDT poisoning. The fall in ATP and respiration rate of DDT-poisoned houseflies is not due to the exhaustion of endogenous reserves or to the hypermotor activity induced by DDT. In both DDT- and Dieldrin-poisoned houseflies there is a fall in the level of thoracic α-glycerophosphate, which could not be reversed by cyclopropane anaesthesia.

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Endrin and Isodrin


Adipic acid-1,6-C14 (2) pyrolyzed with Ba(OH)2 gave cyclopentane-1-C14, which reduced with NaBH4 gave cyclopentanol-1-C14, dehydrogenation of which with HgO gave cyclopentene-1-C14, which brominated gave 1,2-dibromo-cyclopentene-1-C14, which dehydrobrominated gave cyclopentadiene-1-C14, which condensed with excess 1,2,3,4,7,7-hexachlorobicyclo[2.2.1]hepta-2,5-diene gave "Isodrin"-6, and 7-C14 (D). A containing 0.1 mc C14 gave 2% II. (CA 52: 10986a, 1958)

497 Brooks, G.T. THE SYNTHESIS OF MC-LABELED 1,2,3,4,10,10-HEXACHLORO-6,7-EPOXY-1,4,4,5,6,7,8,8a-OCTAHYDRO-EXO-1,4-EXO-5,8-DIMETHANONAPHTHALENE (ENDRIN). J. chem. Soc. (1958) 3603-7.

A study of the absorption, metabolism, and excretion of insecticides derived from decaldehyde-1,4,5,8-dimethanobenzene required a method for the preparation on a milligram scale of such compounds labelled with C14. C14-labelled Endrin has now been synthesized by peracetic acid oxidation of C14-labelled Isodrin prepared by Detsch-Alder addition of [1-C14] cyclopentadiene to 1,2,5,6,4,7,7-hexachlorobicyclo [2.2.1]hepta-2,5-diene.


Topically applied Isodrin and Endrin (C14-labelled in the terminal unchlorinated ring) were found to be less toxic than Aldrin and Dieldrin to susceptible houseflies but more toxic to Dieldrin-resistant houseflies. Both strains of houseflies converted Isodrin to the corresponding epoxide Endrin. Small amounts of Endrin also were recovered in the external rinse. The penetration, metabolism, and excretion of the insecticides and the presence of residual material in tissues are discussed. Endrin was not formed in the tissues of heat-killed insects, suggesting an enzymatic oxidation. Acetone-extracts of five houseflies treated with Isodrin or Endrin contained small amounts of a nonreactive water-insoluble product, which behaved as a ketone derivative of Endrin. There was no evidence that radioactive material was excreted.

Miscellaneous


Bromoaecetic acid disappeared from the blood in 45 minutes. Radioactivity of the tissues varies directly with the dose administered, except in the intestine and the Malpighian tubules of which it varied a little. The radioactivity in muscle is slight and occurs mostly in the highly muscular parts which is at the end of the digestive duodeneum. When the deproteinized extracts are separated by electrophoresis, 6 electrophoretically and 2 electrophoretic compounds may be distinguished by autoradiography. (BS: 17-105748, 1958)


Doses of 90, 180, and 360 g of bromoacetic acid-2-C14 were 2 injected into cockroaches (Periplaneta americana) and their blood was studied. A maximum of activity appeared 5 - 10 minutes after injection, and it disappeared within 60 minutes. Radioactivity rose proportionally to the amount injected in various parts of the roach, but not in the color and the Malpighian tube. Electrophoresis on paper of deproteinized roach extracts produced 2 electrophoretic and 5 electrophoretic radioactive compounds (after injection of C14), the major component resembling 5-(carboxymethyl)glutathione in migration rate. Earlier work on the subject is also reviewed. (CA 52: 14874, 1958)


The insecticide 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methanodibenzodioxathiepin 3-oxide-5a, 9a-C14 (Thiodan-5a, 9a-C14) was prepared for use in biological studies which required that quantities as low as 1 part per million be detectable. Starting with a 411-mo quantity of barium carbonate-C14, the chemical yield of 51%.


Radioactive tracer technique: "Tetdon V 18" (an acaricide) and Tetdon, which is 3,4,4',4'-tetrabromobenzene. Apple trees were sprayed with the powder and as a mixture of the leaf for a long period, while the leaves show continuous, economical in use than the weight, about 40 to 45% of the leaves is broken down. (An earlier abstract: "Dexamifone, a new acaricide to Iberites 2 (1957) 217)

503 Heath, D.F. SOME APPLICATIONS OF "COMPRES RENOUV. REVUE DU SAVOIR". (Abstract)

504 Lidbeck, M. ÜBER DIE AUER (Study on the absorption of 3C6) AUER, DEUTSCHES INSEKTENREIN (1954) 56.

505 Relevant work reviewed for 3C6.


A review article of a general nature.


Schea (octamethylpropylphosphate) and their diet-sucking insects on a variety of different diets. A concentrate in certain rapid-acting compounds is more resistant to biochemical behaviour and stability.

508 Mühmann, R., Schrader, O. INSECTICIDAL PHOSPHORIC ACID.

The practical application of insecticidal phosphoric acid compounds in the temperature-tolerant form. 32P was used.
barium carbonate-$^{14}$, the quantity of final product obtained was 210 mc, which represents a radio-
chemical yield of 51%.

502 Halberstadt, J. SOME EXPERIMENTS WITH RADIOACTIVE PREPARATIONS OF 2,4,5,4'-TETRACHLORO-
DIPHENYL SULPHONE, A NEW ACARICIDE. Meded. landbouw. geneeskd., Gent., 22, 3-4 (1958) 788-94.
A scientific note on the method of preparation of the compound, and on experiments in which it was
applied to apple trees. Toxicity tests on rats and their results are reported. $^{32}$ was used for labelling.

503 Halberstadt, J. EXPERIMENTS WITH RADIOACTIVE PREPARATIONS OF THE ACARICIDE "TEDION V 18"
Radioactive tracer techniques are applied to investigations into the behaviour in plants and animals of
"Tedion V 18" (an acaricide for the control of spider mites). The sulphur in the active ingredient of
Tedion, which is 2,4,5,4'-tetrachlorodiphenyl sulphone, is partly replaced by the radioactive isotope $^{34}S$.
Apple trees were sprayed with preparations of this radioactive Tedion in two formulations; as a wettable
powder and as a miscible oil. Radioactivity measurements showed that an active residue remains on the
leaf for a long period, whilst the Tedion taken up in the leaf is subject to conversion and transport within
the plant, being continuously supplemented from the surface residue. The miscible oil proves to be more
economical in use than the wettable powder. Administered to rats (max. dose 100 mg per kg body
weight), about 40 to 46% of the Tedion is found unchanged after 48 h, mainly in the faeces; the remainder
is broken down. (Auth. summary)

(An earlier abstract "Determination of uptake and loss in plants and animals of 2,4,5,4'-tetrachlorodiphenyl
sulphone, a new acaricide as measured with the aid of $^{34}S"$ appeared in Inter. J. appl. Radiat. and
Isotopes 2 (1957) 217)

II - D Organophosphates

Survey Articles

504 Heath, D. F. SOME APPLICATIONS OF $^{32}P$ TO THE STUDY OF SYSTEMIC INSECTICIDES. p. 136-40 in

505 Jädicke, M. ÜBER DIE AUFNAHME RADIOAKTIVER KONTAKTINSEKTIZIDE BEI PFLANZEN UND TIEREN
(Study on the absorption of radioactive contact insecticides by plants and animals). Nachr. gesch.
Pflanzendienst, Ber., 5, (1954) 122-4. (In German)
Relevant work reviewed from 1944 to 1954. With one exception, the radioisotope employed was $^{31}P$.

338-35, 129-30,
A review article of a general, introductory nature. 8 references.

(1964) 5-6.
Schaden (octamethyl pyrophosphoramide) and Deneton or Systox (O,O-diethyl O-ethyl-benzamidoepoxythio-
phosphate) and their derivatives have shown unusual promise for the control of mites and aphides and other
sucking insects on a variety of agricultural crops. These materials are freely transported in the plant and
concentrate in certain rapidly growing tissues. It is necessary, therefore, to have detailed knowledge of
possible undesirable residues in edible produce. Radio-phosphorus tracers were found to aid basic studies on
biochemical behaviour and routine analysis of residues in treated produce. (BA 59; 20080, 1959)

508 Mühlmann, K., Schneider, G. HYDROLYSE DER INSEKTIZIDEN PHOSPHORSÄURESTER (hydrolysis of
insecticidal phosphoric acid esters). Z. Naturf., 18 b (1957) 196-208. (In German)
The practical applicability of phosphoric esters depends largely on their hydrolytic stability. The hydrolysis
constants in the temperature range 20-70°C and for pH 1-9 were determined. The results are presented in
tabulated form. $^{32}P$ was used throughout for labelling.
A review article. Principles of selective toxicity are discussed. Some unpublished work by Kneger is mentioned who investigated Malathion metabolism in insects employing unusual P-labelled compounds, and separating the metabolites by column chromatography. Results of chromatographic analysis on an iminocycl column of metabolites in the bodies of flies 4 h after topical application of radioactive Malathion (150 mg/kg) are shown in a figure. Nine water-soluble degradation products, not the expected 2 were produced. Periplaneta americana, Blatella germanica and Musca domestica all degraded Malathion to the same extent and to the same products but the toxicity, particularly for the cockroaches, differed widely.

A section in chapter 10 (Technique) is devoted to radionuclide synthesis using P. The phases in synthesis are (a) exchange, whereby the initial radioactivity is transferred to the starting material; (b) synthesis of an intermediate such as (OCOCH$_3$)$_2$P(OMe)$_3$H; (c) coupling the intermediate with the appropriate compound to yield the product; and (d) purification. Almost all currently used organophosphates can be prepared from (1) PCl$_3$ and P(O)Cl$_3$·phosphates or phosphorothiolates; for nearly all subsequent syntheses (except of phosphoramidic) PCl$_3$ given by far the best yield. (3) P(O)Cl$_3$·phosphorothiolates. (3) PFS$_3$·phosphorothiolates. Exchange reactions, the repair of intermediates, activities and yield, coupling and purification are discussed. Numerous references are cited.

Spencer 1959 - [768]

The review gives an outline of the development and present state of knowledge in the internal therapy of plants, and deals chiefly with products which have a systemic action. Pyrazoxon (O,O-diethyl S,S-diisopropyl phosphorothioate) (water-soluble 10000 ppm) showed good systemic action after trunk application to apple, root absorption in beans and seed treatment of millet. Experiments with P-labelled Pyrazoxon showed that it was distributed throughout the entire apple plant following application to root, stem or a single branch.

Wedding 1959 - [766]

Anmition

Baldit, G. L. AMITON - A NEW ACARICIDE AND SCALICIDE. J. Sci. Food Agric. 9 (1959) 516-24. Investigation on the behaviour of P-labelled Amiton (O,O-diethyl S-(diethyl-amino) ethyl phosphorothioate) and its salts in plants showed that Amiton oxalate penetrates the cuticle and is translocated readily through the plant in solution of pH 7.5 or more but not in acid solutions, probably because dissociation of the salt does not occur in these. Acaricidal concentrations have little effect on insect predators, probably because the oxalate has no fungitoxic action and only low contact action. At five times the acaricidal concentration, the Amiton oxalate had no effect on Hippodamia quaesita or Amblyseius oecolus Say, but it was slightly more harmful to Aphyon (Metaaphyon) leonis Timm, and Oritia oesidiosa Say.

Co-Ral

Claborn et al. 1959 - [758]


Only small amounts of P$^{32}$ were absorbed through the skin and eliminated in the urine following dermal application of the compound to cattle. High levels of the unchanged tautomeric were found on the lead seven times after treatment. The compound was ineffective as a systemic against stable flies and screwworm larvae but highly effective against these insects by contact. Oral treatments, at 10 and 20 mg per kg, approximately 38% of the dose was excreted in urine as polar degradation products and about 35% in the faeces 7 days after treatment. (auth.)

Kneger, H. R., Castida, J. E. INSECTICIDES. METABOLISM TO RATS, A GOAT, AND A COW. Co-Ral was applied dermally to the rats that were sacrificed at predetermined intervals. Other factors investigated included its oxygen analogue, the effects of solutions, levels of Co-Ral and its activity, milk residues, and the amount of Co-Ral excreted in urine after dosage. (auth.)

Lindquist, D. A., Burns, E. C. WHITE RAT. J. econ. Ent. 53 (1960) 49-56. The fate of orally administered thiothionates has shown synthesis of the P$_2$-labelled compound. The compound was rapidly metabolized, and 80% of the urine within 24 h, whereas the urine was not due to the Baron radiotracer were found in the urine after dosage, small but significant.

(See also abstract in Bull. Ent. 1959, 82, 15.)

Radeff, R. A., Claborn, H. V. Food chem. 2, 6 (1960) 437-40. Co-Ral, O-Clilor-4-methylphenol, is an effective systemic and contact insecticide in millet sprayed with this compound. It is organo-soluble extractable (Co-35 ppm, respectively, for the levels declined gradually over time.

Robbins, W. E., Hopkins, T. L. BAYER 21/199 and its COBRA. J. econ. Ent. 51 (1958) 415-418. The joint oral administration of O-Clilor-4-methylphenol in a four- to six-fold, increased by different routes. Piperonyl butoxide is 21/199 and it is the joint administration of piperonyl butoxide.

Robbins, W. E., Hopkins, T. L. ON CATTLE. J. econ. Ent. 51 (1958) 415-418. The metabolism, excretion, and spray application of two herefords with these behaved like the other and two animals were killed. Two animals were killed after treatment with 21 per cent, and 21/199 was present externally. (auth.)

Schmidt and Weihsaas - [757]


104
Co-Ral was applied dermally to rats, a cow, and a goat at 30 to 45 mg per kg. The animals were sacrificed at predetermined intervals and the tissues were tested, chromatographically, for residues of the insecticide. Other factors investigated were the in vitro and in vivo opening of the pyrrole ring of Co-Ral and its oxygen analogue, the ease of excretion of Co-Ral and the oxygen analogue from proteinaceous solutions, levels of Co-Ral metabolites appearing in blood, and the effect on the blood cholinesterase activity, milk residues, and the nature of the products excreted in the urine and faeces. P32 was used for labelling. (auth.)

The fate of orally administered bayer 21/199 (O, O-diethyl O-3-chloro-4-methyl-7-trans-2-oxo-7-oxa-1,10-diazacyclododec-1-enephosphorothioate) which has shown systemic activity against Hypoderma in cattle, was studied by administration of the P32-labelled compound to white rats at an average dosage of 20 mg/kg body weight. The compound was rapidly metabolized and excreted. About 78% of the radioactivity of the original dose was excreted in the urine within 24 h. Paper chromatographic analysis indicated that the radioactivity in the urine was not due to the bayer 21/199 but was associated with more polar compounds. Smaller amounts of radioactivity were found in the feces, bile, lymph and blood. Among samples of various tissues taken 24 h after dosage, small but significant amounts of radioactivity were found in bone, liver and kidney. (from auth.)
(See also abstract in Bull. ent. Soc. Amer. 5, 3 (1957) 26; abstr. 34)

Co-Ral, O-(2-chloro-4-methylumbelliferyl) O, O-diethyl phosphorothioate, also known as Bayer 21/199, is an effective systemic and contact insecticide for livestock use. To determine whether it would be excreted in milk of spayed cattle, dairy cows were sprayed with 0.5 and 0.75% concentrations. Maximum organo-soluble extractable (Co-Ral plus other organo-soluble compounds) was approximately 0.2 and 0.3 microg/mg, respectively, for the 0.5 and 0.75% concentrations, reached 5 h after treatment. These levels declined gradually over 7 days, being only a trace at 10 days. P32-labelled Co-Ral was used.

The joint oral administration of piperonyl butoxide (1%) increased the toxicity of both bayer 21/199 (O, O-diethyl phosphorothioate) and its corresponding phosphate to mice four-to six-fold. This increase in toxicity was also found when synergist and toxicant were administered by different routes. Piperonyl butoxide increased the in vitro but not the in vivo inhibition of mouse brain cholinesterase by 21/199 or its phosphate. Preliminary studies with P32-labelled 21/199 demonstrated that the joint administration of piperonyl butoxide inhibited its metabolism to more polar metabolites. (auth.)

The metabolism, excretion, and tissue distribution of P32-labelled Bayer 21/199 have been studied following spray application of two Hereford bulls. Only low levels of radioactive compounds were found in the blood, and these behaved like polar degradation products. The compound appears to have been sparingly absorbed, about 2.4% (unesterified) and 6.3% (esterified) of the applied dose being accounted for in the urine of the two animals 2 weeks after treatment. At that time only very low levels of organo-soluble compounds which behaved like 21/199 were present in the tissues, but a considerable residue of unchanged 21/199 was present externally. (auth.)

519 Schmidt and Weidhaas - (737)

p²-labelled Co-Ral (Bayer 21/139) (Q, O-diethyl Q-(3-chloro-4-methylumbelliferone) phosphorodithioate) was prepared. The bed bug (Cimex lectularius L.) and the Gulf Coast tick (Amblyomma maculatum Koch) were utilized to evaluate the ant systemic activity of Co-Ral and Potasan. Rabbits were treated orally, dermally, subcutaneously, or intramuscularly with Co-Ral, and orally or dermally with Potasan. The numbers of animals treated, dosages in mg/kg, numbers of insects tested, and mortality data are given. The relative toxicity of Co-Ral, oxygen analogue of Co-Ral, chloroferon, and Potasan were compared from LD₅₀ determinations made with adult 3-d old female houseflies (Musca domestica L.), adult bed bugs, 4th-instar larvae of the yellow-fever mosquito (Aedes aegypti L.) and mixed sexes of white rats, Co-Ral was more stable in several species of insects than in mammals. Metabolites isolated from insects and mammals consisted of the oxygen analogue, O-ethyl and Q, Q-diethyl phosphoric acid, Q, O-diethyl phosphorodithioate acid, and possibly "depetyl" Co-Ral. The cumatril ring structure was not opened in vitro as demonstrated by alkaline degradation. The same metabolites were recovered from insects and rats but different quantities of each metabolite were formed. The ability of rats to degrade Co-Ral to water-soluble products more rapidly and completely than insects is probably a significant factor in determining the selective toxicity of Co-Ral.

Delnav

520


Technical Hercules AC-528 (Delnav) was separated by partition chromatography into 8 different fractions. The major components were the cis and trans isomers of 5, 3,3′-dioxanediethiol 5, 5′-bis(Q, O-diethyl phosphorodithioate). The structure, toxicity to houseflies and rats, anti-cholinesterase activity and stability to alkaline hydrolysis were studied for these 8 Hercules AC-528 components. Radioactive Hercules AC-528 was prepared and the metabolism in rats and cockroaches studied for the cis and trans isomers, S,8-dioxanediethiol 5, 5′-bis(Q, O-diethyl phosphorodithioate) and bis(diethylphosphorothioxy) disulfide. In a wide variety of in vivo and in vitro biological systems the cis and trans isomers were the most stable of the radioactive components; the single exception was a study on hydrolysis by human plasma where the diene derivative was the most stable. In a subacute feeding study with rats, Hercules AC-528 was found to accumulate to a small degree in fat. However, the residues disappeared rapidly when feeding of Hercules AC-528 was discontinued. Other factors in investigating Hercules AC-528 included: cholinesterase depression and recovery in rats following administration of a sublethal dose; the effect of subacute feeding on rat plasma, red blood corpuscles and brain cholinesterase activity; metabolism of the components of Hercules AC-528 by Periplaneta americana L. and rat liver slices; the formation of more polar, non-hydrolyzed metabolites from the radioactive components by rats and cockroaches; and the nature of the hydrolysis products formed from the components in human plasma and following oral administration to rats. (auth.)

521


p²-Delnav® (Q, 3,3′-dioxanediethiol 5, 5′-bis(Q, O-diethyl phosphorodithioate) was applied as a spray to a Hereford steer and the residues and metabolic pathway were determined. Fatty tissues accumulated small amounts of the insecticide, but 3 d after treatment most of the dose was still on the hair. No residues were found in meat samples. The metabolic degradation of the insecticide in mice was not affected by the route of administration. Paper and alumina chromatography demonstrated the presence of phosphate and/or phosphorothiolate compounds in some of the minor fractions of technical Delnav. (auth.)

Note by the editor: Delnav® is also known as Hercules AC-528.

(An abstract of earlier work was published in Bull. ent. Soc. Am. 43, 3 (1958) 96, abstr. 196, under "Residues following spray application of p²-labeled Hercules AC-528 (Delnav) to a Hereford steer")

DPP

522


Japan's method (Y, biol. Chem. 179 (1949) 189) for calculating the initial concentration of enzyme active centres and the turnover number can only be applied to enzyme preparations of a purity which has not been achieved for most esterases known. Such preparations of esterases contain non-enzymic groups (impurities and perhaps fraction DPP). The combination produces than the ones associated with esterases successfully to overcome these two active centres and for the immobilized cholinesterase.


Bovine red cell chelatase was separated from the all-chelatase present in the percentage of the p² bound. The non-specific cholinesterase were prepared from preparations (number of value previously reported). The reaction products of DPP were subjected to chromatography or associated with the inorganic phosphorus. The suggestion that the OH group of substituted centres of the esterase concerned.


On paper electrophoresis the pseudo and the β-peak. The same local dialyzed DPP-treated human DPP were submitted to some electrophoresis strips, but after column α-2 and the β-peaks. The complex of DPP, only one component, that for the turnover of serum proteins cholinesterase component.

Dixon, G. H., Neunath, H. T. TRYPsin. (Short communication). A new technique was developed whereby the phosphoprotein electrophore.

The method was a modification of the earlier one. The column was packed in a solution of an aliquot of the reaction mixture, forced through under pressure. The clear separation from each other to be located by monitoring the column. The presence of the labelled protein by supension experiments are given in tabular form: phosphorylation of imidazoloc to.


Rabbit and guinea-pig sera were in order to separate the serum enzymes are combined with p² after incubation activity is located only in one p of guinea-pig serum, it is located cholinesterase. The implication

Bovine red cell stroma was capable of combining with DFP-P. The combination was found to be mainly due to the all-esterase present in the stroma. The true cholinesterase of the stroma accounts for only a minor percentage of the enzyme bound. The reaction products of DFP-P with highly purified preparations of true and pseudo-cholinesterase were prepared by incubation of the enzymes with DFP-P. For these enzyme preparations turnover numbers could be established. The figure found for true cholinesterase confirmed the value previously reported (350000). A turnover number of 50000 was found for pseudo-cholinesterase.

The reaction products of DFP with all-esterase, true and pseudo-cholinesterase were hydrolyzed and subjected to chromatography on Dowex-50, in all three cases the bulk of the radioactivity proved to be associated with the inorganic phosphate and serine phosphate fractions of the chromatogram. The results suggest that the OH groups of serine might be of importance in the combination of DFP with the active centre of the esterase component.


A new technique was developed in order to facilitate the detection of unstable DFP-enzyme derivatives, whereby the phosphorylated enzyme could be rapidly separated from excess DFP and its hydrolysis product DFP. Use was made of a column of Dowex-50 X 8 cation exchange resin, 200-400 mesh, in the NH_4^+ form. The column was packed in a polyethylene tube and pre-treated with 0.1 M sodium citrate buffer pH 3.0: an aliquot of the reaction mixture of the enzyme with DFP-P is then applied to the top of the column and forced through under pressure. Upon elution with 0.1 M acetic acid, DFP and DFP-P were rapidly eluted, with clear separation from each other, while the labelled protein was retained at the top of the resin. It could be located by monitoring the column, and then cutting through column and resin in that region and eluting the labelled protein by suspension of the resin in 1 M NaOH. The results of the above and of dialysis experiments are given in tabulated form. No evidence was found to support the hypothesis that the phosphorylation of imidazole constitutes the initial stage of the combination of DFP with trypsin.


Rabbit and guinea-pig sera were submitted to electrophoresis on starch columns and on filter paper, in order to separate the serum esterases and cholinesterase and to determine the nature of serum proteins which are combined with DFP-P after intramuscular injection of DFP-P. Three days after injection, the radioactivity is located only in one part of the esterase activity (perhaps on B-esterase) in rabbit serum. In guinea-pig serum, it is located mostly on B-esterase and partly on another protein which is very probably cholinesterase. The implications of the results are discussed.

Turnover number of preparations 1985-8. Initial concentration of enzyme preparations of a purity which has the enzyme contain non-enzymatic groups (importants and perhaps fractions of the esterase molecule itself) which would then also combine with DFP-P. The combination product thus contains more DFP than enzyme-active groups since groups other than the ones associated with enzyme activity are labelled. The paper presents two methods employed successfully to overcome these difficulties, which result in reliable figures for molar concentrations of active centres and for the turnover number in crude and partly purified preparations of or red cell cholinesterase.


When a preparation of purified, human plasma cholinesterase was inhibited by radioactively labelled DFP, the phosphorus of the inhibitor was introduced into the inhibited enzyme. Hence the inhibition reaction of this enzyme by DFP was in this respect a similar reaction to the inhibition of the esterolytic proteinases. The amount of phosphorus introduced into the still active cholinesterase was 0.0023%. (auth. summary)


Horse-liver all esterase reacts with DFP to form the enzymatically inactive DFP-enzyme. With $N$-nitroacetoacetone disopropylphosphonate is released from the inhibited enzyme; this is accompanied by a recovery of the enzymatic activity. In order to investigate the chemical nature of the DFP-binding site of all esterase the DFP-enzyme was digested with pepsin. Essentially one DFP-peptide was formed which contained per mole of DFP-group the following moles of amino acid residues: alanine (1), glutamic acid or glutamine (2), glycine (3), and serine (2). DFP$^{32}P$ of high specific activity (200 $\mu$g/mg DFP) was used.


The structure of a disopropylphosphonyl-containing peptide obtained by digestion of DFP-inhibited horse-liver all esterase by pepsin was established as follows: gly-glu-DFP-OH-ser-ala-gly-gly-glu-ser. The DFP$^{32}P$-peptide was prepared as described by the author (ibid. 387-95).


An investigation into the possibility of using the enzyme cholinesterase and disopropyl fluorophosphate, the inhibitor, was possible by using $^{32}P$-labelled DFP of 2-10 m $\mu$g/mM activity. It was found that electric eel cholinesterase 1) reacts with DFP to form a compound which remains unindicated in 10% trichloroacetic acid at room temperature, and 2) combines with $2.1 \times 10^{-10}$ mol of DFP per unit of activity, unit activity being defined as the amount of cholinesterase which will hydrolyse 1 g of acetylcholine in 1 h at pH 7.4 and 38°C with 0.015 M acetylcholine and an ionic strength of 0.14.


The work is aimed at obtaining data on the inhibition of crystalline chymotrypsin by DFP$^{32}P$. It was assumed that this inhibition could serve as a satisfactory model for the corresponding reaction on cholinesterase. Details of the experimental procedure and results are given.


After reaction with DFP$^{32}P$, a-chymotrypsin was subjected to a proteolytic digestion. From the digest two related peptides containing the radioactively-labelled disopropylphosphoryl-group were isolated. The amino acid composition of one peptide was established as aspartic acid or asparagine (1), serine (1), glycine (2), and proline (1). In addition to these amino acids, the second peptide contained a leucine residue.


535 Saunders, B.C., Worby, T. FLOMOPHOSPHONATE (D). The preparation of $^{32}P$-labelled FPO (OCH$_3$)$_2$P(OH)$_2$ on a 1-g scale operation and which was used in the production of the $^{32}P$ used had a specific activity of 2200 $\mu$g/mg. The yield obtained was 111. (auth. summary)

536 Schafft, N.K., May, S.C. PHOSPHORYL CHYMOTRYPSIN. The nature of the combination reaction product of disopropyl phosphate with partially hydrolysed chymotrypsin was obtained by paper chromatography. The product is a complex of phosphorus and chymotrypsin, Dowex 50.

537 Schafft, N.K., May, S.C. PHOSPHORYL DERIVATIVE OF CHYMOTRYPSIN. The reaction product of diisopropyl phosphate, labelled with $^{32}P$, with $\mathrm{HCl}$. Serine phosphatase (based on phosphomolybdate) is free from synthetic serine phosphatase (auth. summary).


$^{32}P$-labelled diisopropyl phosphate. Serine phosphatase, phosphomolybdate by Dowex 50 chromatography of phosphoesterase, (3) phosphoserine. Two other fractions (4) and are believed to be isozymes (auth. summary).


$^{32}P$-labelled Serine (4gopropyl) those of DFP (diisopropyl) phosphates.

128
A method is described for the preparation of $^{32}$P-labelled dl-isoglycerolphosphorofluoridate in water or oil solution starting from radioactive phosphoric acid. The specific radioactivity amount to 200 mc/mg.

(aut.)


The preparation of $^{32}$P-labelled DPF is described. Details are given of the preparation of radioactive FPO.COCH$_3$.Mg$_2$ (I) on a 1-g. scale; a modified apparatus is described which is suitable for the small-scale operation and which takes into account the volatility of the radioactive intermediates and final product. The $^{32}$P used had an activity of 20 000 cpm/mg and the resulting I an activity of 2000 cpm/mg. The yield of I, prepared according to CA 45: 6760 h, is 65%. (cf. CA 45 (1951) 1116)


The nature of the combination between chymotrypsin and DPF was investigated with $^{32}$P-labelled DPF. The reaction product of dl-isoglycerolphosphorofluorophosphate (D.P.F.) and chymotrypsin, dl-isoglycerolphosphorofluorophosphoryl chymotrypsin, was partially hydrolyzed by papain, trypsin, and 2 N HCl or directly with 2 N HCl. Serine phosphoric acid was obtained in 30% yield from the hydrolysate by fractionation with Dowex 50 chromatography. The product has a nitrogen to phosphorus ratio of 0.8 to 1.3, contained 1 mole of serine per atom of phosphorus, and could not be distinguished from authentic serine phosphoric acid by paper chromatography, Dowex 50 chromatography, or fractional precipitations. (From summary)


The reaction product of dl-isoglycerolphosphorofluorophosphate and eel cholinesterase, dl-isoglycerolphosphoryl cholinesterase, labelled with $^{32}$P, was partially hydrolyzed by papain, trypsin, and 2 N HCl or directly with 2 N HCl. Serine phosphoric acid was separated from the hydrolysate by approximately a 40% yield (based on phosphorus) by fractionation with Dowex 50 chromatography. Identity was established by comparison with synthetic serine phosphoric acid by fractional alcohol precipitation and Dowex 50 chromatography. (From summary)


$^{32}$P-labelled dl-isoglycerolphosphorol chymotrypsin was partially hydrolyzed with 2 N HCl at 100°C for 2.5 h. Serine phosphoric acid, phosphoeryglycine, and glycylserine phosphoric acid were separated from the hydrolysate by Dowex 50 chromatography. Phosphoeryglycine, hydrolyzed under the same conditions, was partly converted to glycylserine phosphoric acid. Evidence is cited that only phosphoeryglycine represents the normal dipeptide sequence in dl-isoglycerolphosphorol chymotrypsin. (From summary)


$^{32}$P-labelled dl-isoglycerolphosphorol chymotrypsin was partially hydrolyzed with 12 N HCl at 27°C for 4 d. Dowex 50 chromatography of the hydrolysate resulted in the separation of (1) phosphoserine, (2) aspartyl-phosphoserine, (3) phosphoeryglycine, (4) aspartylphosphoeryglycine, and (3) glycylasparaglyphasphoserelyglycine. Two other fractions have the same amino acid composition and sequence as peptides (3) and (4), and are believed to be isopropyl derivatives. Asparagine is not a constituent of these peptides. (From summary)


$^{32}$P-labelled Sarin (isopropylmethylphosphonofluoridate) was used. Sarin is an esterase inhibitor similar to those of DPF (disopropyl phosphorofluoridate). The isopropylmethylphosphonofluoridate derivative of...
tryptin, isopropy methylphosphonyl tryptin, was partially hydrolyzed with 12 N HCl at 87°C for 3 d. Dowex 50 chromatography of the hydrolysate resulted in the separation of (1) methylphosphonylectine, (2) arsylmethylphosphonylserine, (3) methylphosphonylethylglycine, and (4) arsylmethylphosphonylserglycine. Another peptide with the same amino acid composition and sequence as peptide (4) was separated and is believed to be isopropy derivative. Asparagine is not a constituent of these peptides.

Winteringam and Harrison 1965 - (782)

Winteringam et al. 1957 - (727)

**Diazinon and Related Compounds**

541


The persistence and metabolism of Diazinon (C, O-dieethyl O-(6-isopropyl-4-methyl-6-pyrimidinyl)phosphorothioate) Dimethate, Parathion, and Acethion (O, O-dieethyl 2-carboxothioethyl phosphorothioate) have been studied in the mouse, American cockroach (Periplaneta americana L.), and housefly (Musca domestica L.). The results have been used to explain the selective toxicity of these compounds toward insects as compared with mammals. For Diazinon, selectivity is attributed to high levels of oxygen analogues in the susceptible species. For Dimethate and Acethion, selectivity is attributed to a persistence of unaltered parent compound in the whole body. Small differences were found in Diazinon absorption and metabolism by normal and Diazinon-resistant house flies.

References are quoted for the methods adopted for the preparation of radioactive Dimethate, Acethion, Diazinon and Parathion.

542


Diazinon may be labelled with \( ^{31} \text{P} \), \( ^{32} \text{P} \) or \( ^{33} \text{P} \). Since the last offers an easy synthetic route and is more readily measured radiochemically, elemental red phosphorus was selected as a starting material, after irradiating it to a specific activity of approximately 50 mc/g. The method of synthesizing phosphorus trichloride is described. The two step chlorination and the use of the powdered antimony were utilized to increase the specific activity and yield of phosphorus trichloride. Paper chromatography analyses of the labelled products were made. Experimental details of the methods employed for the synthesis of phosphorus trichloride, triphosphoryl trichloride, O,O-dieethyl chlorophosphate and Diazinon are given.

543


\( ^{32} \text{P} \)-labelled Diazinon, administered orally to a cow at 20 mg/kg, is rapidly metabolized and excreted. Only low levels of unchanged toxicant were found in blood and milk samples. About 74% of the dose, excreted as polar degradation products, was accounted for in the urine 30 h after treatment. (auth.)

544


The two compounds were separated by inverse partition chromatography, impregnating the paper with a silicone gel and with \( \text{H}_{2}\text{SO}_{4}-\text{NH}_{4}\text{OAc} \) as the mobile phase. The spots were located by spraying with \( \text{i}_{2} \) or with toluide-di-i reagent containing \( \text{H}_{2}\text{SO}_{4} \), \( \text{HCl} \), and \( \text{H}_{2}\text{O} \) on, with radioactive products, by autoradiography. (CA 59: 1380d, 1956)

545


Diazinon was labelled with \( ^{32} \text{P} \). A \( \text{C}_{4}\text{H}_{8} \) solution of the enolic form of 2-isopropyl-4-methyl-6-hydroxy- pyrimidine and \( ^{32} \text{P} \text{Cl}_{3} \) form the corresponding dichlorophosphate ester which, with excess \( \text{NaOH} \), gives active Diazinon purified by was microartappatus employed are generally active dityl phosphate was present. The \( K \) enolate of the same 6-hydroxy-

(2-isopropyl)-4-methyl-6-pyrimidine (CA 60: 1929g, 1959)

546


Diazinon was labelled with \( ^{32} \text{P} \). A \( \text{C}_{4}\text{H}_{8} \) solution of the enolic form of 2-isopropyl-4-methyl-6-hydroxy-pyrimidine and \( ^{32} \text{P} \text{Cl}_{3} \) form the corresponding dichlorophosphate ester which, with excess \( \text{NaOH} \), gives active Diazinon purified by was microartappatus employed are generally active dityl phosphate was present. The \( K \) enolate of the same 6-hydroxy-

(2-isopropyl)-4-methyl-6-pyrimidine (CA 60: 1929g, 1959)


\( ^{32} \text{P} \) is introduced into \( \text{P}_{2}\text{O}_{5} \) by out in a Carius tube. The tube is a solution of 2-isopropyl-4-methyl-

thionophosphate ester is prepared. (Voir 546)

547

Vigne, J. P., Tabau, R. L., FOR \( ^{32} \text{P} \) ET THIONOPHOSPHORÉS MÉTHYL 4-MÉTHYL 6-OXY 6 PYRIMIDINES. Les auteurs deviennent une méthode organophosphoröuse qui n'est pas utilisée.

(voir 546)

548

Vigne, J. P., Tabau, R. L. PRÉPARATION DU \( ^{32} \text{P} \) PAR UNE RÉACTION \( \text{D'ÉCHAMPÊTRE} \).

Dans un précédent mémoire (3) on a étudié un méthyl-4-méthyl-6-hydroxy-5-oxoforme de \( ^{32} \text{P} \text{Cl}_{3} \) préparé à partir d'un certain nombre de réactions d'actif, nous avons cherché à trouver un nouveau méthode pour permettre de préparer rapidement des halogénés radicaux diphosphoröuse.

(voir 547)

549


Les auteurs, décrivant en dehors de des végétaux toxiques par un nouvel méthode, avec du \( ^{32} \text{P} \), 2. Une autre phase mi-inverse, ainsi qu'en

3. L'isolement et une quantité d'activité antigénëstensive de dosage dans le fait d'inutiliser le DTP tout particulièremen dans l'usage de l'animal.